

Framework Contract SIEA 2018 Lot 1 – Sustainable Management of Natural Resources and Resilience

Delegation of the European Union to Barbados

“SUPPORT TO THE EU-CARIBBEAN COOPERATION ON MARINE RESEARCH UNDER THE HORIZON EUROPE RESEARCH PROGRAMME”

Contract N° SIEA-2018-15981

FINAL REPORT

December 2023

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**DELEGATION of the EUROPEAN UNION TO
BARBADOS**

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research under the Horizon Europe research
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Avant propos

Addressing the Sustainable Development Goals (SDGs) and climate agreements calls for engagement and collaboration between many actors with the capabilities to co-design, develop, test, and implement new solutions and innovations. This is particularly true for SDG 14 as seas and oceans are used by a broad variety of countries, stakeholders, and cultures, especially in the highly heterogeneous Caribbean region. The region is considered one of the most vulnerable in the world to the impacts of climate change, with coastal communities and low-lying areas being particularly exposed to the combined threats of sea level rise, biodiversity loss and extreme weather events.

Healthy oceans are fundamental to achieve SDGs in the region. Science, Technology, and Innovation (STI) are key to understand the mechanisms that ensure the oceans' health and increase climate resilience. However, investment in research and development as a share of GDP in 2014 and 2018 was respectively 0.08% and 0.09% in the Caribbean region and 0.73% and 0.66% in Latin America, against a global trend of 1.73% (in 2014) and 1.79% (in 2018)¹. Moreover, data shows another negative feature: a low level of collaboration among Caricom scientists and a dominance of researchers from outside the region, in particular from the USA. Only around 2% of publications by scientists from the region are co-authored by researchers from other Caricom countries, against 40% of publication co-signed by US based researchers². There is need to foster research in marine sciences within the region and enhance the integration of its knowledge production at a global scale as well as strengthen the science-policy-society interface.

Global agreements are promoting the science policy interface in oceans. The objective of the recent UN Biodiversity Beyond National Jurisdictions (BNJ)³ adopted on the 19th of June this year, is to ensure the conservation and sustainable use of marine biodiversity in high seas, areas beyond national jurisdictions, which cover over two-thirds of the oceans. The agreement will be decisive to protect 30% of marine ecosystems by 2030 allowing for the creation of wider marine protected areas and the promotion of the use of area-based management tools for sustainable use of oceans. This shall be enhanced through ocean governance cooperation and capacity building for the use of marine technology and management tools to assist member states in particular developing states, to responsibly utilise and benefit from marine biodiversity of areas beyond national jurisdiction, including environmental impacts assessment considerations in decision-making.

The UN Decade of Ocean Science for SSD 2021-2030 (see section below) calls for the need to promote marine research and the science policy interface. Cooperation between the EU and CELAC⁴ is among the strategic priorities of the EU foreign policy, with the LAC region being a key partner for the EU. This political priority is also reflected in the 'Global Approach to Research and Innovation'⁵, adopted in May 2021. This bi-regional R&I dialogue is developed in the framework of the EU-CELAC Joint Initiative on Research and Innovation (JIRI). In the most recent meeting (30 October 2020) both regions recalled that the Atlantic Ocean requires enhanced joint research efforts on both sides of the ocean from the Arctic to Antarctica and the necessity for a systemic approach to the challenges and opportunities offered by the Atlantic Ocean, including its subsets such as the Caribbean, as well as the need to move closer to the All-Atlantic Ocean Research and Innovation Alliance (AAORIA), where the active involvement of CELAC countries could bring further benefits, through enhanced cooperation of countries connected to the Atlantic Ocean.

¹ UNESCO Institute for Statistics, August 2020

² *Ibidem*

³ The so-called "high seas treaty" offers an updated framework to The UN Convention on the Law of the Sea that came into force in 1994. More details [here](#)

⁴ Community of Latin American and Caribbean States

⁵ https://ec.europa.eu/info/sites/default/files/research_and_innovation/strategy_on_research_and_innovation/documents/ec_rtd_com2021-252.pdf

More recently, in the Declaration of the EU-CELAC Summit 2023 the following actions and commitments are acknowledged by member parties:

20. We encourage actions and commitments for the protection, conservation, restoration and sustainable use of the oceans in view of the 2024 'Our Ocean Conference' in Greece, and the third UN Ocean Conference hosted by Costa Rica and France in Nice in June 2025, preceded by a high-level event on Ocean Action in Costa Rica in June 2024.

21. We recognize that the issue of sargassum significantly impacts the economies, marine flora, fauna, and fishing activities of the entire Greater Caribbean region. We understand the urgent need to present this situation to the United Nations General Assembly, seeking its declaration as a regional emergency.

Although the research institutions of the Caribbean region have long lasting cooperation with their colleagues of EU Member States, they have low involvement in the RTD Horizon Europe 2020 research program, in particular in marine and ocean research. Cooperation with individual or regional entities offers an opportunity for more intensive participation.

EXECUTIVE SUMMARY

The European Commission through the European Union Delegation (EUD) to the Eastern Caribbean countries, OECS and CARICOM/CARIFORUM based in Barbados in close cooperation with its Directorates-General (DG) for Research and Innovation (RTD), International Partnerships (INTPA) and Maritime Affairs and Fisheries (MARE), issued a contract to support the EU-Caribbean cooperation on marine research under the Horizon Europe (HE) Program. The main objective of this action is to ***promote and support a long lasting sustainable multi-stakeholder bi-regional dialogue on marine research, foster interregional (EU-Caribbean) and intraregional cooperation*** in leading to the identification and prioritisation of common research areas of mutual interest and benefit, and thus, stimulating and supporting the participation of the Caribbean research stakeholders in Horizon Europe research program and other EU related programs for marine cooperation.

Methodology

The high diversity of the region and the broad spectrum of marine related research was a key challenge of this action requiring the combination of various methods: desktop research, field visits, on line survey and interviews, and two workshops, one initial and one final international validation workshop. As a result, during the nine months of the action, the two experts were able to engage with almost 300 stakeholders as to co-define the Caribbean marine research and capacity building priority needs to foster the cooperation with the EU.

Main achievements

Besides the successful implementation of the tailored made methodology used and results extracted, the field missions identified pro-active individual experts and practitioners willing to participate in joint research in the Caribbean region. A careful selection of their profiles led to the organisation of the final hybrid event at UWI-Barbados on 14th-15th of November 2023, with 125 participants (both in situ and remote participants). Besides the validation of the findings, the workshop provided the opportunity for extended interaction among the 35 in situ participants leading to joint research project proposals in future Horizon Europe calls as well as to enable strategic alliances from international and regional organisations i.e. OECS expressed interest in signing the AAORIA Declaration. In order to enhance the science policy interface, the results of the study were presented in the Senior officials JIRI (Joint Initiative on Research and Innovation) summit on the 28th of November in Brussels.

Main findings

Blue economy, especially Biodiversity and Ecosystem services in the region are severely threatened by local factors (coastal pollution, overexploitation of fisheries, destruction of coastal habitats, inequalities of populations, specially indigenous peoples) and global factors (climate change and impacts, i.e. macro algae blossoms), while protection and informed-policy response remain below desired levels.

The low level of Gross expenditure on research and development (GERD) in the region is mirrored by a relatively low level of scientific critical mass, science outputs, intraregional research partnerships, and incipient Science, technology and innovation (STI) policies. There are also concerns with the dominant external financing mechanism: the widespread use of demand-driven competitive funds may result in a wide dispersion of projects with low funding, the prioritization of short-term projects subject to political cycles and insufficient attention to research areas that address long-term and national challenges.⁶

The top priorities for the research community in the Caribbean in the last two decades is⁷, according to the documents produced: 1) *fisheries and aquaculture* with 978 documents

⁶ Economic Commission for Latin America and the Caribbean (ECLAC), Science, technology and innovation: Cooperation, integration and regional challenges (LC/TS.2022/156), Santiago, 2023.) <https://hdl.handle.net/11362/48683>

⁷ SCOPUS search on the 11th December 2023

produced followed by 2) **Ecosystems and biodiversity** (858 documents) and 3) **Ocean and climate, mitigation or adaptation**, with 756 documents.

Here below we present a list of the most relevant findings and conclusions resulted from the study:

- The momentum to increase cooperation in R&D has been created. The UN Decade for oceans science for Sustainable Development 2021-2030, the Declaration of the EU-CELAC Summit 2023, the UN Agreement BBNJ and SDG's call for urgent research in the region. Research is seen as an important tool to improve sustainable use of marine biological resources as part of the Blue Economy and Climate change resilience strategies, including its effects i.e. Sargassum massive arrivals.
- The scientific community is willing and able to respond to this call for more Ocean Science. There is a strong and vibrant human resource willing and capable of collecting and analysing evidence to support climate resilience through the sustainable use of marine resources in a renewed blue economy. However, the science policy interface needs to be supported for researchers to produce the kind of evidence (multi/interdisciplinary) needed for policy decisions and the transfer of actionable knowledge to empower Caribbean population, especially SIDS.
- Research in the region faces several challenges, mainly associated with access to long term funds, infrastructures- such as data collection devices and data sets- and the capacity to store and analyse data. It is expected that donors like the EU, shall be able to provide support not only through finance but also through effective scientific cooperation and networks to address common challenges and implement regional and national research agendas that are aligned with locally perceived needs .

Overall, the survey results (see figure below) showed that the most imperative actions for strengthening the marine research efforts in the Caribbean are: funding, international and intraregional (with especial focus on SIDS) cooperation, access to research labs and infrastructures and capacity building.

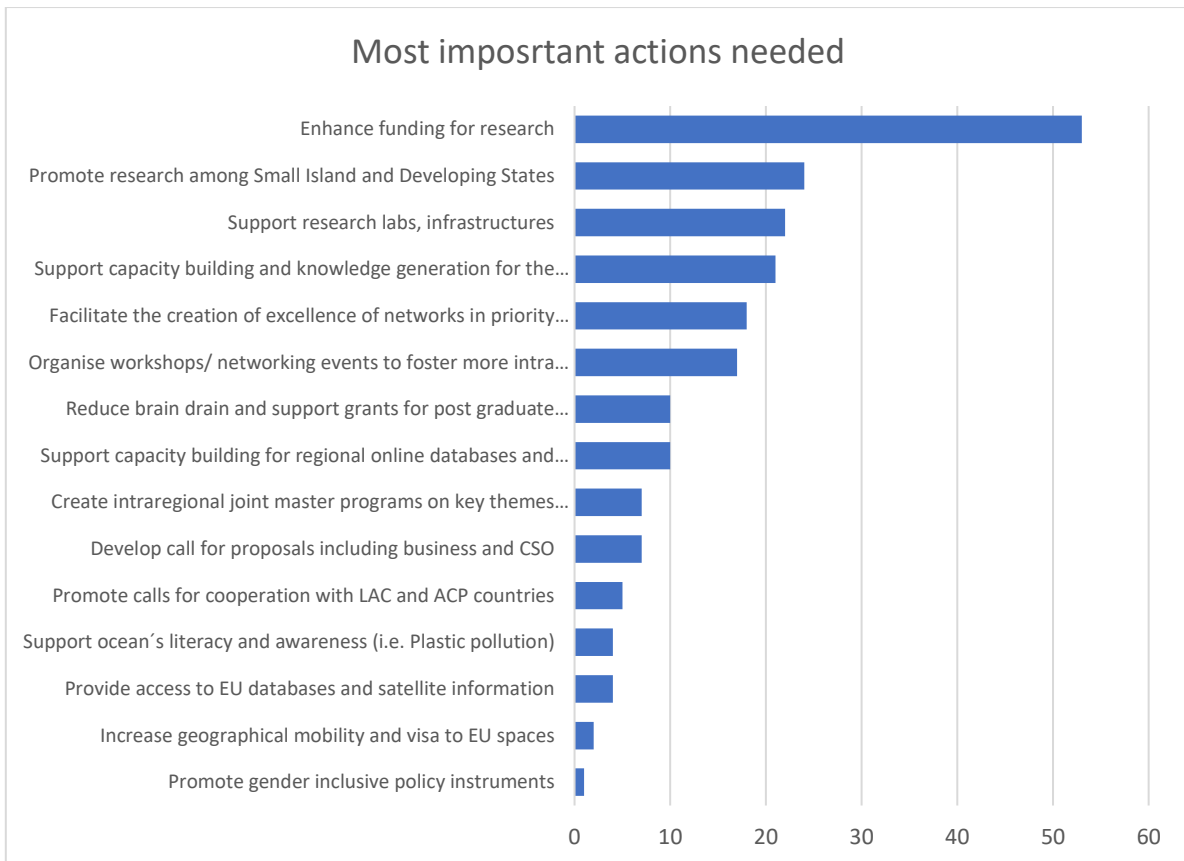


Figure 0. Top actions for strengthening research in the region

Additionally, the consultants will also like to draw the attention to the following elements emphasized during the field work and the regional validation workshop:

- **Marine Spatial Planning** is an important tool for research and evidence-based policies and strategies, i.e. blue economy commitments by Belize and Barbados, that need to be further developed in the region. This could allow developing shared intraregional databases, access to external data and infrastructures (Copernicus among others), increase the monitoring tools and infrastructures or capacity building on the monitoring tools (including their maintenance in the sea) and analytic capacities.
- There is the need to **enhance the integration and collaboration of experts and institutions at the national, subregional and regional (LAC) level in order to create synergetic action and multidisciplinary actionable knowledge**. Capitalizing in regional projects that mobilized experts in the four thematic areas discussed in the workshop can be further supported as coordinators for **intraregional thematic research platforms/networks** supported by Virtual Research Environments. They could coordinate the Caribbean research community in each thematic area and provide a single voice for policy interaction.
- In this same line, **access to support services and infrastructures**, both virtual (e.g. databases, computing services and tools for analysis) and physical (e.g. research vessels, boyos and monitoring satellites, sensors, etc.) represent one of the biggest challenges. These regional thematic networks should be hosted in institutions, **centres of excellence**, that can attract researchers (fighting brain drain) from the whole subregion, with access to joint infrastructures and data management tools, in order to build regional databases, Open Science platforms and access to training and supporting services i.e. for project proposal developing for Horizon Europe and other funds in support of the EU mission Restore our ocean and waters by 2030. This mission is developing concrete solutions to support the restoration of marine and freshwater ecosystems and biodiversity, tackle marine pollution and foster a circular, carbon

neutral blue economy. These solutions could be later replicated and/or scaled-up in the Caribbean with local partners or stakeholders".

- These **knowledge hubs shall also attract private funding and support knowledge transfer and policy advise**. Creating trust among researchers and intraregional working networks requires long term funding and infrastructures, as for the European Research Area (ERA). Namely, infrastructures call of the Horizon Europe program could be open to foster the **Caribbean Research Area as part of the widening participation** and spreading excellence of the ERA channelled through the Outermost regions in the Caribbean.
- The **precarious working conditions of researchers**, in particular for women and young researchers, must be addressed to limit brain drain and create a thriving and supporting environment for researchers, women in particular with specific policy instruments and incentives.
- **EU-Caribbean cooperation should increase open, excellent, inclusive, actionable, multi and interdisciplinary research** (Sustainability science⁸) which is broadly missing in the Caribbean, and is vital to address serious threats and complex challenges that affect communities' livelihoods and jeopardize opportunities for sustainable blue economies.
- The need for social sciences in assessing the social impact of projects and ethical inclusion of social stakeholders is key to reduce **inequalities and poverty**, which are considered the main barriers to SDG's in the region.
- More holistic and interdisciplinary oceans research should be promoted in order to inform complex policy decisions, i.e. cumulative impacts of biotic and abiotic pollution and systemic emergency plans; social and environmental impact assessment across QH stakeholders for blue economy plans, extended and transboundary or beyond national jurisdiction MPAs network, among others. They are of key importance to sounding policy development and will promote, by its nature, interdisciplinarity and mutual learning and cooperation in the Wider Caribbean Region. European partners can facilitate this dialogue and support them based on their expertise, i.e. the Facility for Regional Policy Dialogue on Integrated Maritime Policy / Climate Change presented by Thanos Smanis in the Barbados workshop.

For more information and thorough analysis and findings, read the following chapters of this report.

⁸ Aguire- Bastos C. , Chaves-Chaparro, J. &S. Arico (eds). UNESCO (2019) "Co-designing science in Africa: first steps in assessing the sustainability science approach from the ground". Available here: <https://unesdoc.unesco.org/ark:/48223/pf0000368900.locale=en>

1 Context: The Caribbean Region and research landscape

1.1 The challenges

The 2030 Agenda for Sustainable Development identifies Science, Technology and Innovation (STI) as a key driver for enabling and accelerating the global transformation towards prosperous, inclusive and environmentally sustainable economies in developing and developed countries.

The world is facing increasingly complex challenges: growing inequalities, increasing vulnerabilities to climate change, natural disasters, rising sea level, transforming global markets, conflicts and health emergencies. It is of utmost importance to acknowledge the need for transformative change at the socio-technical system level. This requires STI policy to embrace various forms of technological, social and institutional innovations.



The 2030 Agenda for Sustainable Development was adopted by all United Nations Member States in 2015. It provides a shared blueprint for peace and prosperity for people and planet, now and into the future. At its heart are the 17 Sustainable Development Goals (SDGs).⁹ SDG 14, life below water, is particularly relevant for the nations in the Caribbean Sea. High inequality and poverty rates are the biggest challenges to address the SDGs in general, and SDG 14 in particular.

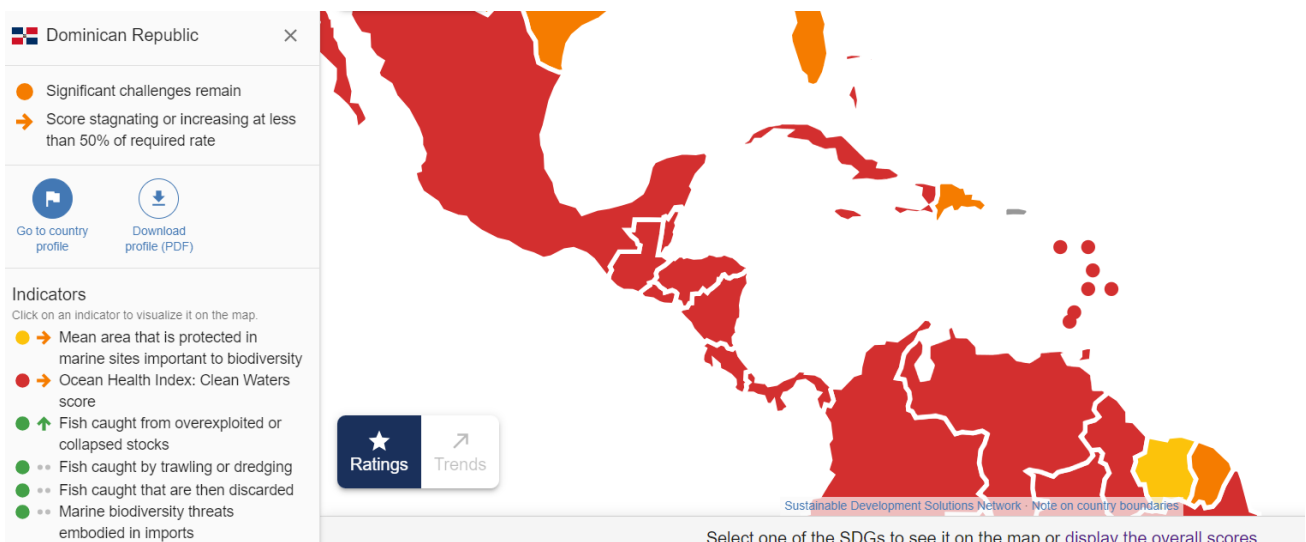


Figure 1. UN SDSN, 2023 SDG's dashboard

⁹ <https://sdgs.un.org/goals>

According to the Sustainable Development Report¹⁰ and dashboard 2023 by UNSDSN, major challenges remain (red in the figure above) in the consecution of SDG14. In the region, only the Dominican Republic has achieved advancements although significant challenges remain (orange). Targets related to fisheries (14.3-14.5) and marine biodiversity threats embodied in imports (14.6) are achieved in many territories, as fisheries remain small scale and traditional. However, many countries have low capacity and lack equipment to adequately monitor the evolution of catch and stocks. Other indicators such as the area that is protected in marine sites important to biodiversity- except from Cuba and Dominican Republic- and specially Ocean health index: clean waters score is still a challenge in all territories (see figure below).



Figure 1.2. SDG 14 Ocean health index: clean waters score

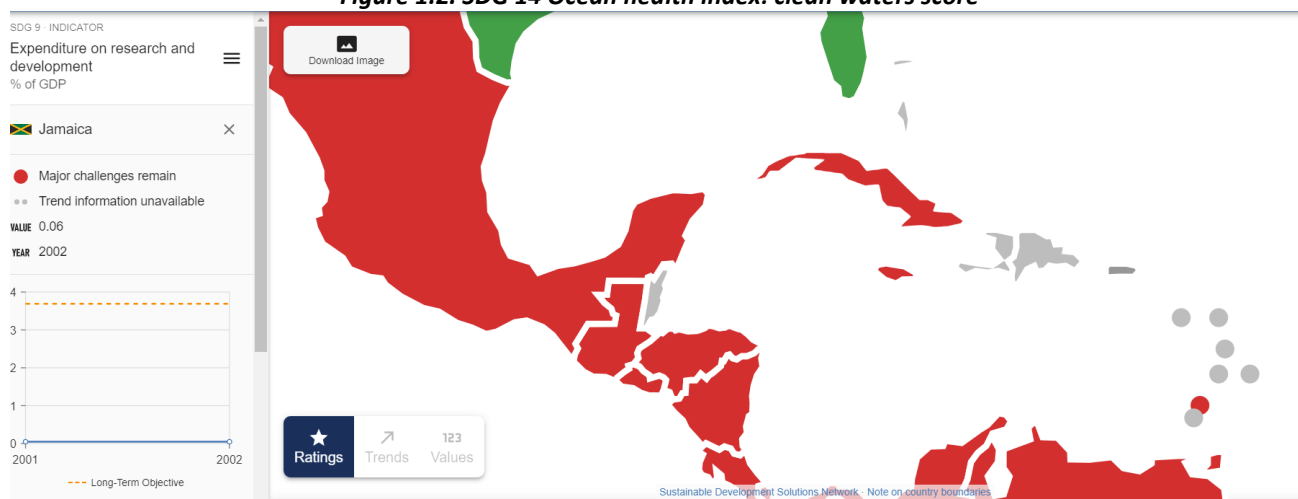


Figure 1.3 SDG 9

A review of the SDG 14 and 9 for industry (in particular indicator 9.7), innovation and infrastructure results in a similar picture (see above). For many territories there are no data, and for the remaining performance is less than desired (red).

It is widely acknowledged that STI Investments are essential to achieving the targets set for the SDGs. Caribbean countries and territories (including EU OMRs and OCTs) still need to put in place effective

¹⁰ <https://dashboards.sdindex.org/map/goals/SDG14>

strategies to use STI to further their economic and social development to reach the SDG goals¹¹ and SDG14/SDG9 in particular.

Addressing the SDGs calls for engagement and collaboration between many actors with the capabilities to design, develop, test and implement innovations. STI policy should engage a wider variety of innovation actors relevant for developing countries. These might include firms and entrepreneurs, educational and research actors, organizations financing innovation, trade unions and cooperatives, national and international donors, NGOs, civil society and grassroots organizations, as well as economic agents active in the informal economy.



Figure 1.4 SDG 9: Industry, innovation and infrastructure dashboard (UNSDSN, 2023)

The Caribbean region is considered one of the world’s most vulnerable regions to the impacts of climate change. The region has many coastal communities and low-lying areas particularly exposed to the combined threats of sea level rise and extreme weather events.¹² Small Islands Developing States (SIDS) are extremely important for global biodiversity as islands harbour 20% of all plant, bird, and reptile species in only about 3% of the earth’s land surface. The Secretariat of the Convention on Biological Diversity considers the species in SIDS to be at the highest risk of extinction: 95% of bird, 90% of reptile, 69% of mammal, and 68% of plant extinctions worldwide have occurred on islands.

Caribbean Islands

TAXONOMIC GROUP	SPECIES	ENDEMIC SPECIES	PERCENT ENDEMICISM
Plants	13,000	6,550	50.4
Mammals	89	41	46.1
Birds	604	163	27.0
Reptiles	502	469	93.4
Amphibians	170	170	100.0
Freshwater Fish	161	65	40.4

Figure 1.5 Taxonomic groups and endemic species in Caribbean Islands

¹¹ https://sdgs.un.org/sites/default/files/2020-12/Operation%20Note%20STI%20for%20SDG%20Roadmaps_final_Dec_2020.pdf

¹² <https://www.iica.int/en/press/news/cop27-caribbean-nations-worlds-most-vulnerable-countries-climate-change-should#:~:text=The%20Caribbean%20is%20one%20of,addition%20to%20rising%20sea%20levels.>

Tourism is one of the most lucrative sectors in the Caribbean region with its biodiversity as one of its main attractions. The threats posed by climate change induced sea level rise and increasing exposure to extreme weather events (including hurricanes) can jeopardize income generation by the sector (Scott, Simpson and Sim 2012). Innovations that render the tourism sector more resilient to climate change are hence a top priority for these countries. Alongside tourism, other development agenda's priorities are agriculture and fisheries, information and communication technologies (ICTs), air and maritime transport infrastructure and services, and energy efficiency, economic diversification and public debt reduction.¹³ Most of the Caribbean Community (CARICOM) countries show an improvement of debt to GDP ratios and post-pandemic recovery of economic growth since 2020.¹⁴ The World Bank classifies 5 CARICOM countries as high income, 8 as upper middle income, and 1 (Haiti) as a least developed country (LDC).¹⁵ As a result some are not eligible for Horizon Europe program, which is the focus of this report.

1.2 The need for more science

Information about regional investment in R&D is scarce but clearly insufficient in view of the requirements for knowledge and solutions production related to persistent challenges, i.e. ocean eutrophication, acidification or temperature increase provoking new/increased challenges as the massive Sargassum arrivals. These became a top political priority in many countries of the region as indicated in the Declaration of the EU-CELAC Summit 2023, art. 21: "We recognize that the issue of sargassum significantly impacts the economies, marine flora, fauna, and fishing activities of the entire Greater Caribbean region. We understand the urgent need to present this situation to the United Nations General Assembly, seeking its declaration as a regional emergency".

Within the LAC region, the GERD¹⁶ is also comparatively low, varying from **0,08% to 0,09% in the Caribbean region from 2014-2018 and 0,73% and 0,66% in Latin America**, against the positive global trend of 1,73% and 1,79% (UNESCO Institute of Statistics, 2020). This same UN source, for STI statistics, only provided GERD data for Bermuda, Cuba and Trinidad and Tobago. Over 2015-2021 Cuba reports the highest percentage of GERD, between 0.34% in 2016 and 0.55% in 2019. Bermuda reports about half of this, and Trinidad and Tobago's GERD ranges between 0.06% (2020) and 0.09% (2017). For the same period, Latin America and the Caribbean (LAC) report around 0.6% whereas the mean for middle income countries is approximately 1.2%. This suggest that the **investment in R&D in the Caribbean is low compared to their regional and World Bank income groups.**¹⁷

The lack of data makes it difficult to make an assessment of STI finance in the region. At the same time, according to the UNESCO 2020 World Science Report, publication statistics show an increase in the production of research material, especially in some vulnerable SIDS as Antigua and Barbuda, the Bahamas, Grenada and St Kitts and Nevis. Larger countries, such as Guyana and Suriname, are experiencing a similar trend (see also figure below).

¹³ Ramkissoon and Kahwa, 2015

¹⁴ https://repositorio.cepal.org/bitstream/handle/11362/48693/1/S2201297_en.pdf

¹⁵ <https://today.caricom.org/2021/12/15/caricom-gdp-as-an-indicator-of-the-status-of-national-economies-a-false-impression/>

¹⁶ Investment in R&D as a share of GDP

¹⁷ <http://data.uis.unesco.org/#> June 30, 2023

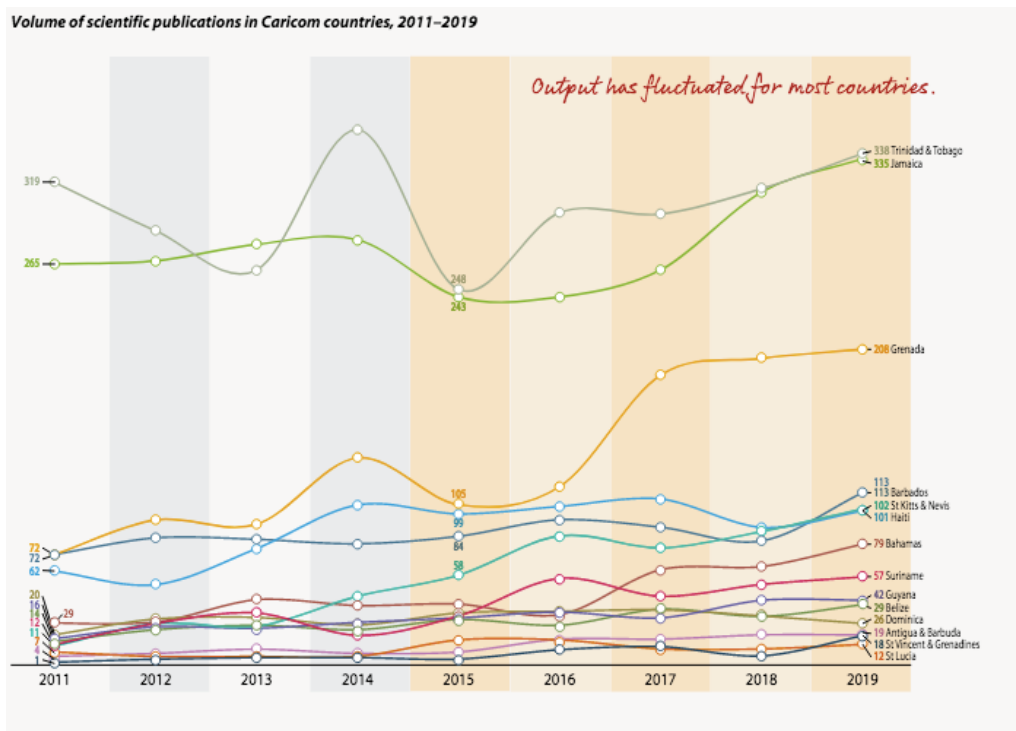


Figure 1.6: Volume of Scientific Publications in Caricom Countries 2011-2019

These positive research tendencies mirror by a growing culture of research of some universities, mainly private one. For example, in 2018 St George’s University in Grenada published 93% more publications than in 2015. During the same time frame, publications from the American University in Antigua and Barbuda grew by 300% and Ross University School of Veterinary Medicine in St Kitts and Nevis increased its output by 46%¹⁸.

The majority of research output is related to health sciences in private organisations – filling in the public low investment in health research-, with some contributions from the agriculture, fisheries and forestry fields. Hence, although the observed growth in scientific publications testify to a more vibrant research culture, its scope remains too narrow to prepare Caribbean societies for required digital and green economies transformation.

Research collaboration is important to improve the relevance of problem definition and raise the level of expertise necessary to carry out research. The region’s main university, the University of Western Indies (UWI), is a multi-national institution with centres and campuses in 16 English speaking countries but the research cooperation and effective exchange among them seems insufficient.

In general terms, the level of collaboration among CARICOM scientists is low: only around 2% of publications are co-authored by researchers from CARICOM countries, against 40% of publication co-signed by US based researchers¹⁹, showing a risk of dealignment among national and donor’s research agendas as well as of brain drain.

On the policy side, eight countries have ministries that have STI in their portfolio; eleven have a development plan that includes STI in one way or another and six have or are formulating STI policies.²⁰ Some countries have progressed in their research outputs and demonstrate positive trends in higher education institutions, according to UNESCO’s reports dated 2015 and 2021. In addition,

¹⁸ UNESCO Science Report 2021 <https://www.unesco.org/reports/science/2021/en/report-series>

¹⁹ *Ibidem*

²⁰ Walker, L., & de Paula, J. (2022). Science, technology and innovation for sustainable development: Lessons from the Caribbean’s energy transition.

countries are becoming increasingly aware of the importance of STI activities and have committed to advancing the STI legal framework. Yet, national science, technology and innovation systems in the Caribbean remain weak compared to more developed countries and even in comparison to some emerging economies. There are also concerns with the dominant financing mechanism. The widespread use of demand-driven competitive funds may result in a wide dispersion of projects with low funding, the prioritization of short-term projects subject to political cycles and insufficient attention to research areas that address long-term national challenges.²¹

The region has important infrastructures for tertiary education and research such as the University of West Indies (UWI). Marine science is one of the UWI's fields of expertise. UWI hosts the Center for Marine Sciences (CMS)²² on Jamaica. UWI is a key actor for intraregional (and international) scientific cooperation with campuses in Jamaica, Trinidad and Tobago, and Barbados, the Centre of Hotel and Tourism Management in the Bahamas as well as University Centres/Schools of Continuing Studies in twelve other Caribbean countries.²³

Other important marine research facilities are the Institute for Tropical Marine Ecology (IMTE) in Dominica, the Caribbean Marine Biological Institute (CARMABI)²⁴ at Curacao, the Perry Institute for Marine Sciences in The Bahamas²⁵ and the Central Caribbean Marine Institute (CCMI) at the Cayman Islands²⁶. Important examples of regional research cooperation in the area of marine science are the CARICOMP²⁷ network which involved laboratories in Jamaica, St. Lucia, and Barbados,²⁸ the Association of Marine Laboratories of the Caribbean (AMLC)²⁹, a confederation of 38 marine research, education, and resource management institutions.

There are other examples of interregional collaboration. In June 2023, the three universities in of the Netherlands Antilles at St. Maarten (USM), Curacao (UoC) and Aruba (IPA) signed a MoU to reaffirm the commitment that was made in 2014 among the Caribbean institutions (UNICARIB) to cooperate in curriculum development, the sharing of resources, and research, student, professional, and academic exchange.³⁰ However, its implementation is still weak.

The French Outmost regions are led by the University of the Antilles, with campuses in Guadeloupe and Martinique and MoU with UWI and other regional (both EU and Caribbean) partners.

The Caribbean Regional Fisheries Mechanism (CARICOM); OECS or the Caribbean Community Climate Change Center (CCCC) are also coordinating research related projects to inform regional policies related to marine and maritime.

Funding for marine research is insufficient except in countries using blue bonds, as Belize³¹ or Barbados³² that pioneer in condemning external debt to the US for blue economy actions and strategies channelled through "The nature conservancy" based in the US. On November 4, 2021, The Nature Conservancy closed on the transformational Belize Blue Bonds for Ocean Conservation agreement

²¹ Economic Commission for Latin America and the Caribbean (ECLAC), Science, technology and innovation: Cooperation, integration and regional challenges (LC/TS.2022/156), Santiago, 2023.) <https://hdl.handle.net/11362/48683>

²² <https://www.mona.uwi.edu/cms/>

²³ <https://caricom.org/institutions/university-of-the-west-indies-uwi/#:~:text=UWI%20comprises%20three%20main%20campuses,in%20twelve%20other%20Caribbean%20countries.>

²⁴ researchstationcarmabi.org

²⁵ [About Us \(perryinstitute.org\)](https://www.perryinstitute.org)

²⁶ <https://reefresearch.org/>

²⁷ Cortés J, Oxenford HA, van Tussenbroek BI, Jordán-Dahlgren E, Cróquer A, Bastidas C and Ogden JC (2019) The CARICOMP Network of Caribbean Marine Laboratories (1985–2007): History, Key Findings, and Lessons Learned. *Front. Mar. Sci.* 5:519. doi: 10.3389/fmars.2018.00519

²⁸ https://www.nsf.gov/awardsearch/showAward?AWD_ID=9115368

²⁹ <http://www.amlc-carib.org/>

³⁰ <https://www.usm.sx/news/caribbean-institutions-sign-mous-for-higher-education-95>

³¹ <https://www.nature.org/content/dam/tnc/nature/en/documents/Belize-Blue-Bonds-2023-Impact-Report.pdf>

³² <https://www.nature.org/content/dam/tnc/nature/en/documents/TNC-Barbados-Debt-Conversion-Case-Study.pdf>

with the Government of Belize. At the time of completion, this deal was the largest existing debt conversion for marine conservation. It provided immediate economic relief to Belize with a debt to GDP reduction of 12 percent, in exchange for governmental commitment to the protection of 30 percent of Belize's oceans and an estimated USD 180 million towards conservation on the ground over a 20-year period. In September 2022, the Government of Barbados (GoB), The Nature Conservancy (TNC), and the InterAmerican Development Bank (IDB) announced the completion of a USD 150 million debt conversion that created long-term sustainable financing for marine conservation and secured a GoB commitment to protect up to 30%, or ~55,000 square km, of its Exclusive Economic Zone (EEZ) and Territorial Sea. Both countries presented their experiences in the final workshop of this action in Barbados, presentations available here: <https://eu-caribbean-marine-research.service-facility.eu/en/speakers-presentations>.

In all cases, marine research in the Caribbean is mainly driven by international organizations, as GEF, the Green Fund or the EC – Euroclima and Interreg among others but little on Horizon Europe- as well as Anglo-Saxon NGOs as the nature conservancy or the Caribbean Biodiversity Fund. This increases the risk to have national and regional research agendas not aligned with national and regional development agendas as well as little intra national and intra-regional cooperation as well as gaps in information on the research done and optimal transfer of results to policy and society. Thus, the importance of this kind of studies in order to fund real research needs as well as to strengthen the intra-regional research agenda (being developed under OECS) to cope with the low critical mass of researchers and brain drain in the Caribbean.

UNEP, UNESCO IOC, FAO and UNDP are international organisations with regional Caribbean offices that are also part of the research and capacity building actors contributing to evidence-based policies for the oceans in line with the UN Decade of Oceans Science for Sustainable Development 2021-2030. The United Nations, through UNESCO IOC, has proclaimed this Decade conscious of the need for more ocean science to support the SDGs and national sustainable development policies around the world, especially in SIDS around 10 challenges directly translated into research topics (see bibliometric study section). Therefore, the momentum is optimal to strengthen the legal, regulatory and institutional frameworks and consolidate and expand intra-regional cooperation to benefit from the economies of scale and exploit the array of individual countries' potential to support the development of STI and foster research activities. In this context it is important to highlight the interconnected fields of the transition to sustainability (the green economy), the sustainable use of marine resources (the blue economy) and the buildup of resilience to climate change.

2 Methodology

The report is based on a combination of desk and field research in selected territories/countries from the geographical scope of this action. The research process was divided in three main phases (See figure 1.7 below): 1. Inception phase, 2. Field phase, 3. Synthesis phase. The tasks in each phase were defined by the ToR, and contribute to the specific outcomes as detailed below.

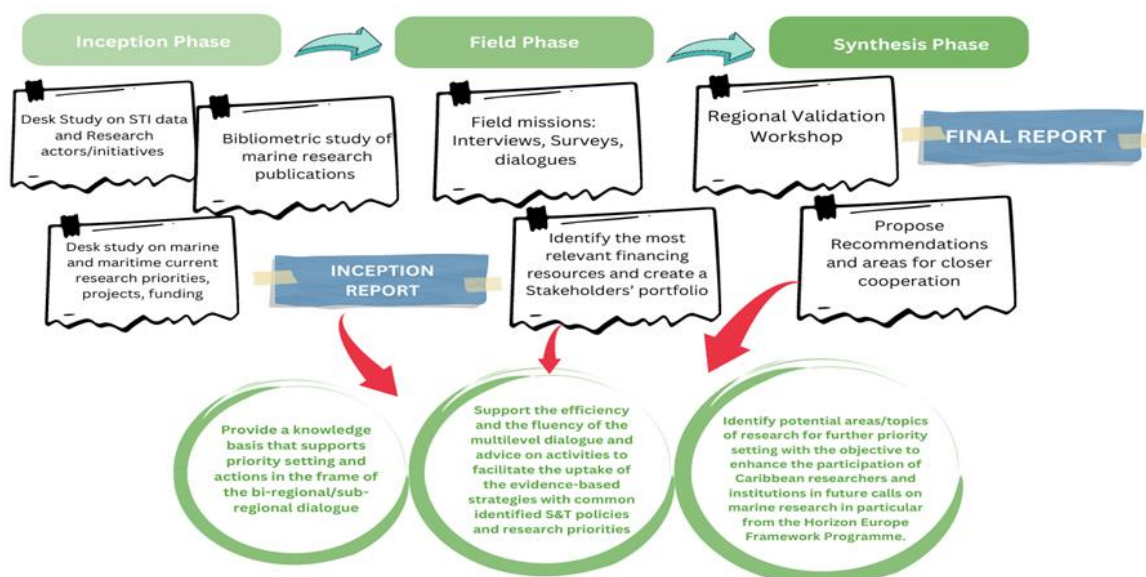


Figure 1.7: Methodology

The final validation regional workshop, added to the initial ToR as proposed by the team leader during the Kick off meeting, was instrumental to the success of this action, as it serves to both discuss and find agreement on priority areas by theme (see specific section below) but also to draw a holistic picture of actors and financing mechanisms ready to support them and gaps to be filled in- in particular through the Horizon Europe program. More importantly, it installed the seeds for future cooperation and networking and parallel negotiations towards the inclusion of the Organization of the Eastern Caribbean States (OECS) in the All-Atlantic Ocean Research and Innovation Alliance (AAORIA). A follow up meeting between EC, UNESCO, AAORIA and other partners will be organized in early 2024.

Data collection and report writing met several challenges. For each challenge a mitigation strategy was defined and implemented:

Risks	Impact	Mitigation Strategy
Conditions for experts' missions (security, safety, health: i.e., natural disaster, COVID) are not satisfactory	Low	Close monitoring and discussions with EC, especially Barbados Delegation sur place Cuba could not be visited but CIMAB did mobilize the national institutions to provide inputs to the survey and presented results in Barbados workshop
Lack of availability of key stakeholders (policy makers, high level civil servants, project directors, etc.) to discuss the countries' situation, needs and priorities.	High	The team will contact the stakeholders well before the mission, when possible, to duly explain their mission objectives and the information needed. An official supporting letter from the EUD to introduce the team facilitated the access to stakeholders. In case of non-availability, remote consultations were conducted after the country visit.
Conditions for workshop (see above) satisfactory	Medium	Close monitoring, flexibility in dates
Lack of R&D data in the region	Medium	Use of other sources of information (project reports, grey literature, interviews, surveys). Specific discussion in the regional workshop was facilitated.
Political conditions	High	Cuba has traditionally been reluctant to allow foreign consultant to visit the country. In the end Cuban stakeholders only participated remotely.
Identification of stakeholders	Medium	Institutional mobility and brain drain and low level of participation of Caribbean scientists in international for a made it difficult to identify key stakeholders. EUD, UNESCO marine expert's database and UNESCO delegation to the region as well as snowballing were used to overcome this challenge.

Table 1. Risks and Mitigation Strategies

Furthermore, the team leader would like to further develop on the following **key challenges** and mitigation strategies implemented.

The diversity of the region's territories and low internal scientific cooperation (even at national level) is a key challenge the regional dialogue and agreement on marine research agenda. Furthermore, the diversity of perspectives, culture and expectations from different QH groups -industry, policymakers, civil society (including NGOs and Indigenous and Local Knowledge (ILK) holders) and RPOs/RFOs³³- do increase differences for agreement too. Ensuring a balanced and safe environment for dialogue during the final workshop was key to success.

The clear understanding of the scope and expectations from the action was key to an effective and more focused objectives and workplan. In this sense, the close monitoring of the team leader to involve all of the various EC Directorates and offices was key for the success of this action and the new proposed activity to organize an international validation workshop in Barbados (14-15 November) or the presentation of the action results in the JIRI summit held in Brussels on the 28-29 November. Similarly, the exchange with EU delegations in the territories visited, i.e. Delegation in Belize, Barbados or with Cuba was very important to identify national stakeholders and understand the priority areas, projects and programs of the EC and create synergies.

The efforts of the experts to create synergies and exchange with key relevant initiatives and actors in the CAR and EU region has been assured as shown in the final validation workshop in Barbados.

The scarcity of available general R&D data on marine research in many of the territories is a challenge that was very strongly pointed out in the Barbados Workshop and some ideas are proposed in the conclusions of this report.

³³ Research Performing Organizations (RPOs) and Research Funding Organizations (RFOs)

Although a key scientific actor in the regions, the complex political situation of Cuba did not allow for a mission to the country. The team leader, Spanish speaker that had visited Cuba with UNESCO in January 2020, tried to visit the country twice, in March and July with the support of the EUD in La Havana. However, the working visa was not granted and the mission to Cuba was not possible. However, the dialogues with UNESCO office in La Habana, IOC Caribe and national organizations and stakeholders, enabled the participation of the CIMAB representative in the final Workshop and the feedback of six RPOs in the survey.

Finally, the consortium personal attitude and social/networking skills were very important to enable a trust environment both, the collection of information as well as the facilitation of the workshop discussions. The team leader has extensive field experience both in LAC and African region and undertook specific training in social sciences methods (interviews, workshops, dialogues, etc.) and practices. Both experts have worked with Indigenous peoples and are very aware of the need of inclusiveness also towards other marginalized groups in this very unequal region.³⁴

³⁴ Poverty and inequality are the biggest barriers to Sustainable development (J. Chaves-Chaparro, S. Àrico and C. Aguirre-Bastos, 2019) from the 2019, UNESCO publication “Co-designing science in Africa: first steps in assessing the sustainability science approach from the ground” available [here](#)

3 Desk research results

3.1 Policy background and main stakeholders

In general terms, due to the island effect and being tourism a big part of the share of GDP at least in the smallest territories/countries of the Caribbean region, sustainable development policies do exist. Some of these policies wish to differentiate themselves by attracting sustainable tourism and therefore, the need to show political commitment towards the conservation of coastal areas and key species (turtles, whales, manatees, etc.) habitats and ecosystems, leading to the development of comprehensive policy frameworks in many territories. A list of 35 national policy instruments -with links to sources- can be found in the annex of this report. However, some key areas required to achieve Climate Change strategies, as the Renewable Energies development, is not well legislated and little literature does exist- as stated in by the University of West Indies in Trinidad and Tobago (Chandrabhan, 2020).

Basically, there is general global issue³⁵ in the **weak science-policy-society** interface that produces policies which are not sufficiently evidence-based. The networks of ties between science and policy constitute science-policy interfaces in a territory. Connecting science to policy is a major issue confronting the world today in efforts to achieve sustainable development, this is especially true in the Caribbean region and for climate change and ocean challenges, that are very complex by their interdisciplinary and multifactual nature. The recent COP 28 held in Dubai discussed around the need to reduce fossil fuels use but the region is increasing its production as warned recently by UNEP.

There is another general regional issue on weak governance that leads to very **low implementation of policies**. Regional policies are, in such an heterogenous region, even harder to agree and implement.



Figure 1.8. Enablers for Effective Climate Action. IPCC

³⁵ According to the panel of 20 distinguished scientists from around the world who consulted with 400 more during the United Nations Environment Programme (UNEP) Foresight Process on Emerging Environmental Issues for the twenty-first century, the cross-cutting issue labeled “Broken Bridges: Reconnecting Science and Policy” is the fourth most pressing one confronting the world today in efforts to achieve sustainable development (UNEP, 2012). In essence, critical scientific knowledge is not being communicated effectively to audiences ranging from decision-makers to the general public. The panel found that public confidence in the environmental science that is communicated is diminishing due to deepening distrust of scientific outputs. There is increasing resistance among policy decision-makers against easily accepting scientific advice. Climate change provides many examples (Beck, 2012)

According to McConney et al. (2016)³⁶ weak governance is a root cause of the problems constraining the sustainable management of shared living marine resources within the Wider Caribbean Region (WCR). Integral to any fully functioning policy cycle in governance is the communication of marine science data and information, through the stages of the policy cycle, ultimately for use in decision-making. In order to develop a regional science-policy interface for ocean governance in the WCR we must first understand what currently exists. Policy discussions that used marine science extensively were infrequent. Constraints on use of science include low critical mass or capacity, science not being provided in policy-relevant format, not having easy access to databases and low policy demand for science. There is little transboundary marine science information sharing except through informal social networks. Capacity building on STI policies to in support of evidence-based policy-making shall be addressed to enable significant changes in use of properly packaged marine science. External influences, political context, science and evidence, social impact studies, links and networks are to be mobilized in order to systematize the key learning.

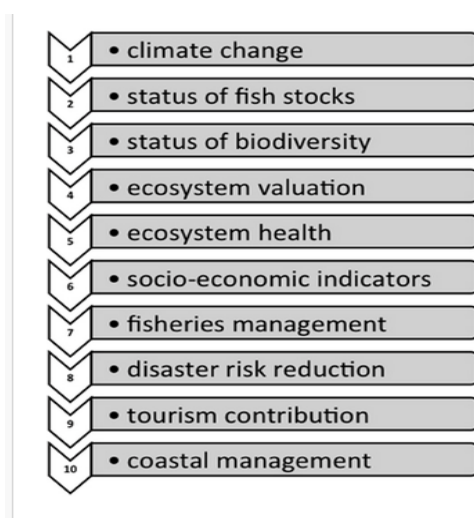


Figure 1.9 Top ten Regional Demands for Marine Science Information use in future policy (McConney et al. 2012)

The issue of national and naturally regional, governance mechanisms fragmented, overlapping and dispersed is a clear barrier for cooperation. In general terms, the LAC region is lacking of clear regional articulation to defend the region priorities in the international negotiations. This happens also in thematic discussions, and being oceans spaces with multitude of uses, makes the situation more complex.

Even in traditionally research areas as fisheries, there is no clear interlocutors, in this same study from McConey, the Caribbean Regional Fisheries Mechanism (CRFM) was the most frequently identified as the legitimacy partner for a regional marine policy meeting that included science, particularly for its Ministerial Council meetings that directly addressed sub-regional fisheries policy. The United Nations Environment Programme (UNEP), Organization of the Fishing and Aquaculture Sector of the Central American Isthmus (OSPESCA in Spanish), and the Frontiers in Marine Organizations identified with hosting regional marine policy meetings (Adapted from McConney et al., 2012). The Caribbean Network of Fisherfolk Organizations (CNFO) is also mentioned. This can show the policy partners that EU shall take into account if interested in opening discussions on a general science marine policy for the Caribbean region. There is a list of stakeholders and marine sciences initiatives that is presented in a table in the annex number 1-2.

Stöfen-O'Brien et al. (2021) alerts that marine scientific research on the issue of marine litter in the Caribbean SIDS is predominantly undertaken by extra-regional scientists and organizations which might weaken the science-policy transfer to develop sustainable and tailor-made solutions. The paper highlights issues and problems associated with parachute science for the Caribbean SIDS before

³⁶ from UWI CERMES. UWI CERMES coorganized and hosted the validation workshop of the report,

offering a series of potential policy-ready response options to address the identified challenges for marine litter that can be translated into many other marine research topics.

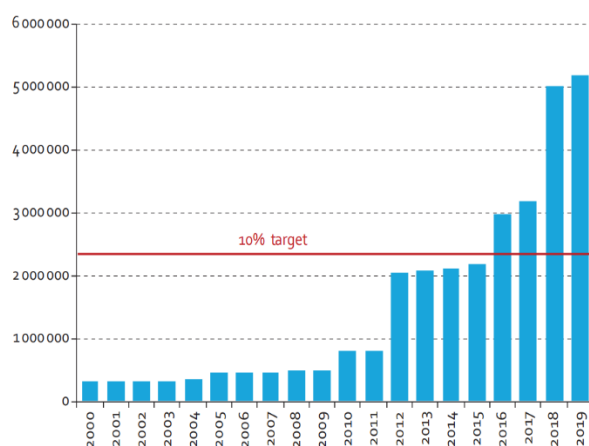
At the more practical level, the weakness on the science-policy-society interfaces and governance challenges are directly impacting in research funding mobilization, i.e. the low participation of Caribbean partners in Horizon Europe. In the Dominican Republic mission, partners were complaining that the information about open calls for marine research, arrived to most of the RPOs once the deadline was achieved or with little time to present a strong proposal. New initiatives as the EU Global Gateway should have this in consideration and be complemented with institutional capacity building programs to reinforce the science-policy-society interface.

- 1983 Cartagena Convention & its Protocols (especially SPAW)
- **2002 Revised Treaty of Chaguaramas – Chapt 4, Part 2, Art 60**
- **2002 Agreement Establishing the CRFM**
- 2010 Castries Declaration on IUU Fishing
- 2010 Regional Food and nutrition Security Policy [Env & Natural Resource]
- **2014 Caribbean Community Common Fisheries Policy & its 4 Protocols:**
 - 1) Small-scale fisheries;
 - 2) Climate Change & Disaster Risk Management; and
 - 3) Aquatic Food as a Strategic Resource for food security & nutrition
 - 4) Sustainable Use of the living marine resources
- CLME+ Strategic Action Programme (2015-2025)

Box 1.1: Key regional treaties and instruments

Apart from key regional treaties and instruments (see above), the new UN agreement adopted on the 19th June to ensure the conservation and sustainable use of Marine Biodiversity of areas Beyond National Jurisdiction (BBNJ) -which cover over two-thirds of the ocean and will be decisive to protect 30% of marine ecosystems by 2030. The new areas will be added to the more than 5.000.000 KM² Marine Protected Areas (MPA) in the LAC region accounted in 2019 (figure below). The agreement includes cooperation in capacity building and the transfer of marine technology and management tools to assist Parties, in particular developing States Parties, to responsibly utilize and benefit from marine biodiversity of areas beyond national jurisdiction, including environmental impacts assessment considered in decision-making. The agreement will required more data and spatial planning capacities and tools to extend the protection to these areas. New cooperation and funding mechanisms will be in place to support the research and capacity building for modelling and monitoring MPAs, as indicated by UNEP-Cartagena Convention officer in charge, Dr. Chris Corbin in his intervention in the Barbados workshop.

Total surface of marine protected areas in Latin America and the Caribbean (2000-2019)
(Square kilometres)

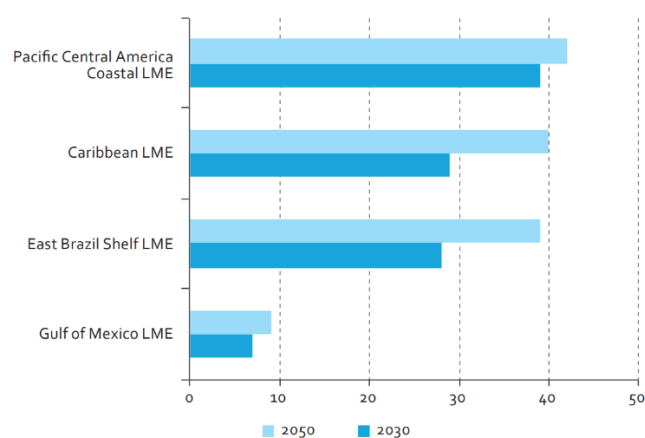


Source: Prepared by the authors based on United Nations Global SDG Database, UNEP-WCMC and IUCN (2020) "Marine Protected Areas" *The World Database on Protected Areas (WDPA)* [online database] www.protectedplanet.net December 2018, and country data from ECLAC (2020) "CEPALSTAT" [online database] <https://cepalstat-prod.cepal.org/cepalstat/tabulador/ConsultaIntegrada.asp?idIndicador=3961&idioma=e> [accessed in November 2020].

Figure 1.10: Evolution of the MPAs surface for LAC 2000-2019

The Economic Commission for Latin America and the Caribbean (ECLAC) launched in 2020 a regional outlook on **SDG 14 implementation in LAC**. Specifically, it seeks to identify the main developments, advances, and changes in legal and institutional frameworks, including gaps and barriers the implementation of the Sustainable Development Goal 14: "Conserve and sustainably use the oceans, seas, and marine resources for sustainable development," The outlook also strengthens cooperation to reduce gaps and eliminate barriers to advance in the implementation of SDG 14 and, ultimately, SDG 13. In light of the transboundary nature of the marine environment and interdependencies between the agenda's targets and goals, the implementation of the ocean SDG will fall short of the transformative ambition of the 2030 Agenda without effective coordination at the regional level. Among the main thematic areas for research were reducing ocean acidification causing i.e., coral reef risks, **sustainable fishing including the 90% of small-scale artisanal fishing**, conservation of coastal and marine areas CLME Caribbean Large Marine Ecosystem (Project) urged to **increase scientific knowledge, develop research capacity and transfer marine technology and budget allocated to marine technology**.

Projections of coral reef risk for years 2030 and 2050 due to ocean acidification
(Percentages)



Source: Adapted from ILEC, UNEP-DHI, UNESCO-IHP, UNESCO-IOC and UNEP (2016) "Water System Information Sheets: Northern America" *Transboundary Waters: A Global Compendium*, Talau-McManus, L. (ed.), Volume 6-Annex A, B and C, United Nations Environment Programme (UNEP), Nairobi.

Figure 1.11: Projection of coral reef risk in 2030 and 2050

In a similar line, Dr. Milton O. Haughton. Ex. Director of the Caribbean Regional Fisheries Mechanism, presented the main challenges for Ocean Economy in the region as presented in the Barbados workshop on the 14th November 2023 below:

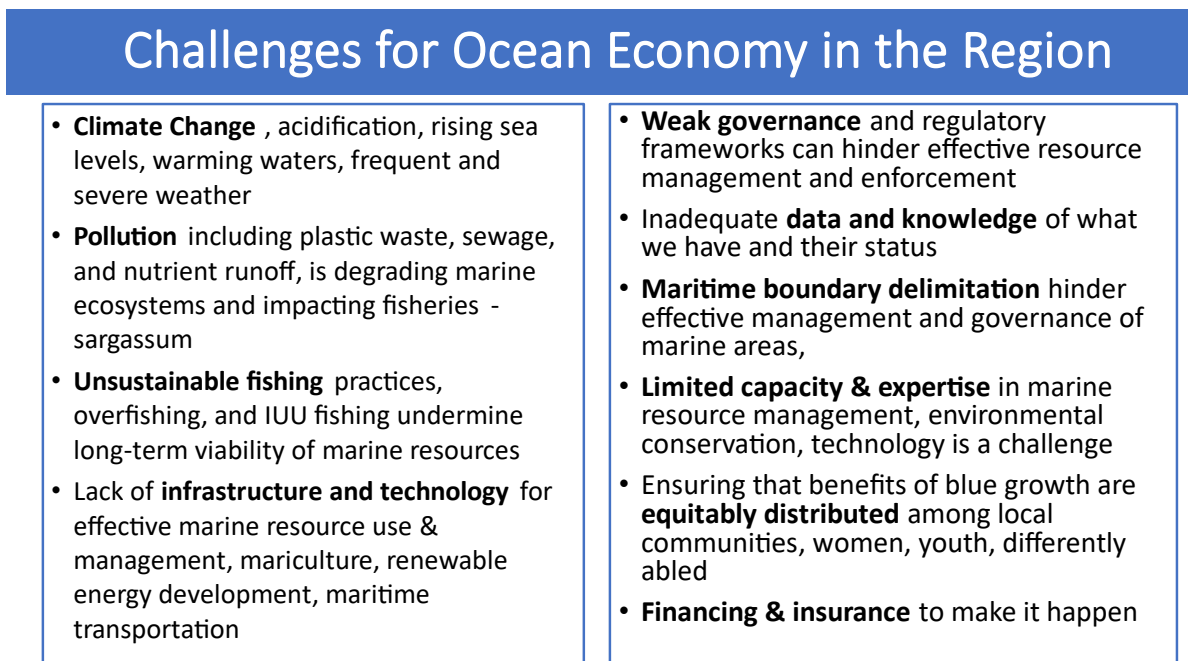


Figure 1.12: Challenges for Ocean Economy in the Region

3.2 Science production in the Caribbean region

Due to the lack of STI indicators and statistics in the region (UNESCO, 2021), the estimation of the specific marine research capacities in the Caribbean region has been complemented with the analysis of scientific publications by country or affiliated institution. A bibliometric study has been conducted based on the Scopus database using various search strings from 1999 to get an overview of almost 25 years of scientific production.

3.2.1 STI data desk research

UNESCO is the UN agency in charge of producing STI data worldwide through its Institute of Statistics that is compiled regularly on the UNESCO World Science Report, the last one dated from 2021. However, the data from the territories (including countries) of the study is very scarce. Moreover, the scope of this study includes both LAC (Cuba and Dominican Republic) and CARICOM countries. Cuba, and the Dominican Republic the biggest science producers in the geographical scope of this project with 1626 and 232 indexed publications in 2019³⁷. They are considered as Latin American region under the UNESCO division and therefore, compared within this sub region in the figure below.

³⁷ Puerto Rico is considered as a territory of the US and is not appearing in the UNESCO statistics database with specific indicators on science production.

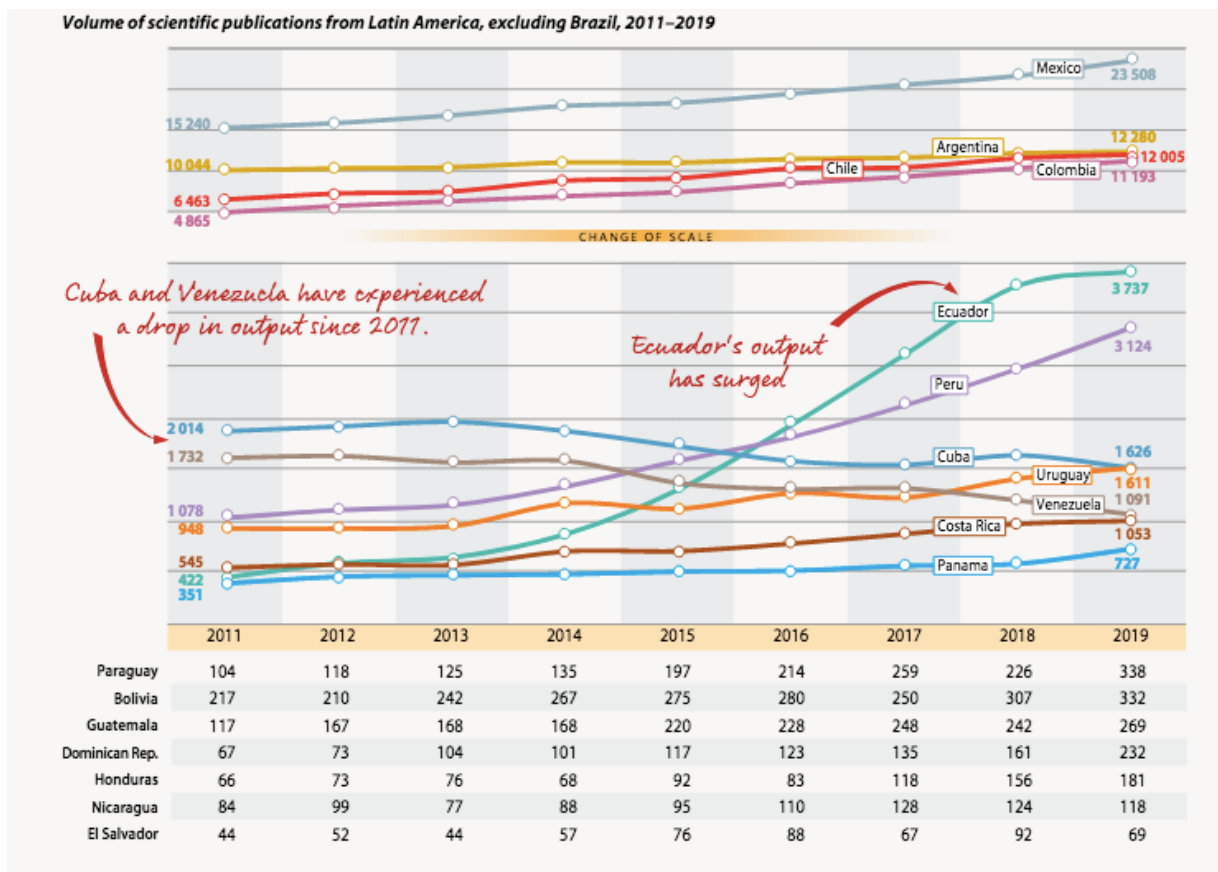


Figure 1.12: Volume of Scientific publications from Latin America, excluding Brazil, 2011-2019. UNESCO, 2021

The information on this figure is important in view of promoting intra-regional collaboration (LAC level) with top producers in the Latin America region and to promote better collaboration within the Caribbean region, which is a major issue. This is reflecting the influence of Northern countries in the Caribbean research agenda- specially SIDS and territories with low critical mass of scientist- setting and (mis) use of limited human resources- including brain drain.

The rest of the territories of this project are part of the CARICOM region in the UNESCO World Science Report. According to this same source (see figure below), the biggest volume of scientific publications in the countries of this study are produced Trinidad y Tobago (338)- that increases 17% the number of researchers over 2015-2017-, Jamaica (335), Grenada (208) and Barbados (113), giving a good idea of which are the leading countries with whom to promote internal cooperation.

Volume of scientific publications in Caricom countries, 2011–2019

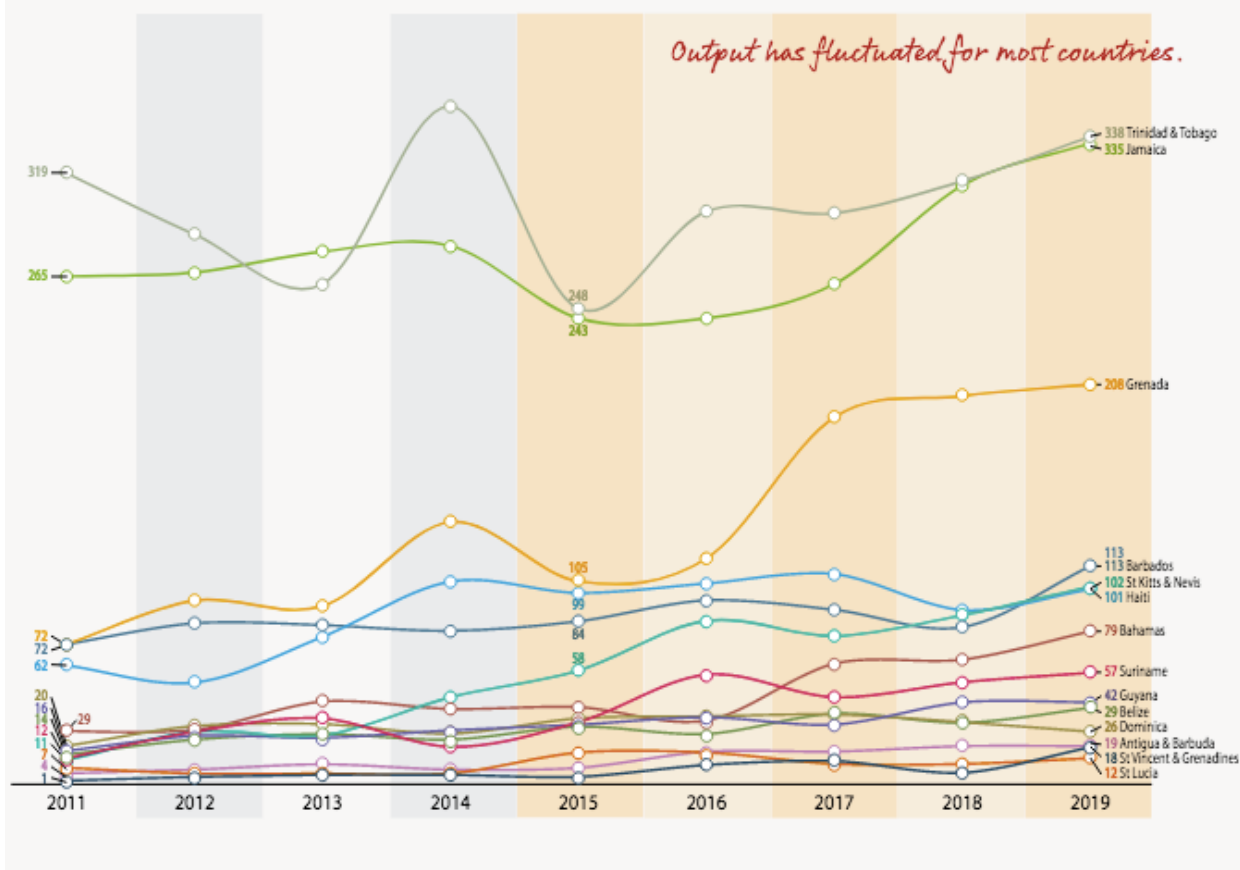


Figure 1.13: Volume of Scientific publications in Caricom countries, 2011-2019. UNESCO, 2021

The report calls attention to the very low level of collaboration among Caricom scientists, in fact only around 2% of 2016-2018 publications are co-authored by researchers from Caricom countries, against the 80% of publication with foreign countries- of which 40% of publication co-signed by US based researchers followed by scientists based in the UK, the Netherlands, France and other Northern countries.

The figure below helps to identify real home R&D capacity (leading scientist, first author) vs being co-authoring (with undefined role) of publications lead by Northern (mostly US) scientists. This is important in defining a cooperation strategy among the EU and the Caribbean as the funding/capacity building actions to support Caribbean science community could be deviated to US and other northern countries in reality.

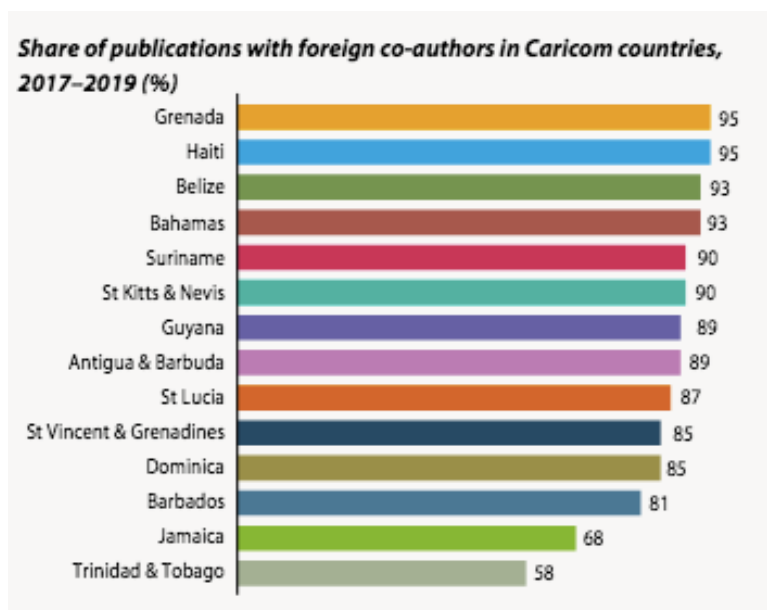


Figure 1.14: Share of publications with foreign co-authors in Caricom countries, 2017-2019 (%). UNESCO, 2021

Top five partners for Caricom countries for scientific co-authorship, 2017–2019 (number of publications)

Caricom Country	1st collaborator	2nd collaborator(s)	3rd collaborator(s)	4th collaborator(s)	5th collaborator(s)
Antigua & Barbuda	USA (33)	Canada (6)	Egypt/Spain (5)		Australia/Dominica (4)
Bahamas	USA (137)	UK (51)	Canada (45)	Australia (29)	Germany (25)
Barbados	USA (112)	UK (67)	Canada (46)	Jamaica (33)	Trinidad & Tobago (31)
Belize	USA (65)	UK (23)	Mexico (18)	Canada (15)	Australia (11)
Dominica	USA (46)	Germany/UK (11)		Brazil/Nigeria (8)	
Grenada	USA (469)	Japan (95)	UK (58)	Canada (44)	Germany (34)
Guyana	USA (55)	UK (26)	Australia/France (18)		Brazil (17)
Haiti	USA (234)	UK (33)	France (29)	Canada (27)	Brazil (23)
Jamaica	USA (379)	UK (118)	Canada (95)	France (52)	Mexico (51)
St Kitts & Nevis	USA (114)	UK (46)	South Africa (27)	Canada/Denmark (23)	
St Lucia	USA (14)	Dominica/Nepal (5)		Barbados/Jamaica/Trinidad & Tobago (4)	
St Vincent & Grenadines	USA (20)	Canada (6)	Nigeria/UK (4)		Barbados/Trinidad & Tobago (3)
Suriname	Netherlands (64)	USA (51)	France (34)	Belgium/Brazil (31)	
Trinidad & Tobago	USA (207)	UK (168)	India (92)	Canada (63)	Jamaica (45)

Source: Scopus (excluding Arts, Humanities and Social Sciences), data treatment by Science Matrix

Figure 1.15: Top 5 partners for Caricom countries for scientific co-authorship, 2017-2019 (number of publications). UNESCO, 2021

3.2.2 Bibliometric study

Generic search

Using SCOPUS, the team leader has undertaken a series of research to better define the Marine scientific community in the territories of our study.

A first search was done on a general basis using “marine” and “research” in the title, abstract or keywords of the documents and “Caribbean” in the abstract founding 611 documents- compared to the 472 of the inception report searches done on the 11.03.2023, so 8 months before.

In the figures below, we see that the majority of the papers/conference reports/books were produced from 2011, which is a common finding also in the thematic searchers- as we will see later on.

The sub-thematic distribution under this general theme, shows a bigger effort of the Caribbean research community to the agriculture and biological sciences (31,3%) followed by the environmental sciences (23,9%) and Earth and planetary sciences (14%). Engineering, social sciences and most importantly, in terms of understanding climate change and the complex interactions of the marine and maritime system in the region, **multi and/or inter- disciplinary sciences are very low**. This is also talking about the niches in knowledge and bad interaction among researchers and institutions and probably, policy makers as confirmed by McConney et al. (2016). When the science-policy interface is weak and not aligned, researchers are not producing the kind of evidence (multi/interdisciplinary) needed for policy decisions. As stated in the last UNESCO World Science report (2021) “despite the region’s vulnerability to climate change, Caricom authors are conspicuously absent from research addressing the local impact of climate-related hazards and disaster risk reduction strategies, with fewer than 7 and 5 publications, respectively from 2012-2019”.

In the general context of the SDGs (and its translation into regional and national development agendas)- which are basically interlinked, the lack of multidisciplinary studies could show the segregation of the not only in the academic community but also with the public authorities, typically line ministries, that are funding research. In the case of small countries with limited research capacity, this fragmentation among researchers/institutions and isolation from the policy element, can duplicate efforts and cause big gaps in the STI production, as it is the case of the Dominican Republic (See related chapter).

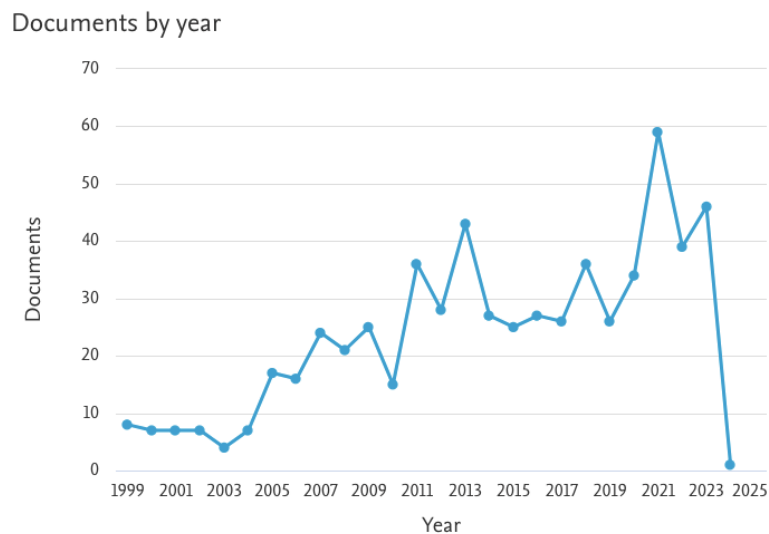


Figure 1.16: Marine research documents by year. SCOPUS searched on the 11.12.20233

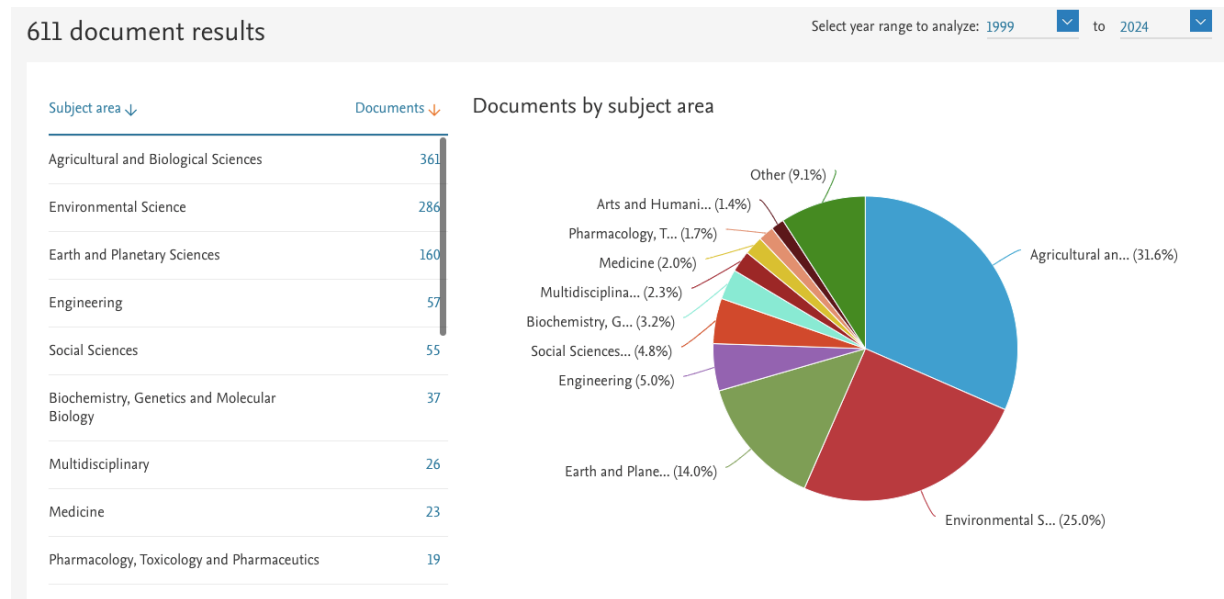


Figure 1.17 Marine documentary by subthemes. SCOPUS, 11.12.2023

Looking into national marine scientific production under this general thematic approach (fig. above), we see **the predominance of the United States**, and positively surprisingly although far, Colombia and Mexico followed by the United Kingdom and Australia. Canada, France and the Netherlands, both with outermost regions (ORs) and overseas countries and territories (OCTs) that give them higher access to co-publication of scientific papers. This becomes clearer when reducing the search to the scope of this action, the picture is clear, as France, Netherlands, UK followed by Puerto Rico, Cuba, Trinidad and Tobago and Barbados as shown in the fig below.

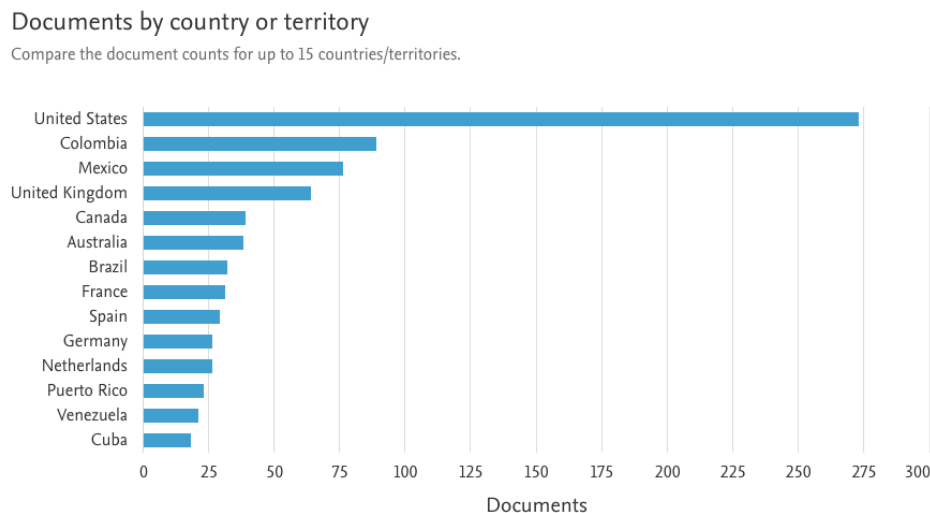


Figure 1.18: Documents by Country. SCOPUS, 10.12.2023

Mexico and Colombia, although are not part of the geographical scope of this action, appear as natural research partners to enhance the marine scientific cooperation in the region and with the EU. Puerto Rico, through the University of Mayagüez, is also a clear partner and research leader

in the region at the level of the Australian James Cook University in terms of scientific production. The production of science is very much in line with availability of funding if we compare, FP7 appears in the 9th position and Horizon 2020 in the 11th position.

Documents by affiliation [i](#)

Compare the document counts for up to 15 affiliations.

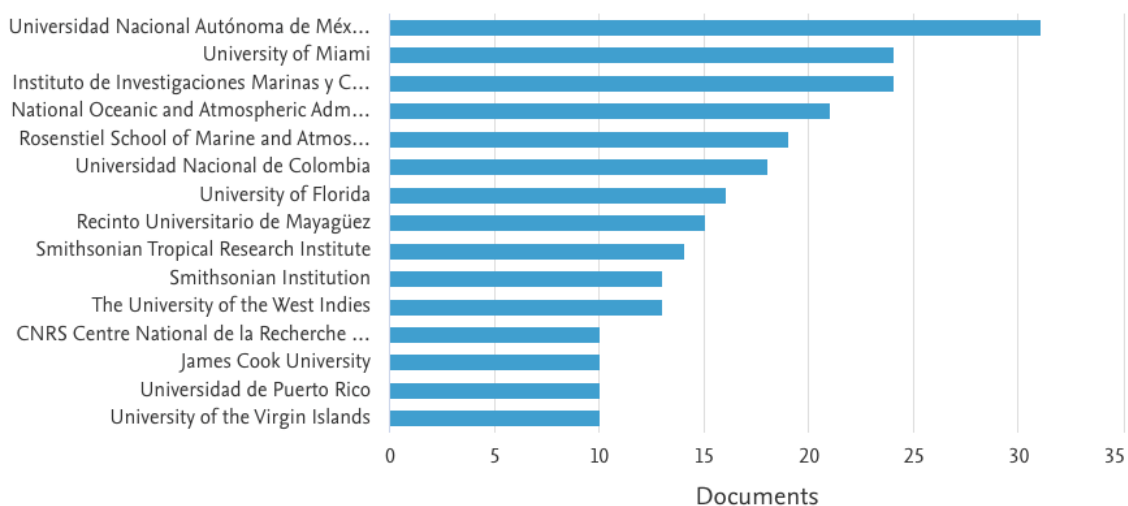


Figure 1.19: Documents by research organization. SCOPUS, 11.12.2023

Documents by funding sponsor

Compare the document counts for up to 15 funding sponsors.

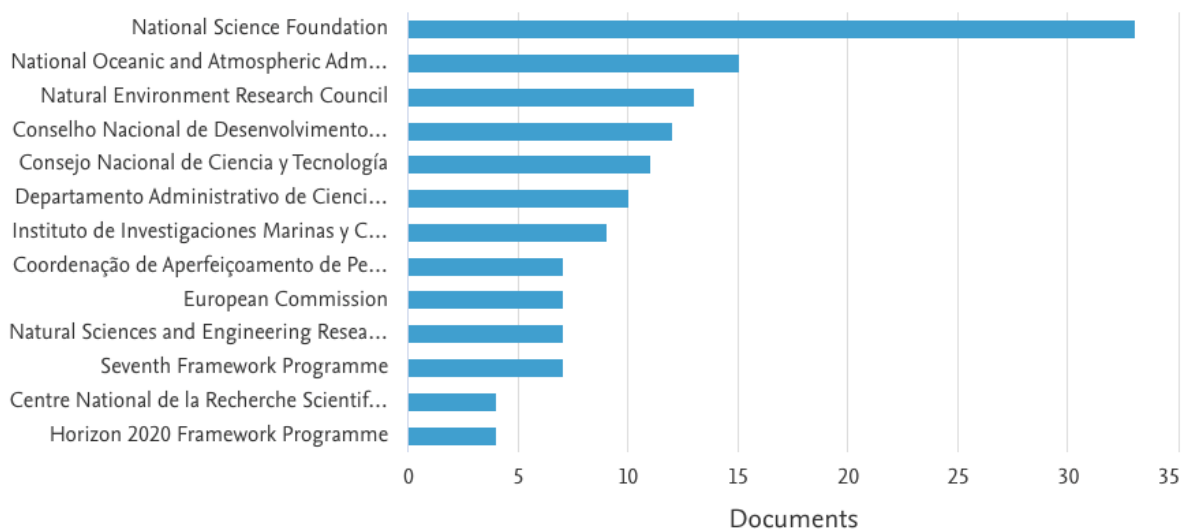


Figure 1.20: Documents by Funding sponsor. SCOPUS, 11.12.2023

Searches by topics

In order to understand the science and policy interface gaps, there is need to look more in detail on the alignment between the topics as prioritized by marine political agendas and by the scientific community in the region, and its translation into scientific publications.

The UNESCO Intergovernmental Oceanographic Commission (IOC) identified in the pilot 2022 edition of the **UNESCO-IOC State of the Ocean Report** the main global challenges requiring urgent actionable research and capacity building that are the 10 key research needs of the UN Decade on Ocean sciences for Sustainable development 2021-2030



Figure 1.21: UNESCO-IOC State of the Ocean Report: the main global challenges

In the context of the wider Atlantic Ocean, including the Caribbean, the All-Atlantic Ocean Research and Innovation Alliance aims at engaging with partners from along and across the Atlantic Ocean, promoting a cooperative approach in ocean science to address together the biggest challenges the Atlantic Ocean is facing. The overall **All-Atlantic Ocean Research and Innovation Alliance Declaration** include similar topics for research that can be used as a basis to co-define the joint priorities for scientific cooperation among EU (and other Atlantic parties i.e., Argentina, Brazil, Canada, Cabo Verde, Morocco, South Africa and the United States) and the Caribbean marine scientific community.

In order to understand in which of the research topics included in the Declaration cooperation among the two regions could be easily mobilized by the various EU mechanisms, we performed a series of SCOPUS search strings by the themes included in this Declaration:

- I. Increase our understanding of the relationship between the ocean and climate, and to develop outcome-oriented science for mitigating and adapting to its consequences
- II. Monitor, protect and restore marine ecosystems and biodiversity, thereby enhancing their resilience and potential for adaptation to climate change and other natural and anthropogenic stressors
- III. Tackle the impacts of marine pollution, including plastics, on marine species and ecosystems
- IV. Develop innovative, outcome-oriented science to support sustainable fisheries and aquaculture
- V. Coordinate Atlantic Ocean observing and seabed mapping efforts and improve modelling capacities
- VI. Promote circular, sustainable and inclusive ocean economies
- VII. Promote ocean literacy and broaden engagement in ocean sciences and ocean sustainability

The searches on these themes were limited to the last 20 years as we saw before it is only in 2010 when the region is producing a more significant number of papers. We have included below the graphics with the top 5 countries and the ones that are part of the scope of this project.

The top priority for the research community on the Caribbean (USA, Mexico, Colombia, UK and Barbados on the top five and Belize, Cuba in nice positions) **is fisheries and aquaculture** followed by **Observation or mapping or modelling** with US, Colombia, Mexico, Canada and France in the top 5 and Puerto Rico and Barbados in 6th and 7th position. The third research topic is **climate change or adaptation or mitigation** with US, UK, Canada, Australia, Brazil and the Netherlands on the top 5 and Puerto Rico and Jamaica in 5th and 6th positions.

Documents produced by institution on the **IV priority (fisheries and aquaculture)** of All Atlantic Ocean Research and Innovation Declaration with 978 results shows this is the top researched priority in the last two decades, with US, UWI and Mexico as key players.

(TITLE-ABS-KEY(fisheries OR aquaculture) AND ABS(caribbean)) AND PUBYEAR > 2001 AND PUBYEAR < 2025

! Maximum number of countries/territories exceeded

You may only compare 15 countries/territories at a time. Please remove a country/territory before adding another.

978 document results

Select year range to analyze: 2002 to 2024

Analyze

Affiliation ↑	Documents ↓
<input type="checkbox"/> Universidad del Magdalena	57
<input type="checkbox"/> University of Florida	46
<input type="checkbox"/> National Oceanic and Atmospheric Administration	45
<input type="checkbox"/> University of Miami	43
<input type="checkbox"/> Rosenstiel School of Marine and Atmospheric Science	42
<input type="checkbox"/> The University of the West Indies	37
<input type="checkbox"/> Universidad Nacional Autónoma de México	34

Documents by affiliation

Compare the document counts for up to 15 affiliations.

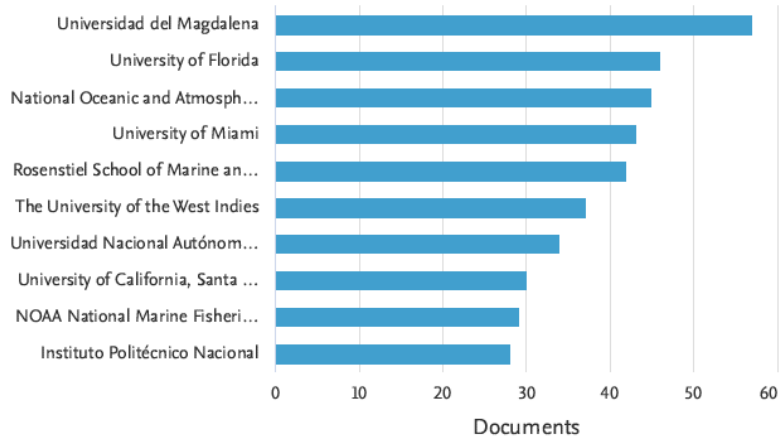


Figure 1.22: Fisheries and Aquaculture

Ecosystems and biodiversity (priority II of the declaration) is a big priority both for policy, meeting the blue economy and 30% of MPAs goal as in Barbados, that is increasingly supported by research with 858 documents found, see below.

(TITLE-ABS-KEY(ecosystem OR biodiversity) AND ABS(caribbean AND sea)) AND PUBYEAR > 2001 AND PUBYEAR < 2025

858 document results

Select year range to analyze: 2002 to 2023

Country/Territory ↑	Documents ↓
<input type="checkbox"/> United States	392
<input type="checkbox"/> Colombia	124
<input type="checkbox"/> Mexico	116
<input type="checkbox"/> United Kingdom	89
<input type="checkbox"/> France	69
<input type="checkbox"/> Spain	67
<input type="checkbox"/> Germany	61
<input type="checkbox"/> Brazil	58
<input type="checkbox"/> Australia	53
<input type="checkbox"/> Canada	49

Documents by country or territory

Compare the document counts for up to 15 countries/territories.

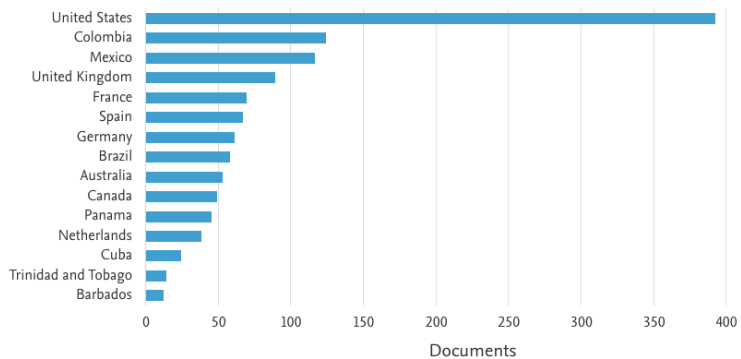


Figure 1.23: Ecosystems and biodiversity

Documents by affiliation ⓘ

Compare the document counts for up to 15 affiliations.

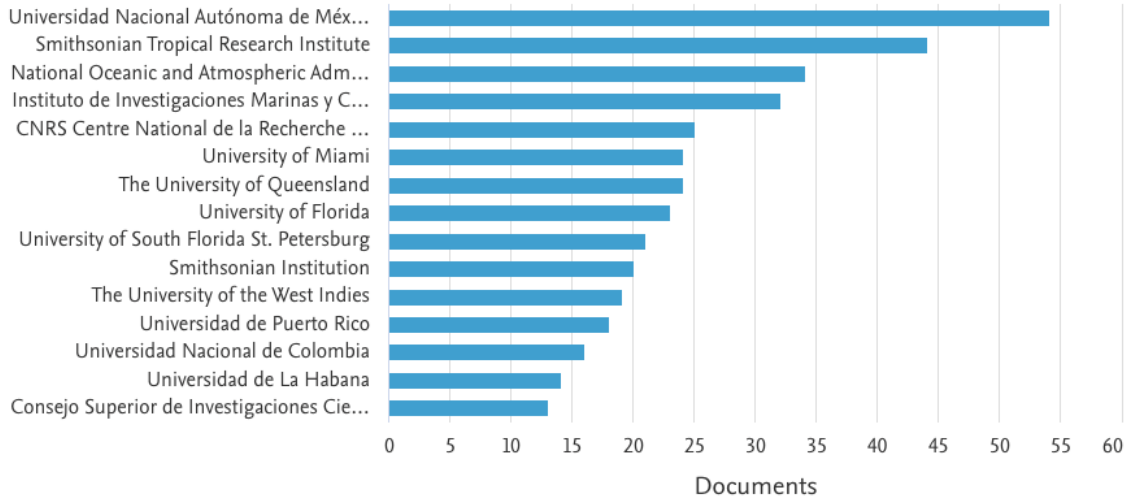


Figure 1.24:

The documents found by country on the first priority “**ocean and climate, mitigation and adaptation**” of the of All Atlantic Ocean Research and Innovation Declaration show that the interest is growing in the last decades in line with national and international policy agendas.

(TITLE-ABS-KEY(climate AND change) OR TITLE-ABS-KEY(adaptation OR mitigation) AND ABS(caribbean AND sea)) AND PUBYEAR > 2001 AND PUBYEAR < 2025

756 document results

Select year range to analyze: 2002 to 2023 Analyze

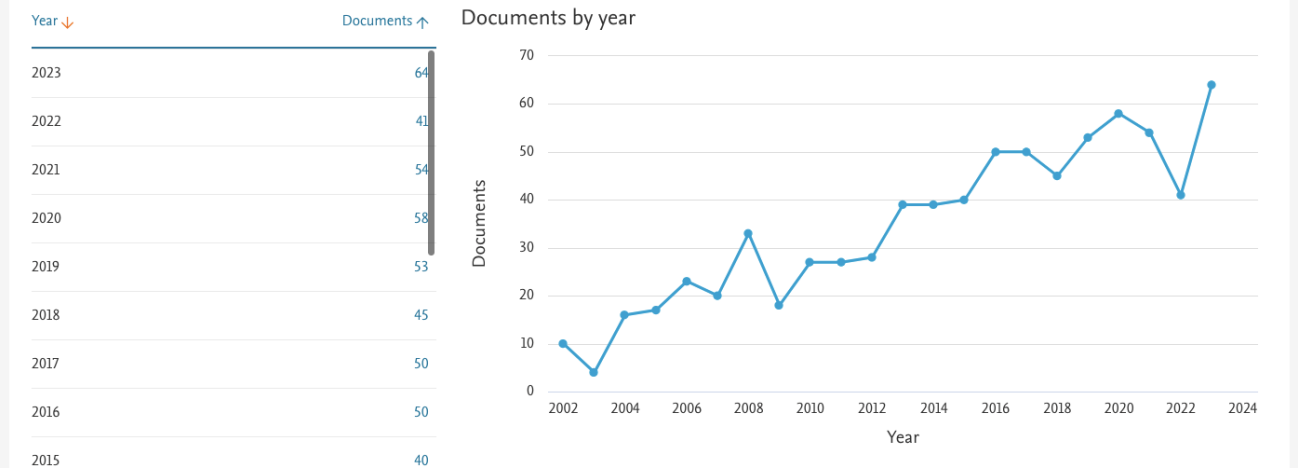


Figure 1.25: Ocean And Climate, Mitigation and Adaptation

Documents by country or territory

Compare the document counts for up to 15 countries/territories.

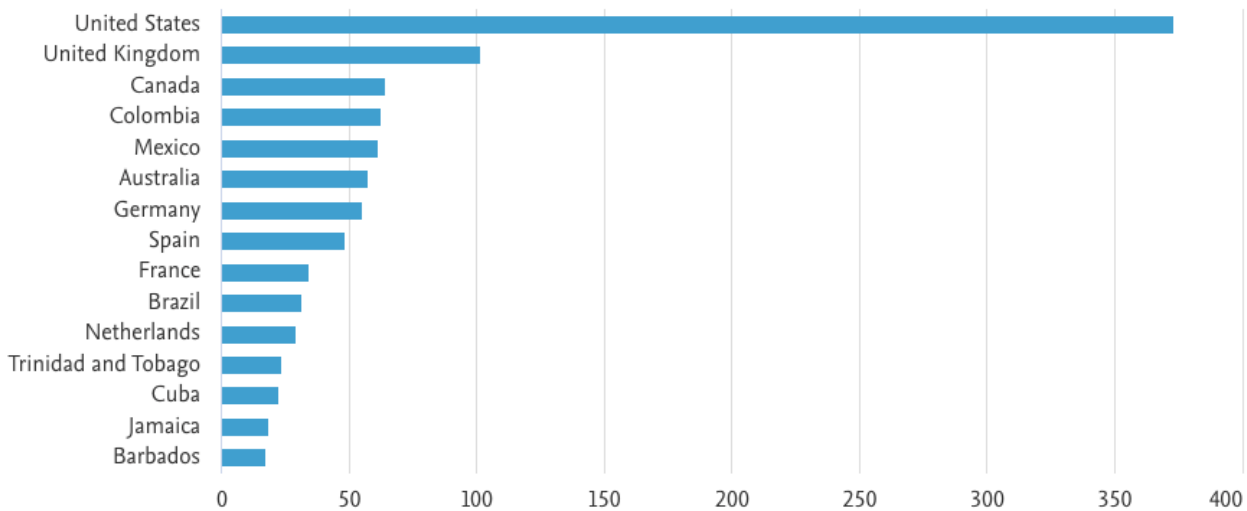


Figure 1.26: priority countries within EU for Horizon Europe cooperation under SDG 13: climate action. 2002-2023

This figure on main science producer, gives us an idea of priority countries within EU for Horizon Europe cooperation under this key topic for SDG 13: climate action.

On the less researched topics, we find priority two of the All- Atlantic R&D Declaration: biodiversity and ecosystems protection and restoration with US, Mexico, UK, Colombia, France, NL and Cuba on the top 6 and a clear increasing production in the last two decades which are the focus of these searches.

Due to the increasing importance of the Sargassum arrivals in the Caribbean Sea, a specific search on it showed how when research and policy agendas are aligned (and research is well funded) the research community replies quickly to address the challenges. Only in 10 years, since the massive arrivals started in 2011, the production of 60 documents in March - mainly by US, Mexico (one of the most concerned countries), France, Brazil, Jamaica, UK followed by Barbados and Puerto Rico are showing the power of funding to reshape the researchers' communities. As of now with 88 documents found, it shows how funding drives research and how the Caribbean scientific community is mobilized and ready to reply to policy needs for evidence.

(TITLE-ABS-KEY(sargassum) AND ABS(caribbean AND sea)) AND PUBYEAR > 2001 AND PUBYEAR < 2025

88 document results

Select year range to analyze: 2005 to 2023 Analyze

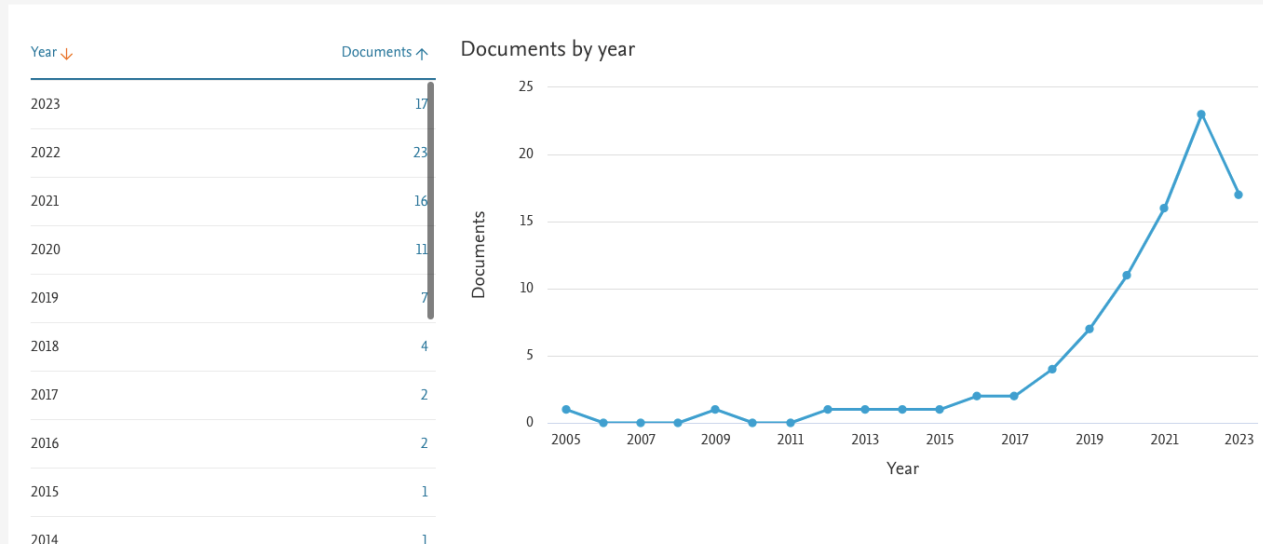


Figure 1.27: Publications on Sargassum

When open up to Algae (not restricted to Sargassum) the number of papers is multiplied by almost four, expertise with other algae is an opportunity to Sargassum research and vice versa (see below).

(TITLE-ABS-KEY(sargassum OR algae) AND ABS(caribbean AND sea)) AND PUBYEAR > 2001 AND PUBYEAR < 2025

312 document results

Select year range to analyze: 2002 to 2023 Analyze

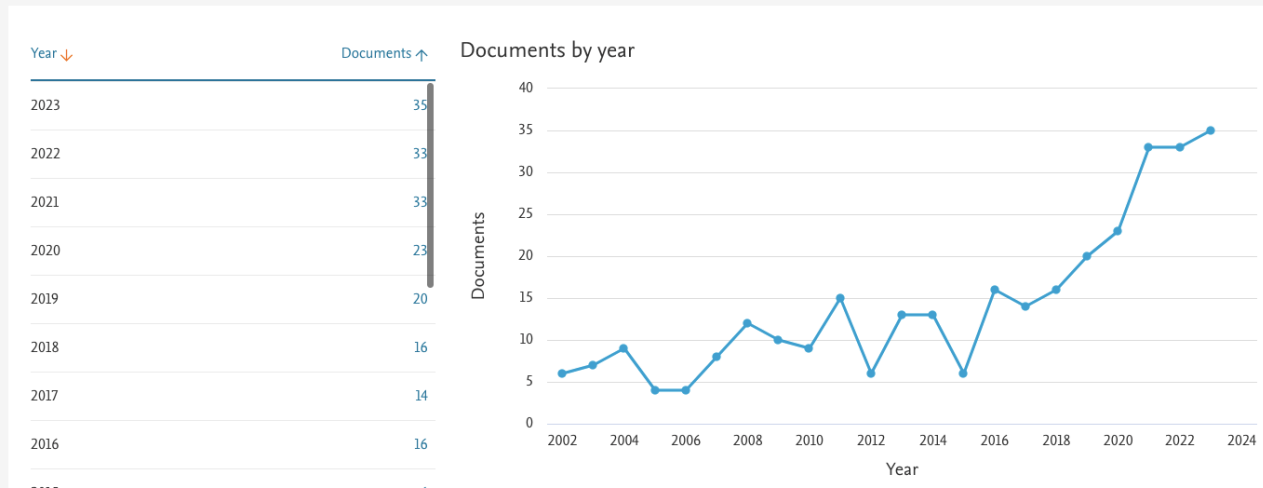


Figure 1.28: Publications on Sargassum and other algae

(TITLE-ABS-KEY (sargassum OR algae) AND ABS (caribbean AND sea)) AND PUBYEAR > 2001 AND PUBYEAR < 2025

312 document results

Select year range to analyze: 2002 to 2023

Affiliation ↑	Documents ↓
<input type="checkbox"/> Smithsonian Tropical Research Institute	5
<input type="checkbox"/> Universiteit Gent	5
<input type="checkbox"/> Universidad del Magdalena	5
<input type="checkbox"/> The University of the West Indies	5
<input type="checkbox"/> LGL Ecological Research Associates, Inc.	5
<input checked="" type="checkbox"/> Université des Antilles	5
<input type="checkbox"/> UNAM - Campus Sisal	5
<input type="checkbox"/> Universidade Federal do Rio de Janeiro	4

Documents by affiliation

Compare the document counts for up to 15 affiliations.

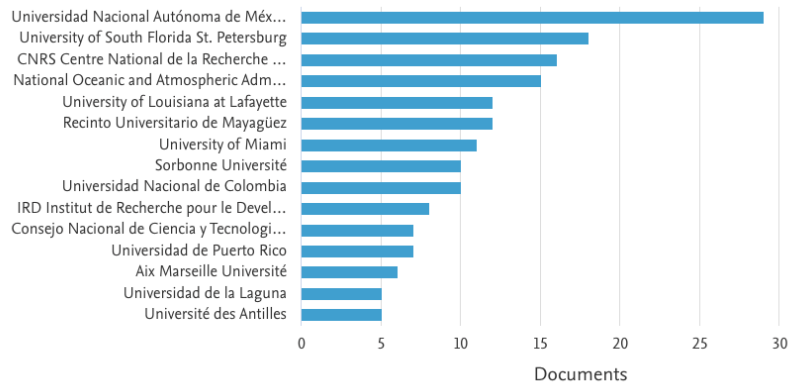


Figure 1.29: Publications on Sargassum and other algae - Universities

Marine pollution- with ninety documents, is also quite recent and getting low interest from the research community, although the plastic litter appears as the most interesting within it and might be linked to the policy advancement on the replacement of single use plastics, and again, the impact on tourism and biodiversity linked to tourism (turtles in particular).

(TITLE-ABS-KEY (marine AND pollution) AND ABS (caribbean AND sea)) AND PUBYEAR > 2001 AND PUBYEAR < 2025

90 document results

Select year range to analyze: 2003 to 2023 Analyze

Year ↓	Documents ↑
2023	1
2022	7
2021	7
2020	6
2019	6
2018	7
2017	10
2016	2
2015	3
2014	4

Documents by year

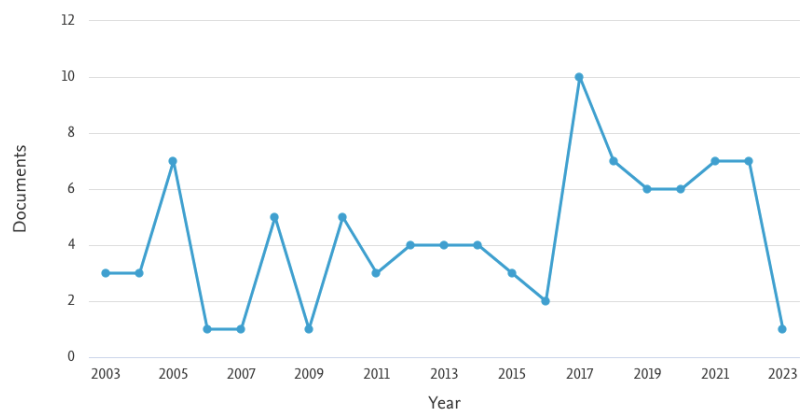


Figure 1.30: Research Documents on Marine Pollution

(TITLE-ABS-KEY (marine AND pollution) AND ABS (caribbean AND sea)) AND PUBYEAR > 2001 AND PUBYEAR < 2025

90 document results

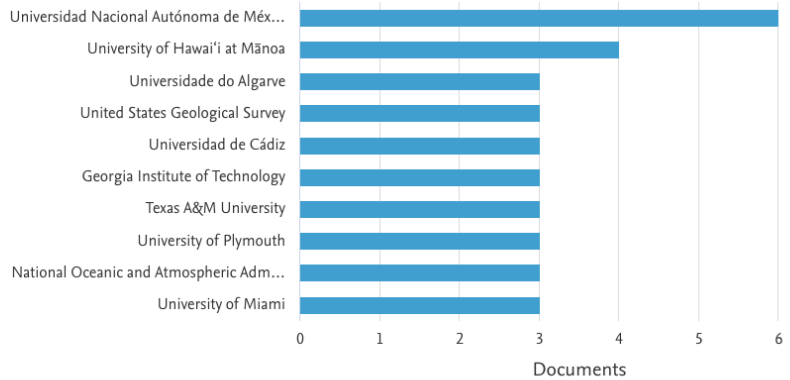
Select year range to analyze: 2003 to 2023

Affiliation ↑ Documents ↓

Universidad Nacional Autónoma de México	6
University of Hawai'i at Mānoa	4
Universidade do Algarve	3
United States Geological Survey	3
Universidad de Cádiz	3
Georgia Institute of Technology	3
Texas A&M University	3
University of Plymouth	3
National Oceanic and Atmospheric Administration	3

Documents by affiliation

Compare the document counts for up to 15 affiliations.



Click on cards below to see additional data.

Figure 1.31: Research Institutions on Marine Pollution

The low production on the theme of **ocean sciences and ocean sustainability** (with only 10 documents and only starting in 2015 in preparation of the 2021-2030 UN Decade of Oceans Science for Sustainability) seems to indicate **that holistic complex issues and basic sciences requires long term funding initiatives and policy commitment to flourish**. It is however positive that Barbados is leading in the subject, showing political commitment as shown in their policy framework (see figure 1.32). In any case, the searchers of more generic terms are more subjected to errors in SCOPUS.

(TITLE-ABS-KEY (ocean AND sciences) AND TITLE-ABS-KEY (ocean AND sustainability) AND TITLE-ABS-KEY (caribbean)) AND PUBYEAR > 2001 AND PUBYEAR < 2025

10 document results

Select year range to analyze: 2002 to 2022 Analyze

Year ↓ Documents ↑

2022	1
2021	0
2020	0
2019	1
2018	1
2017	0
2016	0
2015	0
2014	2
2013	0

Documents by year

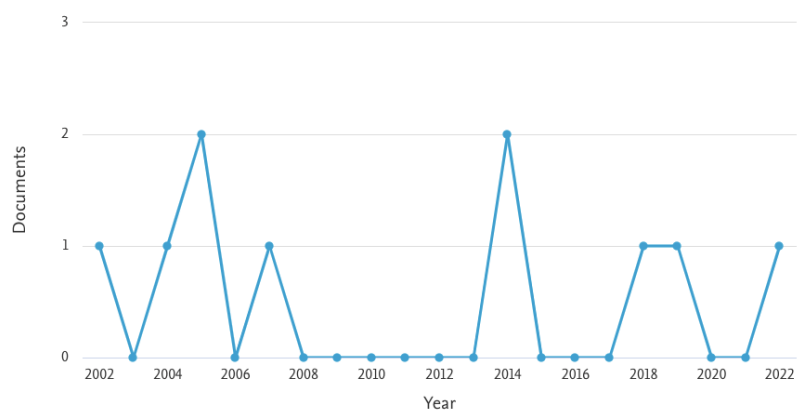


Figure 1.32: Research on ocean sciences and ocean sustainability

3.3 Survey results

Several countries in the Caribbean were visited by the team. In each country they tried to engage with as many key actors related to marine research as possible. However, the capacity to make an X-ray of these research systems was by the nature of this missions limited. For that reason, a complementary tool was developed. This tool consisted of a questionnaire to be answered by stakeholders via the internet. A copy of the survey is included in the annex of this report. Answering was possible through a simple login. There was no need to download any application. The questionnaire went on air in the beginning of October and was operational till the mid-November workshop in Bridgetown in Barbados.

The objective of the questionnaire was to obtain more information from more stakeholders in more countries and territories than could be reached during the field visits. The objective was not to obtain a representative sample of these stakeholders that would sustain quantitative data on marine research in the region. People were reached through mailing lists (with the requests to share the link with their colleagues). Mailing lists were compiled from the stakeholders visited in missions, UNESCO marine experts' data base, contacts of UNESCO in the region, contacts of the EU delegation in the region, and partners in the EU Horizon research program. As a result, there is a likely bias towards respondents who in one way or another already interacting with the European Union or international organizations that are in any case, the easier to be mobilized for enhancing participation of the Caribbean region in EU programs, Horizon Europe in particular.

3.3.1 Respondents

In the end, 71 persons responded to the survey. Most were from the Caribbean region themselves. These represented 19 different countries or territories. Barbados (12 respondents or 17%) and Cuba (6 or 8%) were the countries with the highest number of responders. Sixteen (23%) came from countries outside the region: Spain, Portugal, Italy, Colombia, Belgium, Costa Rica, El Salvador, Greece, USA (**Error! Reference source not found.**).

Respondents were asked to classify their organization by nature and by the kind of topics they were working on. It appears that most respondents worked at a **government institution (22) or NGO (13)**. University and research institutions were relatively underrepresented (20). Other institutions were mainly intergovernmental organizations such as United Nations Agencies and the European Commission. The full list of institutions participating in the survey is available in the annex of the report (Annex 4.2).

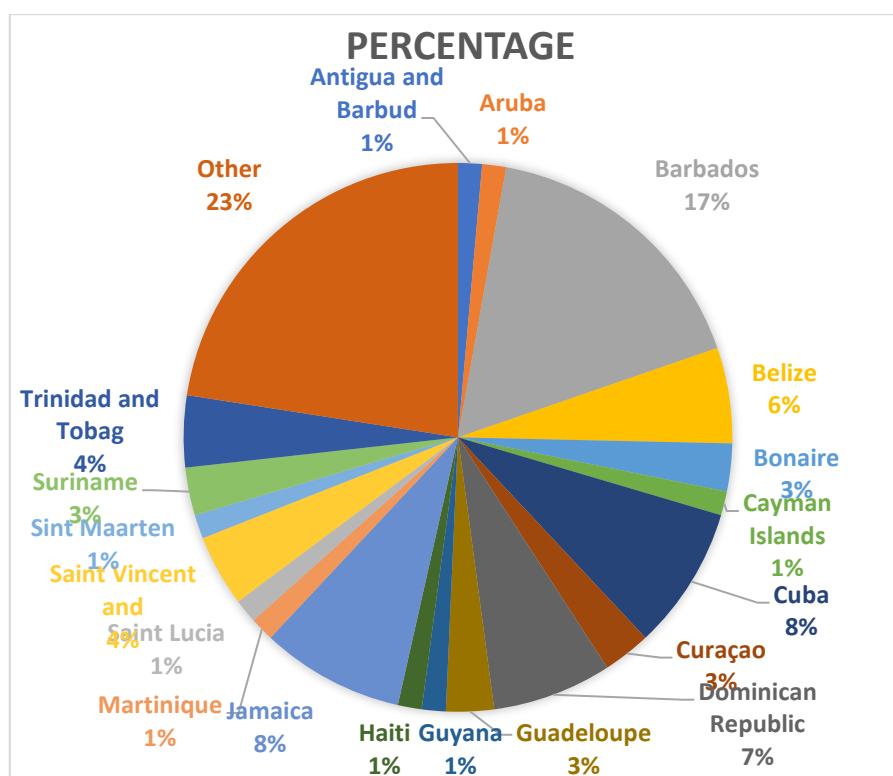
The most frequently mentioned topics were **biodiversity, climate change and natural resource management**. The least frequently were employment and construction. The panel was thus composed of people strongly rooted in the sustainable use ecological resources ([Table 1](#)).

Table 1: Respondents by their employer and the topics their organization works on.

Type of organization		Topics the organization works on			
		Five most mentioned		Five least mentioned	
Government	22	Biodiversity	34	Welfare	1
NGO	13	Climate change	32	Mining (gas, oil, minerals)	1
University	12	NR management	30	Transformative industries	1
Research institute	8	Nature conservation	25	Tourism (hospitality)	1
Private business	2	Environment	24	Construction & Development	0

Other	13	Science, tech. & innovation	20	Employment	0
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All but one of the organizations were involved in research, most with multiple roles: **45 carried out their own research**, 23 supported research by others, 42 used research by others, and 26 subcontract research services. Important financing organizations were NGOs (8 out of 13) and International Organizations (6 out of 13). Among the 22 represented government agencies only 3 financed research .



Graph 1. Percentage of participants by their countries of origin.

Table 2. Role of respondent's organization in research.

Type organization	of All	Provides services	Used research by others	Subcontracts research organizations	Carries out its own research	Finances research
Government	22	13	15	10	14	3
NGO	13	7	8	5	8	8
Other	13	9	11	6	2	6
Private business	2	2	0	0	2	0
Research institute	8	5	3	1	7	0
University	12	6	4	3	12	5
Total	70	42	41	25	45	22

Current state of research in the Caribbean

Most respondents were personally involved in research. In about half of their cases it was their main job. Their individual research interests were aligned with those of their organizations. The most frequent research topics were **Biodiversity, Climate change and Natural resource management**.

International partnerships are important. Fifty-six respondents mentioned working with international partners. Partners were typically from the Caribbean, Europe, Latin America and North America. The mostly cited reasons for selecting a partner were expertise, thematic interest and access to funding. Research funds were predominantly provided by multilateral funds, by their own institutions, or international NGOs (Figure 1.33) Note that no information was asked about research budgets. Thus, it is possible that in monetary terms institutional funds are more important than those from international NGOs.

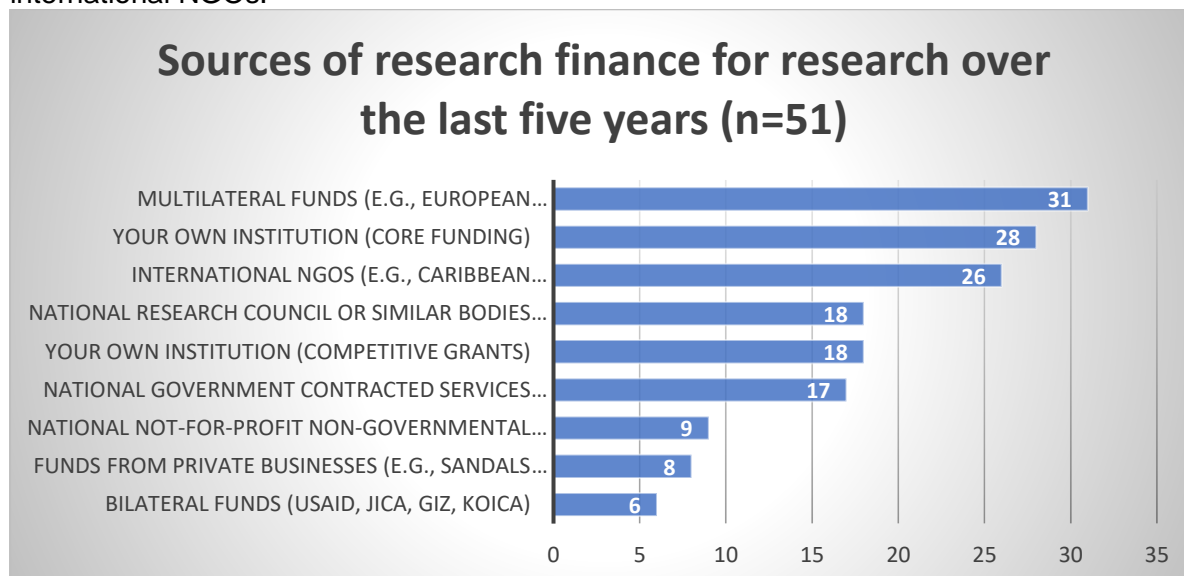


Figure 1.33: Sources of research finance for research over the last 5 years

Sources of funds for research

Frequently mentioned **multilateral sponsors** are **GEF, UNDP, UNEP, the European Commission, and the World Bank**. The most frequently mentioned **European windows** are **Interreg, Horizon Europe, and Life**.

Research requires infrastructure. The questionnaire asked respondents to classify specific items in five categories: obtained nationally, obtained regionally, obtained globally, unavailable but important, and unavailable and not important. To estimate their importance, they were ranked according to the number of times that they were classified as unavailable but important. Note that people were allowed to mark more than one answer. For example, if a researcher sourced data locally, regionally and globally she/he could mark all three options. Figure 1.34 shows that the top three constraints were Access to electronic libraries, Access to research vessels, and Access to offline data storage capacity besides general support services as internet connectivity, vehicles or meeting rooms. Looking at the results in a more general way, one can conclude that the most important constraints were information, data collection equipment, and data storage and processing

Respondents were also asked to classify a list of predefined objectives of research partnership by their importance. The results can be found in Figure 1.35. Respondents found that funding was the most important objective, followed by capacity building and access to expertise. The least important were intellectual property rights, student exchange and better outreach to the society.

3.3.2 Research agenda

Respondents were asked to rank selected research issues. The top priority issues were the blue economy (marine resource use, tourism, coastal communities and sustainable use), followed by Pollution (marine and land based, chemical, blooms and plastics) and Marine biological resources

(species, populations, harvesting, restoration, farming, inspection and control). The topic that was ranked as the least important was Marine geology (includes mineral resources and seismic research). Finally, they were asked to select from a list the three most important objectives for research. The top three objectives were enhancing research funding, promote research among small island and developing states, and support research laboratories and infrastructure ([Figure](#)).

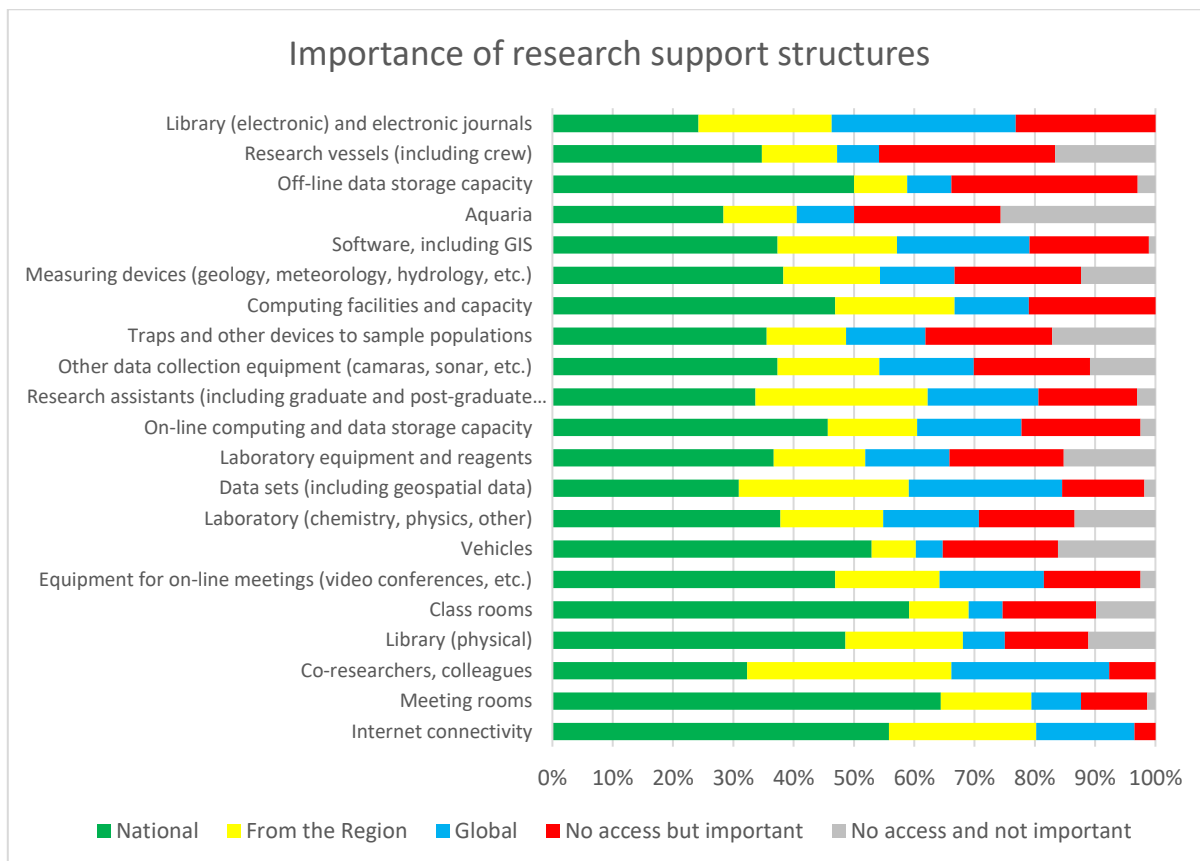


Figure 1.34: Research infrastructures ranked by their importance as a constraint.

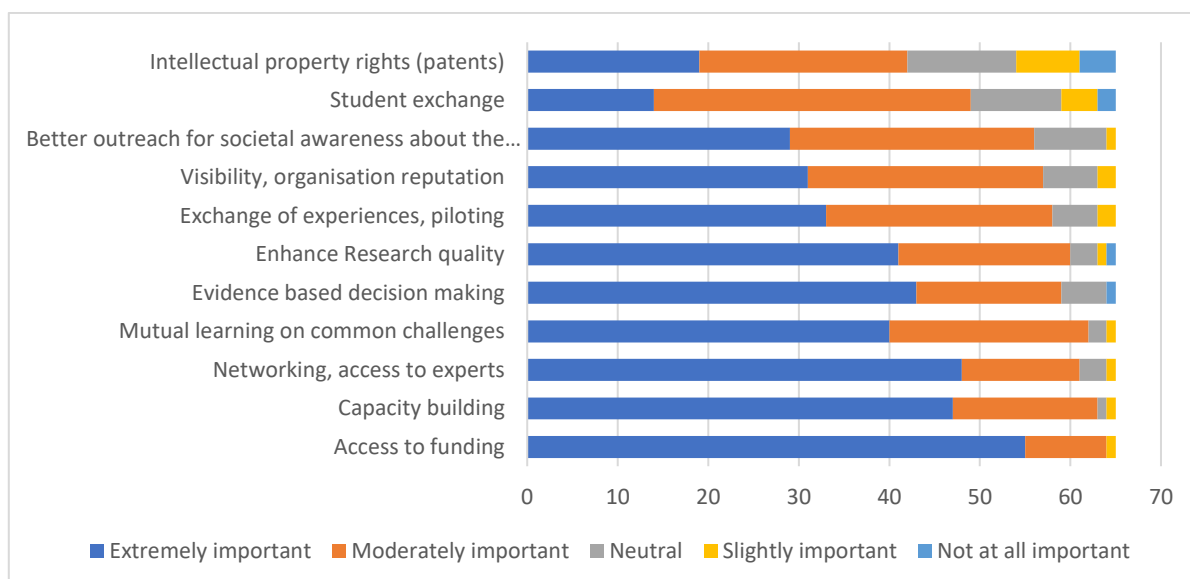


Figure 1.35: Importance of objectives of research partnerships

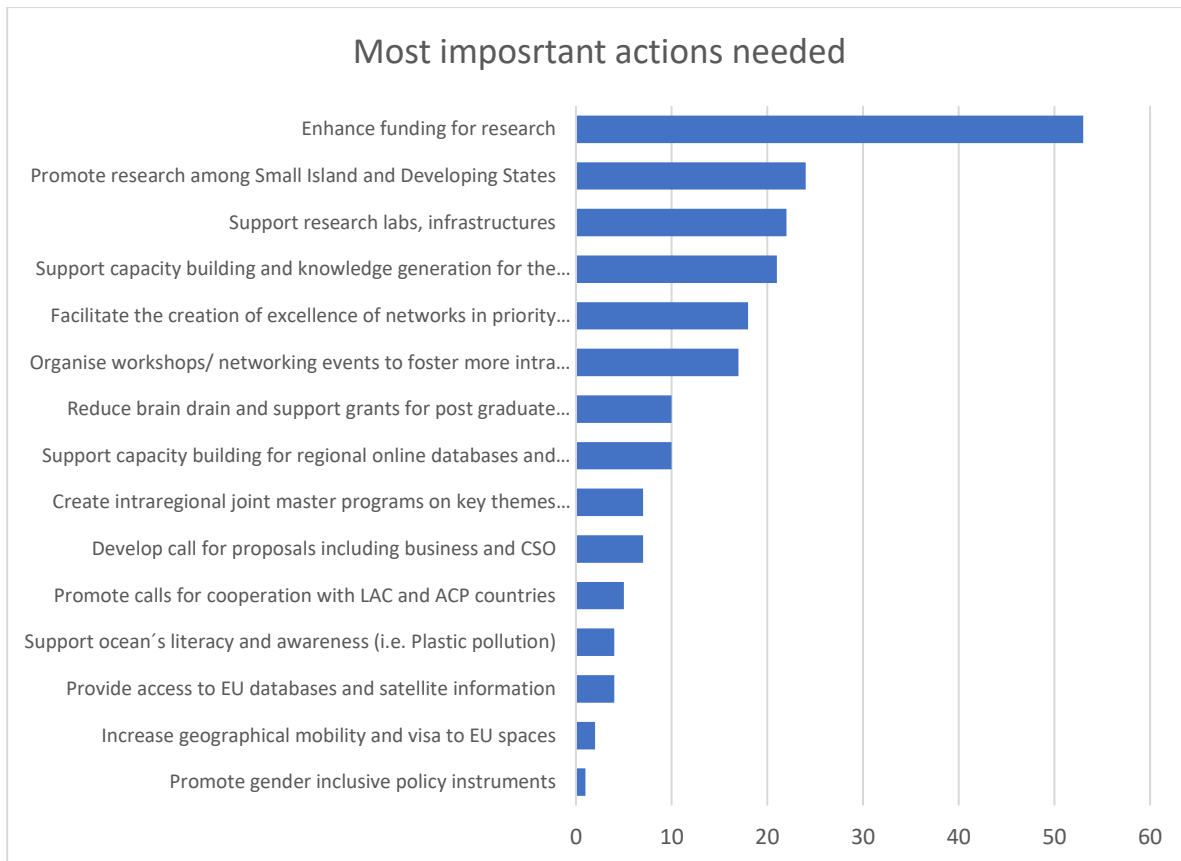


Figure 1.36: Top actions for strengthening research in the region

Conclusions

An online survey provides some insight into the structure of the research organization in the region, its financing, opportunities and challenges for the future.

First, it is clear that a broad plethora of institutions is interested in marine research. Some finance research, others carry it out, some use research by others and some are engaged in the communication of research to the community. Research is financed by core funding and from projects, mainly supported by international donors. The EU is frequently mentioned as one of the donors.

Research in the region faces several challenges, mainly associated with access to infrastructures such as data collection devices, data sets, and the capacity to store and analyse data. From donors it expects funds and expertise to overcome these challenges and implement a research agenda that is aligned with locally perceived needs.

Research is seen as an important tool to improve sustainable use of marine biological resources as part of Blue Economy and climate change resilience strategies.

3.4 Mapping of main regional and international stakeholders and initiatives (The full list of them is included as a table in the annexes of the report)

However, as part of the study the team approached and interviewed selected regional and international organizations, that are key to the **facilitation/ financing** of research and institutional capacities for the region. They all work in the science-policy interface that as stated in the introduction of the report, is an important challenge in the Caribbean.

The survey was not well adapted to these particular organizations and semi structured interviews were conducted to the eleven more relevant stakeholders working in the region covering three different categories:

- ✚ International organisations: UNEP, IOCARIBE
- ✚ Regional bodies CMO, IMA, CRFM
- ✚ Funding organisations: EIB, IDB

CMO (Caribbean Meteorological Organization) and IMA (Institute of Marine Affairs) were interviewed in Trinidad and Tobago and description included in the country profile; CRFM and IDB findings are included in the Belize mission findings. CRFM is also covered in the next section on fisheries in the region. The rest of interviews are summarized below.

IMA, CBF, UNEP, UNESCO, FAO, OECS, EIB and CRFM participated in situ in the Barbados workshop and their comments included in the workshop conclusions. Some of the key information presented in workshop is extracted in this section to complement the map of regional/international stakeholders from a total of 11 bodies.

International organization: UNEP – Cartagena Convention Secretariat- Chris Corbin, Senior coordinator officer

UNEP (United Nations' Environmental Program) has been an influential agency in the region. UNEP is doing work on Climate Change and has supported Green Economy projects in some Caribbean countries. Climate Change, Pollution and Biodiversity as the three planetary crises remain a high priority area as well as work on Small Islands and Developing States (SIDS). Its spin-offs are the Institute for Marine Affairs (IMA) in Trinidad and Tobago, the CIMAB in Cuba (see presentation in Barbados for details), RAC REPENTIC in Curacao and SPAW – RAC in Guadelupe (see mission section for details). UNEP's Kingston office administers the Cartagena Convention Secretariat, as a Regional Convention it responds to its Conference Parties. While based in Jamaica, its efforts are more at the regional level and then support countries within the regional framework.

Some important regional projects are: the Regional Marine Habitat Restoration Strategy, Regional Nutrients Pollution Reduction Strategy, Regional Marine Litter Action Plan, and Regional Marine Litter Strategy, a Regional Strategic Action Plan on Water and Climate Change for Caribbean SIDS and a Caribbean Waste Management Action Plan. All of these have formed the basis for specific project interventions mostly through GEF funding.

The main partners are: other UN agencies (UNDP, UN-Habitat, FAO, IMO (International Maritime Organization), WHO/PAHO), Development Banks (World Bank, IDB, CDB), International Government Organizations (CARICOM, OECS, ACS (Association of Caribbean States)); Academic and Research Institutes (UWI, UTECH) and Regional and International NGOs such as CANARI, IUCN, WWF, GCFI (Gulf and Caribbean Fisheries Institute).

International Organization: IOCARIBE- Lorna Inness, Head of UNESCO IOC Sub-commission for the Caribbean

IOCARIBE is the Sub commission for the Caribbean and Adjacent Regions of the International Ocean Commission of UNESCO. It was established in 1982 as a follow-up on the first regional effort in marine sciences in the Caribbean in 1968. IOCARIB believes in evidence-based policies and hence is keen on science. Ocean science should be the foundation of the sustainable blue economy.

They host the UN Decade of Ocean Science for SSD 2021-2030 (see section below) that has a specific call to African and Caribbean SIDS -as presented in the Barbados workshop- on Sustained Ocean Observations and predictions within a multi-hazard context including Climate and Ocean, Pollutants observatory, understanding accumulated impacts of multiple stressors on the ocean, Sargassum and Harmful algal blooms, Marine Spatial Planning and blue school curriculum and Ocean literacy.

The Ocean Decade Tsunami program wants to make 100% of communities at risk prepared for and resilient to tsunamis by 2030.

IOCARIBE is not a funding agency. The Sub-Commission lends its credibility, and validates and endorses fund-raising efforts. Moreover, it assists in the avoidance of duplication, waste and inefficient use of funds and resources emanating from different sources into the region for scientific projects and initiatives. Most of IOCARIBE's support for its programmes comes from external sources or is provided by Member States in the region.

IOCARIBE works with a broad range of partners such as CARICOM, ACS, universities, Regional Fisheries Mechanism and ECLAC. There is a multi-country MoU to establish an interim coordination mechanism for ocean governance with GEF funds: ProCaribe+. It sees a specific role as a data hub manager, such as the CLME+ hub, a data platform covering the Caribbean and North Brazil Shelf Large Marine Ecosystems and financed by GEF, the Caribbean Marine Atlas (CBA) with support from UNDP and GEF, and the Ocean Info Hub (OIH) funded by the Belgian region of Flanders.

FUNDING organization:

European Investment Bank - Alexandra Almeida, in charge of Caribbean projects coordination.

The EIB is working in the CAR region since 1978, covering 16 countries (excluding OCTs and Cuba), much longer than the EC does. Offices in Barbados and Dominican Republic- to contact delegates. The bank has traditionally funded environmental/climate and micro finances- also public sector loans (recently to cover COVID pandemic needs of equipment and vaccines i.e. Santa Lucia and Barbados) and will continue in these main lines to support the green transition.

It works with the Caribbean Development Bank (CDB) in climate and health resilience for COVID.

The main instruments related to Oceans in the region are two:

- 1) The Caribbean water, sanitation and clean oceans has three components:
 - a) 150 MEUR loan (that will mobilize another 150MEUR as the bank typically finances 50% and the rest is completed by EC (i.e. Global gateway can finance marine transport and Sargassum), other development banks, public budget or private). Sargassum is an area with many stakeholders and the policy of the bank is to support in any finance gaps identify to create synergies with other institutions (EC or CDB among other)
 - b) European Investment Facility approved 17 MEUR projects on this area, basically used water treatment but also complementing any initiative on the valorisation of Sargassum arrivals. Discussions on a pilot on solid wastes.
 - c) Technical assistance (8,5 MEUR) - starting in August/September to assist in the identification of 20 and implementation of 4-6 (10) projects in the region for this initial budget of 17,6 MEUR and the portfolio for later calls in the middle and long-term needs. There are some pre-identified projects by the bank in Barbados, Santa Lucia, Belize, Bahamas, Dominican Republic and Jamaica in partnership with the public sector and private in the case of solid waste. In this area, EIB works with CDB. The final selection will be done jointly by the EIB and EC with the technical assistance to ensure synergetic actions.
- 2) Caribbean green and inclusive recovery facility that will finance small-scales green investments promoted notably by micro, small and medium-sized enterprises (MSMEs), mid-caps,

private sector entities, public sector entities, private individuals and homeowner associations in the Caribbean. These are 4-5 years up to 25 MEUR projects or 12,5 MEUR loans financed through climate related credit lines. There is an indicative initial budget of 100 MEUR (around 20M for Dominican Republic, 10M Jamaica, 10M Bahamas). They are operationalized through development banks or public authorities (i.e. Ministry of environment, economy, tourism) for solar energy, social housing, electric vehicles for taxis, solid waste treatment, Sargassum, etc. It has also three components:

- a) loans up to 12,5 MEUR (projects up to 25 MEUR);
- b) grants (under approval by EIF); and
- c) technical assistance to develop proposals, support mobilization of complementarity funds, bring expertise from EU, other partners, etc.

Unfortunately, the Caribbean Community Climate Change Centre (CCCCC), GCF and GEF did not reply to the request to be part of the workshop. A brief summary is enclosed below:

- CCCCC is a regional organization addressing the impacts of climate change in the Caribbean. It collaborates with governments and development partners to integrate climate change considerations into national policies and programs. CCCCC conducts research on climate change impacts on marine and coastal ecosystems, including vulnerability assessments. It also develops adaptation and mitigation strategies for coastal communities.
- GEF is an international financial institution that funds projects addressing global environmental issues, including biodiversity conservation and sustainable development. GEF supports Caribbean countries in implementing projects related to marine and coastal research, conservation, and sustainable resource management.
- The Green Climate Fund (GCF) is the world's largest dedicated climate fund. GCF's mandate is to foster a paradigm shift towards low emission, climate-resilient development pathways in developing countries. GCF has a portfolio of USD 13.5 billion (USD 51.9 billion including co-financing) delivering transformative climate action in more than 120 countries.

Finally, on the European Union (EU) side, last may it was officially launched a €35-million climate action programme Euroclima in the Caribbean region. Euroclima is the EU's flagship programme for green action to all 33 countries across Latin America and the Caribbean (LAC) and will contribute to the implementation of the Global Gateway Investment Agenda in the region. Global Gateway is the EU's offer to bridge the infrastructure investment gap by using public financing to leverage private capital and investment for projects that.

All of the above institutions participated and presented the information in the final workshop organized in Bridgetown in order to coordinate and create synergies among them together with other key ones that presented current initiatives (agenda and presentations available here: <https://eu-caribbean-marine-research.service-facility.eu/en/speakers-presentations>): CRFM, CBF, OECS and FAO. Below some key slides of their activities and priorities.

3.5 Fisheries in the Caribbean

Fisheries and aquaculture was with almost 1000 documents, the most researched area in the Caribbean. This is in line with the importance of this activity for the livelihoods in the poorest communities of the most unequal region in the world. Traditional fisheries account for almost 90% of the total and is facing many challenges related to climate change, biodiversity and health of the oceans. For this reason, the topic can work as an umbrella theme for the interdisciplinary and holistic research that is critically missing in the region.

The Caribbean Regional Fisheries Mechanism (CRFM) is the CARICOM organisation with regional mandate on fisheries and aquaculture and was invited to make the key note presentation in the Barbados workshop both because of this community importance of fisheries and of its understanding of common regional challenges that is hard to find at local/national levels.

His Executive Director, Milton O. Haughton, presented the main challenges and topics for fisheries research from a systemic and holistic Ecosystems based perspective with social implications. He expressed the need to increase fishing monitoring centres infrastructures, satellite technologies and data exchange for fisheries management and enforcement in the Caribbean region. The region is highly dependent on fisheries for sustenance, livelihoods, and economic growth. However, overfishing and illegal activities pose threats to marine ecosystems, necessitating efficient monitoring and enforcement mechanisms and supporting infrastructures and technologies. Other key challenges include limited resources, data accessibility, and the need for standardized regional data-sharing protocols. **There is need to increase regional cooperation, investment in capacity-building initiatives, and the development of a standardized data-sharing framework can address challenges and bolster the effectiveness of fisheries management in the region.**

The total captures are stabilized over the years, both in numbers and species (See Figure 1.37 and 1.38) and mostly on traditional equipment, no damaging its sustainability according to CRFM and ANAMAR in the Dominican Republic.

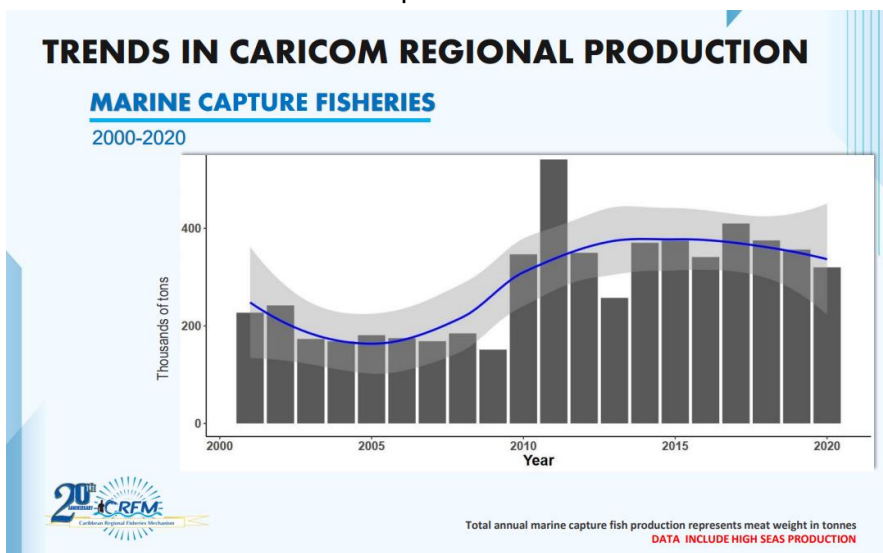


Figure 1.37: Trends in CARICOM Regional Production

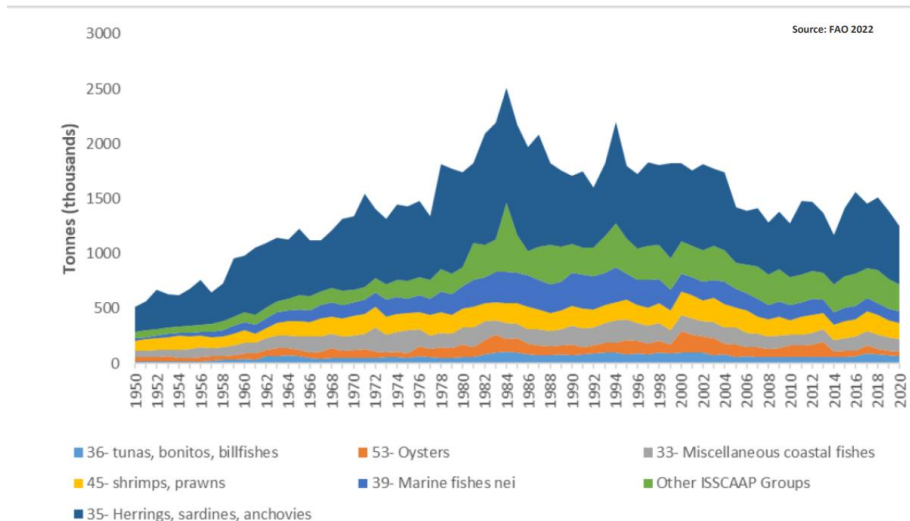


Figure 1.38: total captures, both in numbers and species

Main research priorities as identified by CRFM Ex Director are shown below.

Research Priorities For Sustainable Fisheries

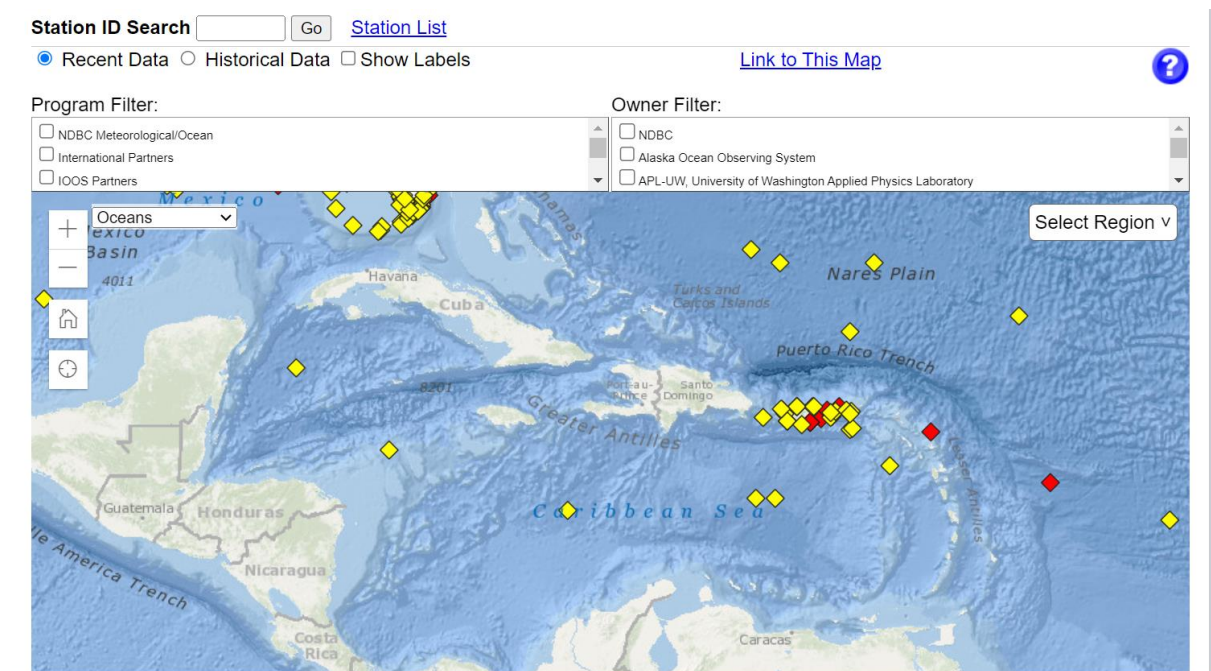
- **Sustainable Aquaculture Development**
 - Collaborative research aimed at developing sustainable aquaculture / mariculture practices
 - Studying the feasibility of aquaculture/mariculture- identifying suitable species, optimizing production methods, and addressing environmental and socio-economic impacts– integrated multi-trophic aquaculture (IMTA)
- **Stock Assessment and Ecosystem-based Fisheries Management**
 - Comprehensive fisheries independent survey of the living marine resources & state of environment of the EEZ
 - Comprehensive stock assessments for key fish species to determine their population status and health & support harvest control strategy & effective fisheries management measures
 - Research on ecosystem-based fisheries management- consider the entire ecosystem and its interconnections, rather than individual species, to ensure sustainable fish stocks and protect the marine environment.
- **Bycatch Mitigation**
 - Bycatch of non-target species, including mammals, turtles is a significant concern in some countries
 - Research and technologies to reduce bycatch in fishing operations is necessary for sustainable fisheries
- **Illegal, Unreported, and Unregulated (IUU) Fishing & Fisheries Crime**
 - Investigate the extent & impacts of IUU fishing, develop strategies to combat these unlawful activities, which undermines sustainable fisheries management, contribute to overfishing & degradation of ecosystems

In this last point, the challenges are also on staff and capacity of the staff as well as infrastructures. At the country level varies but is clearly understaffed and unequipped. The idea to share joint infrastructures, labs and vessels in particular, for the region, was very welcome from the participants.

The main problem identified is that there are no observation buoys, there are only a few ones, but in the US and Puerto Rico.³⁸ Henceforth, it is not possible to obtain information about waves, currents, etc. at the regional level, which represents a big obstacle for fishing plans and monitoring. Moreover, it is also big issue for fishermen salvage and rescue missions, among others. Again, Sargassum and

³⁸ <https://www.ndbc.noaa.gov/>

other pollutants - including organic and non-organic (i.e. plastics, oil accidents) - monitoring/cleaning activities, and its influence on fisheries represent an additional threat given that the current network of buoys is insufficient (see below), and the exchange of data among countries or even institutions within the same country is extremely low.



The need to higher access to unmanned observation instruments has been identified as a priority. The Caribbean now relies on NOAA (National Oceanic and Atmospheric Administration) models that may not be valid for the islands. No Caribbean Island has installed buoys, and this is a significant blind spot. The existing buoys are responsibility of neighbouring country, hence no Caribbean country assumes responsibility.

Another issue is the encroachment on satellite frequencies by mobile phone operators; this means that surface temperature observations are under threat. Keeping in mind that the rising temperatures of the seawater is a direct cause of cyclones, the lack of these data makes it more difficult to predict the rise of cyclones.

Overall, there is a need for more data. There is no information about the exploitation of marine environmental resources nor about fish migration. Are population changes the result of for example over harvesting, climate related population decline or of migration?

Henceforth, the investment in equipment is important, but it needs to be sustainable and long-term. In addition. marine environments are aggressive, as a consequence instruments suffer from corrosion and last typically five years. So, while project financial models may be viable, they need to be part of a long-term program. They are globally important as they contribute to global wealth.

It has been noted that there is local awareness of the above-mentioned issues, nonetheless the Caribbean nations are mostly middle-income countries and their governments have different priorities. Wealthier countries should support these efforts, also as part of the wider climate resilience strategy and climate change related responsibilities. For example, Trinidad and Tobago's economy is gas and oil based, hence dependent on international energy market price fluctuations.

The monitoring instruments, buoys, satellites, etc. are vital but cannot be considered in a vacuum, on the contrary, it is essential to create a system where these instruments are paired with other activities/approaches, such as institutional capacity building.

At the moment, the challenges that the national fisheries authorities are facing, are being addressed (or mitigated) by using tourism as a driver, to improve service delivery based on new data and understandings, linking with the needs of coastal and marine ecosystems.

A relevant example is a EU/USA sponsored field project “EUREKA” – led by Germany. The implementation of the project has been massive, and data analysis is still an ongoing activity, even though they stopped the collection of data. This could jeopardize the accuracy of the project outcomes, as the collection of data should be an ongoing process, leading towards progress.

As an example of the situation at the national level (see also Barbados and Dominican Republic notes on the mission sections below), we include here the transcription of the situation of Trinidad & Tobago (362 km of coastal line) kindly shared by the **Director of fisheries, Nerissa Lucky**:

“The Fisheries Monitoring Centre at the Fisheries Division in Trinidad & Tobago at the moment comprises only of two staff members with two lap tops who undertake limited monitoring of the following:

- 1. A VMS installed on 25 TTO registered longline vessels who have a CLS based satellite system on board. We get alerts when they enter and leave the jurisdiction and when they enter the EEZs of another State. This system is entirely voluntary at this time because we do not have the legislative framework to mandate and monitor for compliance on the use of this system. Our existing law is 1916, we are in the process of updating our legislation. We are also very much constrained as we do not have enough staff to assign full time 24 hr monitoring of this activity.*
- 2. Real time monitoring via the Single Electronic Window of all foreign and local fishing vessels entering and leaving our Ports. We collaborate with the Maritime Services Division and use their platform to view and request that in addition to the CORs uploaded, all fishing vessels submit the Appendix A of the PSMA and a copy of their valid fishing licence. This is also a voluntary requirement, not currently legislated so compliance is limited and is not enforced. We require staffing resources and the legal mandate to better execute. We are hoping to become a Client Agency in the SEW (Cabinet has already approved this), and have the legislation and staffing so that we can better execute our port state responsibilities.*
- 3. Inspection capability for our local vessels and foreign vessels using our ports is very much limited by our staffing challenges. We are unable to fully execute our flag, port, coastal and market state responsibilities.*
- 4. We have partnered with the Trinidad and Tobago Coast Guard who also has a parallel 24 hr Fisheries Monitoring Centre and have access to both the SEW and our VMS. They are part of an Interagency Structure that share an MOU with the Maritime Services Division, Ministry of Trade, Customs and Excise Division, Tobago House of Assembly and the Fisheries Division to implement a number of specified inter agency SOPs to better address IUUF.*
- 5 Maritime Domain Awareness- Each month we receive a listing of vessels in our EEZ from CARICOM Impacts, a regional security body that uses AIS data via their Windward Platform to analyse fishing activity in the Region. We collaborate with them when we have specific requests. Again, our limited staffing and inadequate legislation constrains us from engaging in expanded monitoring. We do have access to Skylight and are part of the Blue Justice Community where we can obtain and share information regionally. Our participation in these platforms is limited at this time due to staff constraints.*
- 6. The CLS system has allowed us to pilot a ELog system for our 25 longline vessels. We are currently testing this system.*

7. We have a very rudimentary observer program for our 25 longline vessels. Our trawl fleet also has a pilot observer program. Legal, Staffing and financial constraints hinder execution.

8 Electronic monitoring of catches on longline vessels. 5 of our longline vessels are equipped with camera systems. We can review their footage but again there is no legal mandate and we do not have the requisite staff to execute review of the camera footage”.

European cooperation funds should pay special attention to this key sector to SDG 1 on poverty, SDG 2 Hunger, SDG 10 reduced inequalities and of course, SDG14 life below water, among others.

4 Field Work: main findings

4.1 Methodology

The team of two experts visited individually nine countries and OCT in the region: Dominican Republic, Belize, Saint Martin, Sint Marteen, Barbados and Guadeloupe were covered by the team leader and Trinidad & Tobago, Jamaica and Curacao by the key expert 2 (see work plan in section 1). The geographical selection was done aiming at the **maximum diversity** of marine research landscapes in terms of scientific production (see bibliometric section above) and boundary conditions, perceived importance/connections in the regional marine research system, policy support measures e.g. blue economy plans, representativity of different research cultures and official languages in order of importance (Spanish 64% of speakers, French 25% ,English (14%) and Dutch; Haitian creole and Papiamento were not covered) and travel costs – due to budgetary and transport connections constrains.



Official languages spoken in the Caribbean ■ Spanish ■ French ■ English ■ Dutch ■ Haitian Creole ■ Papiamento

Figure 1.39: By Auguel - Own work, CC BY-SA 4.0, <https://commons.wikimedia.org/w/index.php?curid=55734267>

- + **The Dominican Republic** has a large territory, shared with Haiti, with long research culture in the University of Saint Domingo and the specialized Center of Biological Marine Research (CIBIMA) founded in 1962, and strong support to marine and coastal based tourism (first visited destination in the Caribbean). However, tourism is challenging heavily ecosystems and biodiversity due to the unprecedented coastal development causing deforestation of mangroves

and coastal erosion as well as liquid and solid waste pollution increasing the bloom of Sargassum and other macro algae.

- ✚ **Guadeloupe** is an overseas department and region of France that is also challenged by the Sargassum arrivals and University of the Antilles is researching on solutions to it and the rest of challenges for the protected areas, including marine.
- ✚ **Jamaica** is higher middle income with a large territory, strong interest in marine based tourism, but limited means structured around the UWI Campus and multilateral organisations- UNEP in particular.
- ✚ **Trinidad and Tobago** is a high-income country but its economy as fossil fuel based, and political interest in marine resources limited, also hosting a UWI Campus.
- ✚ **Curaçao** is a small island with a declining population that relies on scientists from the Netherlands to sustain its marine research.
- ✚ **Sint Maarten/Saint Martin**, is also a small island with a singularity as it is divided into two research systems, corresponding to its status as constituent country of the Kingdom of the Netherlands and of the French overseas collectivity of Saint Martin. Two capitals, two languages and jurisdictions for an area of 34 Km² and 41,486 habitants (2019) severely damaged by Hurricane Irma in 2017.
- ✚ **Belize**, with ten times this population, former English crown colony, is considered both Caribbean and Central American country and SIDS although its mainland is much bigger than the insular territories that was pioneer in the use of blue bonds in the region for conservation and blue economy.
- ✚ **Barbados** is a touristic island- with high income and very high HDI- country following Belize in the Blue economy strategy as ocean's size is 430 times the size of its land area. The UWI campus, and CERMES in particular, is supporting this political will with evidence-based research.

Prior to their visits the experts contacted potential key informants selected through the initial bibliometric studies (paired with the UNESCO IOC Ocean Expert database), and direct contacts from EUD Barbados, EUD Belize, IOC and UNESCO Delegations in the region, and through snowballing.

Interviews were semi-structured, face-to-face or by phone, depending on the availability and when possible, there were accompanied to a visit to the research facility itself.

In the case of the Dominican Republic, as second largest science producer in the region with a more complex and disconnected STI system, a national validation workshop was organised by the team leader in April 2023, hosted by the University of Santo Domingo and UNESCO, to enable a better agreement on national research priorities from the institutional ones.

4.2 Main findings

As anticipated in the inception report, countries and territories of the Caribbean are very heterogenous with different in their boundary conditions as sizes of their marine and terrestrial territories, population, human and economic development or interest/policy priorities for blue economy.

There are key regional institutions i.e. UWI, IMA, CMO, OECS or CRFM (see description in the section above) with potential and interest to sustain marine research. There are important multilateral agencies that can support the implementation and development of a regional research agenda e.g., UNEP, IOCARIBE, FAO among others. Finally, as indicated in the mapping of actors of previous section, the EC is promoting research projects and mobility grants for Caribbean fellows to specialized in Europe through various programmes as Erasmus+ or Euroaxes. Similarly, bilateral agencies as GIZ are funding projects and mobility grants related to Climate change resilience or biodiversity conservation. Development Banks are supporting infrastructures and projects in line with national blue economy strategies as in Barbados or Belize. The whole spectrum of who is doing/financing what is not clear to researchers that are not familiarized with the channels to access to this information and lack of supporting staff, project managers, to facilitate it. Present main actors, initiatives, programs for research funding were logically, one of the main objectives of the final workshop organised in Barbados where the actors visited during the expert missions were invited for networking.

The population in the Caribbean is well educated, although Marine sciences, Biology or Engineering, Oceanography or Spatial planning degrees and specialized masters, are missing, provoking brain drain of the graduate students looking for specialization degrees. The national critical mass of scientists, with little exceptions, is not enough or well-coordinated/funded to support interdisciplinary, or long-term research employment opportunities. There is lack of opportunities to employ the very young population of the region and the lack of regional research platforms or centres of excellence, apart from UWI in some thematic areas, fuels a brain drain. Jamaica has the second largest brain drain in the world.

While evidence-based policy is key to address national and regional challenges, researchers find it difficult to provide the evidence as the infrastructure to collect and/or analyse the data is insufficient, partially due to the cessation of financial support to regional networks e.g., CARICOMP or the short term of them, e.g. BIOPAMA.

Again coordination, sharing of data, virtual research labs and platforms as well as the reinforcement of key institutions mobilizing main expertise across regions and themes, are critical to the strengthening of the science production inside the region and the cooperation with Europe can definitely support these advancements through mutual learning and joint research.

4.3 Profiles of territories visited

A summary with the specific inputs from the geographies visited follows in alphabetical order.

4.3.1 Barbados



Barbados' political commitment for sustainable blue economy seems just natural as the country has a total land area of 439 km²- coastline of 97 km- but a total maritime area of 186,898 km²- so 425 times the land area. With a population of 267,800 in 2022 it has one the highest HDI and GDP per capita 18,738 USD (2023 estimate) in the Caribbean region and 52nd richest country in the world. Despite this, a 2012 self-study in conjunction with the [Caribbean Development Bank](#) revealed 20% of Barbadians live in poverty, and nearly 10% cannot meet their basic daily food needs.

In September 2022, the Government of Barbados (GoB), The Nature Conservancy (TNC)³⁹, and the InterAmerican Development Bank (IDB) announced the completion of a USD 150 million debt conversion that created long-term sustainable financing for marine conservation and secured a Government of Barbados commitment to protect up to 30%,

or ~55,000 square km, of its Exclusive Economic Zone (EEZ) and Territorial Sea. This project will facilitate Barbados' commitment to the United Nations Global Biodiversity Framework, which aims to protect 30% of the world's land, ocean, and inland waters by 2030. The net savings will allow Barbados to channel an estimated USD 50 million into conservation funding over 15 years: USD 23 million into an independent conservation fund, the Barbados Environmental Sustainability Fund (BESF) (USD 1.5 million per year on average), and USD 17 million towards a long-term endowment for BESF, which is expected to generate an additional USD 10 million of returns over 15 years. The project incorporates ocean conservation commitments including developing a transparent, participatory, and collaborative Marine Spatial Plan (MSP) that is guided by the best available science, data, and information; an aspirational goal to protect 30% of the country's ocean by 2030; and the establishment of BESF to allocate conservation funding in Barbados through a grants program aligned with national conservation, environmental, and sustainable development priorities. TNC will support these activities with technical assistance.

The government set aside for offshore oil exploration 70,000 km² of the total EEZ area.

The Fisheries Division is cooperating with governmental and academic institutions, UWI in particular, to enhance the institutional capacities, equipment and tools for policy. In her intervention during the final workshop and later interviewed by the team leader, the chief officer, explained the need for more technologies and tools to fulfil their commitments. Digital transformation is a priority for the division, and led to i.e. simplifying the inspection work for the control of the 1,156-vessel registered, through the use of an intuitive electronic form and tablets for inspection, allowing for photo or videos

³⁹ <https://www.nature.org/content/dam/tnc/nature/en/documents/TNC-Barbados-Debt-Conversion-Case-Study.pdf>

of the infractions reported. With some inexpensive trackers in a 100 of boats, the division is able to know when and where fishing activities are happening showing trends and illicit fishing in territorial waters. [The Project for Improving National Sargassum Management Capacities in the Caribbean \(undp.org\)](#) is running until 2026 with very low budget but mobilizing and coordinating national stakeholders on this issue.

The Barbados Coastal Zone Management Unit is also a key governmental player to fulfil the commitments on the blue bonds and the spatial plan for blue economy. His director, in a joint meeting with the Policy research, planning and information unit of the Ministry of environment, expressed the need to reinforce cooperation with Europe and other regional partners to access and analyse data for spatial planning. They were both very interested in the Horizon Europe and other programs for cooperation and capacity building in this area.

At the regional level, Barbados is part of the *BE-CLME+: Promoting National Blue Economy Priorities Through Marine Spatial Planning in the Caribbean Large Marine Ecosystem Plus* project, aims to maintain and preserve cultural heritage through sustainable fisheries management, improved livelihoods, and alternative livelihoods while strengthening the integration of fisheries and ecosystem management to restore, protect and maintain marine biodiversity, productivity, and resilience of marine ecosystems. The Global Environment Facility (GEF) endorsed the Project in November 2022, including the provision of US\$6.2 million for the project. The participating countries are Barbados, Belize, Guyana, Jamaica, Panama, and Saint Lucia, while the partners partner organizations are CAF, FAO, CRFM, UWI-CERMES, University of Florida, which has committed co-financing of approximately US\$41.7 million. The CRFM is the executive agency, while FAO and CAF are the GEF co-implementing agencies.

The UWI campus in Barbados, plays a pivotal role and hub for marine research. Its Centre for Resource Management and Environmental Studies, CERMES, created in 1985 offers academic programmes in Natural resource and environmental management at the masters and doctorate levels. The centre has expertise in Sargassum (SargAdapt Project), marine Coastal ecosystem biodiversity and services (**MaCoBios**), **Small scale fisheries (StewardFish)** or **gender in fisheries (GIFT)**. They hosted the Biodiversity and Protected Areas Management (BIOPAMA) programme funded under the 11th EDF to assist ACP countries for improved management and governance of biodiversity and natural resources that develop a special GIS tool. It hosted the final workshop at UWI and a special session on BIOPAMA follow up. Also with EU funding, Horizon 2020 7 MEUR project and operating until 2023, **the MaCoBios project** (Marine Coastal Ecosystems Biodiversity and Services in a Changing World) broadly aims to disentangle the ways and means by which ecosystems services can help us respond to climate change and study the effectiveness of nature-based solutions (NBS) with a focus on marine and coastal ecosystems. SARGADAPT was another project ended in 2022 for Sargassum valorisation coordinated by UWI CERMES and CANARI. At the same time, **SARTRAC** was building capacity for adaptation to Sargassum risks across the Atlantic including UWI CERMES, with partners from UK and Ghana among others.

This campus hosted the international workshop organized under this action on the 14-15th November in Bridgetown and opened by the Minister of Industry, Innovations, Science and Technology (see specific section on this report). The Oceans Economy Export Barbados initiative, led by this Ministry, is developing blue economy capabilities to allow more products and services from the ocean e.g.: sea moss, wave energy, aquaculture (land based and open sea farm), maritime transport, tourism and shipping or climate (carbon sequestration). During the thematic discussion, the idea of using Ports can be used as blue hubs was discussed. They can be used for testing and integrating fisheries services and electricity for boats, fish markets, ferries and shipping support, educational centres, start-ups, aquaculture / algae farms, Renewable energy pilot plants or solar desalination sites.

Almost at the same date 10th November, the EU expressed intention to support the upgrading of Barbados' climate-resilient infrastructure for clean water, in line with the Global Gateway investment agenda presented at the EU-CELAC Summit in July. This would be achieved through a 'debt for climate swap' to provide much-needed funding for the upgrade of the Barbados South Coast Sewage Treatment Plant. This would advance the country's efforts to mitigating the impacts of climate change, reducing chronic water shortages and improving wastewater systems.

Name	Institution	Field of research
Leo Brewster	Director, Barbados Coastal Zone Management Unit	Marine Spatial Planning
Shelly Ann Cox	Chief Fisheries Officer, Ministry of Environment and Natural Beautification	Fisheries: digitalization, gender
Colvin Taylor	Enforcement Officer, Barbados Fisheries Division	Enforcement, fisheries
Julian Walcott, Hazel Oxenford, Patrick McConney	UWI CERMES	Caribbean Protected Areas Gateway, Sargassum, Small Scale fisheries, gender
Alice Brome	UNESCO IOC Barbados - coordinator of Tsunami Center	Tsunami centre, Ocean literacy, blue schools
Damien Presco	Consultant, Oceans Economy Export Barbados, Ministry of industry, innovation, science and technology	Blue economy
Travis Sinckler	Senior Environmental officer, Policy research, planning and information unit- Ministry of environment and National Beautification	Marine Spatial Planning
Maria Peña	MaCBIOS Project, UICN, UWI CERMES	Biodiversity and Ecosystems Services

4.3.2 Belize



Belize is part of a number of African, Caribbean, and Pacific (ACP) – European Union (EU) partnership agreements. This started in 1982 when the country signed the second of four Lomé Conventions and continued with the *ACP-EU Partnership Agreement*, the so-called Cotonou Agreement. As a member of the CARICOM and the CARIFORUM Group of Countries, Belize is part of the CARIFORUM - European Union Economic Partnership Agreement (EPA).

With an area of almost 23,000 km² Belize has one of the most stable and democratic political systems in Central America. After its original capital, Belize City, was ravaged by a hurricane in 1961, a new capital, Belmopan, was built inland, about 50 miles (80 km) west of Belize City, which remains the country's commercial and cultural centre as well as its most populous city.

Belize has the second largest living barrier reef in the world, one-third of the Mesoamerican Reef, the largest coral reef system in the Western Hemisphere attracting many scuba divers and tourists. The [Belize Barrier Reef](#) is along most of the 386 kilometres of predominantly [marshy](#) coastline. There are many lagoons and mangrove ecosystems along the coasts and in the northern part of the country that are key to the conservation of the coast (preventing erosion), biodiversity and fisheries in particular. Over 60% of Belize's land surface is covered by forest. 20% is covered by cultivated land (agriculture) and human settlements.

More than 440,000 people live in Belize (Statistical Institute of Belize, 2022) and GDP per capita is almost 7000 USD (World Bank, 2022) with an annual growth of 12,1 in the same year. Tourism accounts for 40% of economic activity. However, since the 1990s the Belizean government has attempted to expand the economy, but heavy borrowing led to debt restructuring in the mid-2000s. The country has a central government debt of 61% of GDP in 2014 and has been pioneer in the LAC region debt conversion through the Blue Bonds for Ocean conservation program by The Nature Conservancy (American NGO). In 2021 the agreement was signed Belize in its commitment to protecting 30% of its ocean by 2026, that includes funding a \$23m endowment to support future marine-conservation projects. It is come to over.

The Government, Ministry of Blue Economy and civil aviation and, in particular the Coastal Zone Management Authority and Institute, is therefore under big pressure to collect data for Spatial planning tools, as stated by the Director of the Unit, in order to develop the national marine plan enabling the sustainable co-existence of the different uses of the sea from fishing and mariculture to marine tourism and transport as well to research on oil, gas, deep-sea mining or offshore wind/solar or wave, current and thermal energies . There is need for support on the access to data i.e. Copernicus and tools/capacity building trainings and EU can play a role as discuss also in the final workshop in Barbados.

The University of Belize (UB), through its Department of Environment and the autonomous Environmental Research Institute (ERI), is also willing to contribute but infrastructure (equipment and even space for labs as the case of the University is still an issue. There is no funding for research, only for teaching, and therefore, the professors struggle to finance their own research with no supporting services from their institution. This is not the case of the ERI that is increasing external funding and able to access research funds, in particular the new Belize Fund for Sustainable Futures (from blue bonds) that is directed by the former founder of ERI. The centre is increasing its member from transfers from other UB departments moving in.

The Nature Conservancy (US, Blue bonds) and other international (Wildlife conservation society, WWF, Oceana or the Great Barrier Reef Foundation- producing the strategy for reef resilience of Belize) and national (Belize Audubon Society-BIOPAMA, TIDE, TREF, BELPO) NGOs are filling in this gaps in the science policy interface but there is a clear need to reinforce the academic institutions to offer the marine specialization courses and evidence (full researchers staff) as to enable the Blue Bonds commitments to happen and being sustained in the long term. BIOPAMA project in Belize includes two marine reserves under the coordination of the Audubon Society.

Finally, Belize hosts the Caribbean Regional Fisheries Mechanism (CRFM) from CARICOM which is very connected to the Ministry of Fisheries, building in front, and therefore, allows for regional voice in the fisheries areas, understood by his Executive Director, Dr. Haughton, as a general umbrella for understanding the functioning of ecosystems as large and impacts to sea and livelihoods of the poorest population in the region, that should not leave behind in accordance to SDG's moto. The project Sargassum Products for Climate Resilience in the Caribbean (SPCRC) finishing this year is testing feasibility of the various uses of the Sargassum with the New Zealand Crown Research Institute. Its findings were presented in the workshop and will enable future pilot plants to test industrial uses and entrepreneurship development around valorisation options.

The Caribbean Community Climate Change Center, directed by Dr Colin Yung, is another regional centre working on climate change resilience with multiple funding from EU (EDF) and its member states (Italy, GIZ) as well as the Green Climate Fund or USAID funding. The centre supported the

feasibility study and funding proposal preparation on biomass fuel to be presented to the Green Climate fund, among others.

Name	Institution	Field of research
Elisabeth Lanzy, Mirco Schroder	Programme officer, EUD Belize	
Jorge Omar Samayoa	Senior Specialist Environment and Rural development Division IDB Belize	Financing blue economy, CC, water and infrastructures
Mauro Gongora Rigoberto Quintana	Fisheries officer, Belize Fisheries Department	Fisheries authority and enforcement
Karen Waight Cecy Castillo Apolonio Aguilar	University of Belize, Science department Interim Dean of the S&T Faculty	Chemistry Chemistry Community CC
Ivis Chan	ERI- UB	Land use management
Janel McNab Samir Rosado	Coastal Zone Management Authority and Institute	Marine Spatial Planning
Alana Godoy	Executive Lead, The Nature Conservancy Belize	Blue bonds, blue economy
Myles Phillips	Marine technical coordinator, Wildlife conservation Society	Small scale fisheries, marine blue economy, ecosystems conservation
Milton O. Haughton and 2 project officers	Executive Director, Caribbean Fisheries Regional Mechanism (CARICOM)	Fisheries, ecosystems-based management, Sargassum, Livelihoods
Janelle Chanona	Oceana, NGO Senator	Belize Network of NGOs Oceana
Asad Magaña	Executive Director, TIDE	MPA management
John Fredrickson	ReefTribe Foundation	Coastal erosion

4.3.3 Curaçao

Curaçao is a high-income country within the Kingdom of the Netherlands. It is a Small Island State consisting of one main island. The marine area belonging to Curaçao covers about 25,401 km² whereof about 1% is protected (Marine Conservation Institute, 2023). Curaçao has a land area of 444 km². Its population of just under 150 thousand people is declining (Central Bureau of Statistics Curaçao, 2023). GDP per capita is 17,718 USD (World Bank, 2023a). Its economy is sustained by an oil refinery and tourism. However, as the refinery processes mainly oil from Venezuela, it is currently sitting idle. The employment situation is positive, probably due to expansion of the informal sector (IMF, 2023). The capital, Willemstad, is a UNESCO world heritage site.



The country has one university offering courses in Law, Engineering, Social Sciences and Economics, Arts, and Social and Behavioural Sciences.⁴⁰ They don't support marine or maritime research.

⁴⁰ <https://www.uoc.cw/>

The Regional Marine Pollution Emergency, Information and Training Centre – Caribe contributes to the sustainability of the marine environment in the Wider Caribbean Region by assisting countries to implement international conventions created to reduce pollution from ships. REMPEITC is one of four Regional Activity Centres of the Caribbean Environment Program (UNEP-CAR/RCU). Established in 1995, is hosted by the government of Curaçao and staffed with subject matter experts voluntarily seconded by states signatory to the Cartagena Convention of 1983. Activities are largely funded by the International Maritime Organization (IMO), the United Nations Environment Program (UNEP) and the United Nations Development Program (UNDP).

The Maritime History Museum⁴¹ provides important insights in the role of the sea displaying slave trade, the colonial Powers dabbling for control, and the importance of the oil refinery. Fisheries occupies a minor role in the island’s society, which is exemplified by the small display in the museum. The Museum is supported by the Prins Bernard Foundation from the Netherlands.

The Curaçao Sea Aquarium⁴² is another aspect of marine science communication. It has several tanks with iconic species and hosts a group of dolphins. The aquarium has no breeding capacity but substitutes loss of animals from the wild. The aquarium owns a research vessel with a submarine. The vessels need an upgrade to be able to carry out research away from the shore.

The sea aquarium doesn’t carry out research by itself but hosts research projects. One is a Queen Conch (*Aliger gigas*) recovery project. It captures larvae from the wild, grows them until they transform into small shells, which are subsequently set out in the wild. The project is also engaging with the local government to adjust legislation regulating the protection and capture of the species. Its sister project on Bonaire interacts with local fisherfolk to create adequate protection.

The major marine research core is the Caribbean Research and Management of Biodiversity (CARMAB.⁴³ CARMABI has merged with STINAPA⁴⁴, the foundation that manages conservation areas. The new foundation broadened its focus to terrestrial research, the management of nature areas and education in addition to marine research. One important ambition of CARMABI is water quality monitoring. There are many issues with run-off, (illegal) sewage dumping, cruise ships, yachts, etc. STINAPA is also working on this issue, but on Bonaire.

CARMABI, the Sea Aquarium and the Curaçao government stated in 2017 the ambition to transform Curaçao in a centre of excellence or a hub for marine research in the Caribbean as a follow-up on a statement by the Curaçao government from 2014 setting the transformation of the island in a Regional Leader in the Natural Sciences. However, there has not been much progress although some funds were earmarked for this endeavour.

Major partners are universities and research institutions in the Netherlands and the region. Major funders are Netherlands’ organizations and Seacology from the USA.

Institution	Name
Sea Aquarium	Dr Michiel van Nierop, researcher
Maritime History Museum	Thamara Moreno Vervuurt and Stephan Smeets (directors)

⁴¹ <https://www.curacaomaritime.com/>

⁴² <https://curacao-sea-aquarium.com/>

⁴³ <https://www.carmabi.org/>

⁴⁴ <https://stinapabonaire.org/organization/>

4.3.4 Dominican Republic



It is the second-largest nation in the Antilles by area (after Cuba) at 48,671 square kilometres (18,792 sq. mi), and third-largest by population, with approximately 10.7 million people in 2022, of whom approximately 3.3 million live in the metropolitan area of Santo Domingo, the capital city.

The Dominican Republic has the largest economy (according to the U.S. State Department and the World Bank) in the Caribbean and Central American region and is the seventh-largest economy in Latin America. Over the last 25 years, the Dominican Republic has had the fastest-

growing economy in the Western Hemisphere – with an average real GDP growth rate of 5.3% between 1992 and 2018. GDP growth in 2014 and 2015 reached 7.3 and 7.0%, respectively, the highest in the Western Hemisphere. Recent growth has been driven by construction, manufacturing, tourism, and mining. The country is the site of the third largest gold mine in the world, the Pueblo Viejo mine.

The Dominican Republic is the most visited destination in the Caribbean. The year-round golf courses and resorts are major attractions. A geographically diverse nation, the Dominican Republic is home to both the Caribbean's tallest mountain peak, Pico Duarte, and the Caribbean's largest lake and lowest point, Lake Enriquillo. The island has an average temperature of 26 °C (78.8 °F) and great climatic and biological diversity. The country is also the site of the first cathedral, castle, monastery, and fortress built in the Americas, located in Santo Domingo's Colonial Zone, a World Heritage Site. The Dominican Republic is highly vulnerable to natural disasters.

The country was selected for field work to collect primary data as it has a good economic performance and is the third in the production of science from the countries of study. The country increased its scientific outputs in a 95% from 2015-2019 according to the UNESCO World Science Report 2021 with 232 publications in 2019 (third after Cuba and Puerto Rico of the list of the beneficiary territories of this action) and 22 publications/ million inhabitants. Main science collaborations, coauthored papers, are with USA (257), Spain (135), Brazil, Mexico and Argentina. It has high rate of manufactured exports (692% of the merchandise exports) and internet sharing (74,85%). The national fund for innovation and scientific and technological development (FONDOCYT) mobilized about US\$ 53 million for private and public research centres between 2008-2018. The national development strategy 2030 seeks for environmental sustainability and its National CC strategy and plan (2016) has a key area on oceans

Moreover, the Dominican Republic is a privileged partner for the European Union, due to shared values, for being the largest economy in the Caribbean and the second most populous country after Cuba, for its dual identity as a Latin American and Caribbean country, for its dynamism and its active participation in various forums dedicated to regional integration, but also for the historical, cultural, and familial ties that bind us. EU had maintained excellent relations since 1989 when the Dominican Republic adhered to the Association Agreement between the European Union and the African, Caribbean, and Pacific (ACP) States.

With the kind support of UNESCO Antenna in Santo Domingo, Franklin Tejeda and the Director of the CIBIMA centre, Dr Gladys Rosado, the team leader visited, between the 27-31st March the main research institutions visited and interviewed to enquire about their research topics expertise and priorities for capacity building and needs for infrastructure as seen in the table of interviewees below.

From the bilateral discussions, many common points appear that could serve as national priorities and joint capacity/infrastructures needs. Besides, some actors could not be visited due to time limitations and they were invited to a **final national workshop organized on the 3rd of April, in the Faculty of Sciences of UASD**. Among the 13 attendants: ANAMAR, the National Geographical institute, the national seismologic centre, the Director of the Faculty of Biology, Director of faculty of geographical sciences, National aquarium, UNESCO and CIBIMA (hosting institution). The leading expert presented the results of the interviews in terms of Research priorities, capacity building and infrastructures/equipment needs and participants were adding on.



Photo 1. Workshop – April 3rd 2023

These are the main conclusions of the discussion:

- There is limited, and more challenging, very dispersed marine scientific capacity. Research infrastructures and funding are scarce provoking governmental and research institutions competition instead of cooperation patterns. However, in the case of joint challenges, as the Sargassum arrivals, there is place for cooperation. The ministry of tourism created a joint interministerial committee to discuss potential solutions with experts. Likewise, public and private universities developed a network to develop them.
- Main themes for cooperation identified: Sargassum dynamics and valorisation, Oceanographic Observation and marine open databases, ecosystems and biodiversity monitoring and conservation (including seagrass beds), evidence for new policy frameworks i.e. National maritime strategy, Marine protected areas management, fisheries monitoring, ecotourism, disaster risk reduction and monitoring, open science, citizen science, education, policy development, impact assessments of programs and projects, foresight studies , social and environmental impact assessment, etc.
- Capacity building needs: Formal education: Creation of Oceanographic Master of Sciences Degree, Oceanography, Marine Engineering or grants for national students. Technical trainings: Use of data from satellites, open access data base creation, Project proposal development (Horizon Europe and others), enforcement and law implementation, IP rights, interdisciplinary work, social sciences tools (interviews, social impact assessment), awareness and education on ocean sciences
- Infrastructures and equipment gaps: Full access to satellite information (US, EU) data needs to be paid a public institution (even the ONAMET which is the early tsunami warning focal point) do not have budget for it. Scientific equipped ship and labs. Systems of buoys to provide long term data in open access. Servers and internet broadband to maintain databases.

People interviewed

Name	Institution	Field of research
Maria Villalpando	R&D coordinator of the Marine Studies Dominican Foundation (Fundemar)	Marine biodiversity, manatees and coral reef conservation Sargassum
Mtro. Genaro Antonio Rodríguez Martínez and assistant	Vice minister of Science and Technology of the Ministry of Higher Education and STI	STI agenda, marine HE and research support authority

Adriana Bueno	Director, Biology Faculty UASD	Biology research, Impacts on coastal marine biodiversity
Jimmi Constantinto García Saviñón	President of the National Authority of Maritime affairs (ANAMAR)	Maritime affairs, enforcement, Sargassum, Fisheries, ecosystems conservation
Andrea Varcacel Gloria García	Technical officers	
Angela Hernandez Castro	National aquarium	Biology conservation, awareness, education
Franklin Tejeda	UNESCO antenna	Tsunami early warning systems and education for sustainable development and sea observation
Wagner Rivera Bolivar Ledesma	National office of Meteorology (ONAMET)- IOC UNESCO Tsunami early warning focal point	Early warning system
Ramon Delanoy	Director National Seismologic Center	Seismology
Gladys Rosado Yira Rodríguez	Director and coordinator of the Center of Biological Marine Research (CIBIMA) within the University of Santo Domingo (UASD)	Marine biology, coastal development, Sargassum, community resilience
Enrique Pugibet Jonathan Delance Jose Enrique Baez Urena	Vice minister of Marine and Coastal Resources and International relations department of the Ministry of Environment	Environmental planning and enforcement coastal
Nathalie Flores	Climate Change Director, Ministry of environment	CC
Ulises Jauregui Edwin Sanchez	Professors, Technological Institute of Santo Domingo (INTEC)	Sargassum Satellite modelling
Raul Gonzalez	Director of the National Council of Fishing and aquaculture (CODOPESCA)	Fisheries control and enforcement
Marcos morales	Director, National Geographic Institute- UASD	Marine and coastal spatial planning, monitoring
Edward Verás	Executive Director of the National Commission on Energy	Fossil and RE offshore

4.3.5 Guadeloupe



Guadeloupe is an archipelago and overseas department and region of France in the Caribbean. Located in a very exposed region, Guadeloupe and its dependencies have to face many cyclones.

It consists of six inhabited islands—Basse-Terre, Grande-Terre, Marie-Galante, La Désirade, and the two inhabited Îles des Saintes—as well as many uninhabited islands and outcroppings, with total area of 1,628 Km² and 383,559 inhabitants. The Gross Regional Product per capita is 22,500 EUR however, it has high levels of poverty relative to mainland France and levels of unemployment- among youth in particular- that are amongst the worst in the European Union. The signing of the Regional

Convention for the Internationalisation of Enterprise (CRIE), membership of the Economic Commission for Latin America and the Caribbean (ECLAC) and membership of the Association of Caribbean States (ACS) are milestones that have enabled Guadeloupe to develop its bilateral or multilateral relations within the framework of international agreements or institutions.

In recent decades, Guadeloupe's natural environments have been affected by hunting and fishing, forest retreat, urbanization and suburbanization. They also suffer from the development of intensive crops (banana and sugar cane, in particular), which reached their peak in the years 1955–75. This has led to the following situation: seagrass beds and reefs have degraded by up to 50% around the large islands; mangroves and mantids have almost disappeared in Marie-Galante, Les Saintes and La Désirade; the salinity of the fresh water table has increased due to "the intensity of use of the layer"; and pollution of agricultural origin (pesticides and nitrogenous compounds).

The Guadeloupe National Park was created on 20 February 1989. In 1992, under the auspices of UNESCO, the Biosphere Reserve of the Guadeloupe Archipelago (*Réserve de biosphère de l'archipel de la Guadeloupe*) was created. As a result, on 8 December 1993, the marine site of Grand Cul-de-sac was listed as a wetland of international importance. The island thus became the overseas department with the most protected areas. The Cousteau Reserve is a marine protected area known for its excellent diving and snorkelling opportunities. It was named after the famous marine explorer Jacques Cousteau, who declared it one of the best dive sites in the world. Apart from the civil society initiatives to restore coral reefs i.e. IFRECOR including research and for the sea turtles, to monitor and protect nesting sites, the marine related research is mostly concentrated around the University of the French Antilles with specialised centres of marine biology, chemistry and physics of the ocean and a third campus is Martinique.

The issue of Sargassum is also critical for the island and also priority for the University and both the Chemistry and Physics department have developed technologies to promote the industrial use of this and similar algae as energy, fertilizer or activated carbon to clean pesticides from soils, in different projects, one Interreg SARGOOD and others as Pirosard and Sartrib undertaken i.e. with the French National Research Agency, INRA and some partners in Mexico, Brazil or Trinidad. The main work on the valorisation of Sargassum is focused on the synthesis of bio-oil and the production of activated carbon particles. Pyrolysis is the most common method of converting biomass into carbon, even if hydrothermal carbonisation (HTC) offers a higher carbon yield than traditional dry pyrolysis.

The Sartrib project lead by this University, aims to recover value from sargassum through vacuum pyrolysis, carried out by Pyrovac in Canada. Vacuum pyrolysis of biomass results in three pyrolysis phases: i) a solid carbon (bio-char), ii) a liquid phase with a high probability of finding carbon particles in suspension, this phase is composed by a bio-oil, and nitrogen rich aqueous phase, and iii) a phase composed of incondensable gases. In this project, we studied the tribological recovery of bio-char and bio-oil and also looked at the electrochemical recovery of bio-char as a cathode for lithium batteries.

The Regional Council of Guadeloupe is a body, elected every six years, consisting of a president (currently Ary Chalus) and eight vice-presidents. The regional council oversees secondary education, regional transportation, economic development, the environment, and some infrastructure, among other things. It coordinated an Interreg project 3 MEUR, SARG`COOP to enable knowledge exchange and research cooperation (including 600 experts) among Caribbean territories for resilience on sargassum arrivals. Its second phase SARG`COOP II is ongoing showing the importance of creating intraregional platforms for joint marine challenges. The Marine Observatory (OMG) focuses on the study of coral reefs, marine biodiversity, water quality, and the impacts of climate change on coastal areas.

The water agency of Guadeloupe, is dealing with the issue of water quality in the region and water treatment directly impacting in the coastal ecosystems and fisheries. The French office for biodiversity in the Antilles is in charge of enforcement.

On the regional level, the Guadeloupe Environment Planning and Housing Direction hosts since 2019 the Regional Activity Center for Specially Protected Areas and Wildlife of the Caribbean (SPAW-RAC) according to the Cartagena Convention. It is funded by the French Government, the SPAW-RAC works under the aegis of the Regional Coordination Unit for the United Nations Environment Programme in Kingston, to implement the SPAW protocol concerning the protection of marine and coastal biodiversity in the wider Caribbean region, from the Gulf of Mexico to the Caribbean Sea. This includes 35 reserves from 9 countries, including France, the Netherlands and the US. The centre is therefore, key for the promotion on MPA research and capacity building among EU and the CAR region.

SPAW listed Protected Areas (in 2019)

Belize

- 1 - Hol Chan Marine Reserve
- 2 - Glover's Reef Marine Reserve in Belize
- 3 - Port Honduras Marine Reserve

Cuba

- 4 - Parque Nacional Guanahacabibes
- 5 - Parque Nacional Cayos de San Felipe

Colombia

- 6 - Regional Seaflower Marine Protected Area
- 7 - Regional Natural Park of Wetlands between the rivers León and Suriquí
- 8 - Sanctuary Ciénaga Grande de Santa Marta

Dominican Republic

- 9 - La Caleta Submarine Park
- 10 - National Park Jaragua
- 11 - National Park Haitises
- 12 - National Park Sierra de Bahoruco

French West Indies

- 13 - Réserve naturelle nationale de l'Amana Guyane
- 14 - Ile du Grand Connétable Guyane
- 15 - Réserve naturelle nationale de Kaw-Roura Guyane
- 16 - Étangs des Salines Martinique
- 17 - Versants Nord de la Montagne Pelée
- 18 - Parc National de la Guadeloupe
- 19 - Réserve Naturelle de Petite Terre
- 20 - Sanctuaire Agoa (ZEE Guadeloupe et Martinique)
- 21 - Étangs Lagunaires de Saint-Martin
- 22 - Réserve Naturelle Nationale de Saint-Martin

Grenada

- 23 - Molinière-Beauséjour Reserve

Caribbean Netherlands

- 24 - Bonaire National Marine Park
- 25 - The Quill and Boven National Park St. Eustatius
- 26 - St Eustatius National Marine Park
- 27 - Saba Bank National Park
- 28 - Saba National Marine Park
- 29 - Mt. Scenery National Park Saba
- 30 - Man O War Shoal Marine Park Sint Maarten

Saint Vincent and the Grenadines

- 31 - Tobago Cays Marine Park

United States of America

- 32 - Dry Tortugas National Park
- 33 - Florida Keys National Marine Sanctuary
- 34 - Everglades National Park in Florida
- 35 - Flower Garden Banks National Marine Sanctuary in Texas



Name	Institution	Main research area
Sarra Gaspard	Chemistry Department, Université des Antilles	Sargassum- fertilisers
Thierry Cesaire	Physics Department, Université des Antilles	Sargassum- activated carbon, energy
Maria Arsene	Chemistry Department, Université des Antilles	Sargassum- fertilisers
Lydia Barfleur	SARCOOP Interreg project coordinator	Sargassum-networks

4.3.6 Jamaica

Jamaica is an upper middle-income country. It is a Small Island State consisting of one main islands. Its marine area covers about 286,046 km² whereof about 3,350 km² is designated for protection (Marine Conservation Institute, 2023). The land area is about 10,990 km², making it the third largest island in the Caribbean. The island is home to about 2.83 million people. Key exports are tourism services and mineral resources (bauxite). In 2021, Jamaica generated around 2.12 billion USD dollars in the tourism sector. This corresponds to 12.39% of its the gross domestic product and approximately 11 percent of all international tourism receipts in Caribbean (WorldData.info, 2023). Jamaica has been among the slowest growing economies in Latin America and the Caribbean given its concentration in low productivity services, limited technology adoption and innovation, high connectivity costs, a weak business environment, and pervasive crime (World Bank, 2023d). GDP per capita is around 6.83 thousand USD. Unemployment stands at 8.4 % in 2021 (IMF, 2023). High unemployment is aggravated by a serious brain drain. Jamaica has the second highest incidence of brain drain in the world with 85% of tertiary graduates migrating (Thomas-Brown, 2023).



Jamaica has about 17 institutions of higher learning. The largest is UWI with an enrolment of around 18,000 students. UWI Jamaica is 38% government funded. The rest of its money comes from tuition fees, contract research and other sources (e.g., call centre, KFC). For comparison: Barbados government covers 60%, Trinidad and Tobago 50%.

Research is “pure” (30%), applied (50% - mainly government funded) and innovative (20% - answer to community needs). Technical innovation extremely limited – only 26 patents were registered. There are standards for publications with a ranking of journals and requirements of the number of publications in the different ranks. But a large part of output is “grey”.

UWI’s Center of Marine Sciences (CMS) trains marine biologists and carries out research on two locations: Port Royal on the south coast and Discovery Bay on the north. There is no work on the east and west coast. Key fields of research are Ecosystem studies, Coastline Management, Pollution Monitoring & Mitigation and pure and applied research on the biology of marine organisms including fish, corals, marine plants and plankton.

Protected areas are managed under a specific masterplan that is supported by appropriate legislation (NEPA, 2023). The Negril area on the west coast is a small conservation area. Its management is delegated to the Negril Area Environmental Protection Trust (NEPT). NEPT doesn’t carry out any research by itself but hosts research by others. NEPT is financed by the Sandals Foundation (hotel chain), Natural Conservation Trust Fund of Jamaica (NCTFJ), GEF and the Ministry of Fisheries.

NCTFJ is still a young organization. It aims to provide sustainable funding for Protected Areas in Jamaica. The NCTFJ is local chapter of the Caribbean Biodiversity Fund (CBF). As they are interested in data driven conservation management NCTFJ supports some of the UWI research in Discovery Bay and Port Royal.

Jamaica is formulating its STI policy under the umbrella of the Ministry of Science, Energy, Telecommunications and Transport. Awareness of the importance of such a strategy is recent. Limitations of Jamaican marine STI capacity are lack of human capacity, resources and the vast ocean area that needs to be covered. There are no research vessels and Jamaica scientists rely often on USA vessels that collect data and share them or sometimes offer Jamaican scientists a chance to work on board.

Name	Institution
Dale Webber, Head of Department of Marine Sciences	UWI
Danellia Aitcheson, director	NCTFJ (National Conservation Trust Fund of Jamaica)
Christopher Corbin – Coordinator Cartagena Convention Secretariat	UNEP (United Nations Environmental Programme)
Jeanne McKenzie – Executive director	NEPT (The Negril Area Environmental Protection Trust)
Olive-Jean Burrowes – Executive Director	National Commission on Science and Technology
Anthony McKenzie – Director	NEPA (Environmental Management and Conservation National Environment and Planning Agency)

4.3.7 Sint Maarten



With a population of 41,486 as of January 2019 on an area of 34 km², the island is a constituent country of the Kingdom of the Netherlands encompasses the southern 44% of the divided island of Saint Martin, while the northern 56% of the island constitutes the French overseas collectivity of Saint Martin. Sint Maarten's capital is Philipsburg.

On 6 and 7 September 2017, the island was hit by Category 5 Hurricane Irma, which caused widespread and significant damage to buildings and infrastructure.^[6]

The University of St. Martin is located in Philipsburg and was founded in 1989. The USM has about 350 part and full-time students, and more than 800 alumni. Its president is currently Dr Antonio Carmona, who was interviewed by the team leader and shared his views on the research marine priorities for the Caribbean and willingness to collaborate more with the Netherlands in terms of research and knowledge exchange. This was also the view of Mr. Muriel Van As Cia, in charge of enhancing the relations of the Netherlands with its overseas territories. The lack of scientific research infrastructures and projects was evident during the Hurricane Irma, that caused larger damage due to the lack of evidence to informed policies and risk mitigation strategies.

Dr. Carmona also pointed out the need to enhance cooperation with the French part of the island too, as it is a small territory with common challenges. He also mentioned the need for research on social and human sciences, i.e. to know more on how the marine livelihoods are affected by the various pollutants and climate change impacts and also on the marine illicit traffic, not only for fisheries and

biodiversity species but for human beings. Sint Maarten has one of the highest prostitution rates of the world.

Civil society organisations, as the Nature Foundation St. Maarten, are trying to fill in this gap of knowledge, research and policy support in the island. This one works on the Man of War Shoal Marine Park for the protection of ecosystems i.e. turtle conservation, water quality for coral disease or shark tagging.

The French side does not have any research facility, not even a lab or residence for French researchers doing some stays in the island. According to the NGO in charge of the Natural Reserve of Saint Martin, of 30 Km² in the North of the island, the challenges to manage it are various and research support is not available, even under the new French policy to increase the MPAs in the Caribbean territories. The team is composed of 8 people and they do not have all legal support to enable sanctions to biodiversity crimes, so they need to call the French office for biodiversity in the Antilles who is in charge of enforcement and law application.

which are little and not equipped to monitor what is happening in the long coastal area. Coral diseases, water eutrophication, illegal fisheries (especially recreational one) and plastic pollution are some of the challenges.

Name	Institution	Main areas of research
Antonio Carmona	President University of Sint Maarten, NL side	SHS, Community research
Muriel van As CIA	Programme Manager Sint Maarten	TWO, Ministry of the Interior and Kingdom Relations; NL
Clement Bonnardel	Biologist, Reserve Naturelle Saint Martin, French side	MPA

4.3.8 Trinidad and Tobago

Trinidad and Tobago (T&T) is a high-income country. It is a Small Island State consisting of two main islands. Its marine area covers about 80,173 km² whereof about 9.09 km² is designated for protection (Marine Conservation Institute, 2023). The land area is about 5.1 thousand km². T&T's population of just over 1.53 million is growing. GDP per capita is around 18.222 USD (World Bank, 2023b). The economy is largely based on oil and gas production, with the petroleum and petrochemical industries accounting for about 37 percent of GDP in 2015 (World Bank, 2023c). Unemployment stands at 4.9% in 2022 (Central Bank of Trinidad and Tobago, 2023).



The country has two universities: Saint Augustine Campus of UWI and the University of Trinidad and Tobago (UTT). The latter has a marine sciences program that was created in 2010. Its 7 staff train about 50 students from BSc through MSc to PhD.

The Institute of Marine Affairs (IMA) has a regional mandate but is based near Port-of-Spain. IMA monitors microplastics, heavy metals pollution but its sampling capacity is too limited. It is also interested in the development of innovative financing models such as blue bonds. Regional cooperation is hampered by language barriers: It is relatively easy to work with Guyana and Surinam. But there is no collaboration with Venezuela even though they are just 7 miles away. IMA has produced an integrated coastal management policy from which a research agenda should be derived.

Another regional institution based in T&T is the Caribbean Meteorological Organization. The collection of regional meteorological data is important as it supports a broad range of other fields ranging from search and salvage to extreme weather response and disaster preparedness to sargassum to tourism. There is however a lack of data or of data. Wave monitoring buoys, for example, are located along the coasts of US territories.

T&T faces challenges to protect its marine resources. Fish are over exploited with no rules and capacity to control illegal, unreported, and unregulated (IUU) fishing. T&T government is revising its legislation under EU pressure. Fish is important for local livelihoods. There is competition between artisanal and large-scale fisheries (trawlers). Fisherfolk communities are marginal and their social and cultural characteristics are not well understood. Fisheries has no economic weight so that there is little political interest in dedicating resources to improving its management.

Progress was made with the protection of the vulnerable leatherback turtle's (*Dermochelys coriacea*) nesting sites. Turtle tourism has spawned a turtle trinket artisanal industry.

In general, the research infrastructure in the region is weak. There is a lack of data and data analysis capacity. There is no research vessel. While a research laboratory network (CARICOMP) exists, the funds to support it have dried up, so it ceased to operate.⁴⁵

Trinidad and Tobago has long recognized the power of science and technology in helping to shape this country's future and its resilience to emerging global challenges. The National Institute of Higher Education, Research, Science and Technology (NIHERST) is preparing a new National Science and Technology Policy.

Name	Institution
Institute of Marine Affairs	Dr Rahanna Juman (deputy director) and Ava Maxam (director)
University of Trinidad	Arthur Potts
CANARI	Nicole Leotaud (executive director)
Fisheries Division at the Ministry of Agriculture, Land and Fisheries	Nerissa Lucky (director)
Environmental Management Authority	Haydan Romano (CEO)
Caribbean Meteorological Organization	Dr Liang (director) and Dr Kerr (Science and Technology Officer)

⁴⁵ See also (Cortés, et al., 2019).

5 Validation workshop

The international workshop, proposed by the team leader during the first meeting with the EC officials back in March 2023, was a big success as attained its main objectives (see concept note attached) to agree on marine research priorities, present and create synergies among main initiatives/funding and networking towards future research projects under Horizon Europe calls. The workshop hosted by UWI, counted 35 in situ and 90 on line participants (see annex). Unfortunately, DRL, in charge of logistics, did not manage to share the institutional information for all the online participants but for 62 as included in the annex.



Photo 2. Participants Validation Workshop – In presence

The workshop was inaugurated by the Barbadian Minister of Industry, Innovation, Science and Technology, the Hon. Davidson I. Ishmael who welcomed this joint collaborative initiative to address the opportunities and challenges in our oceans and thanked the European Union for its commitment to provide relevant assistance to the Caribbean region.

In her welcome message, Ms Maria Cristina Russo, Director for Global Approach and International Cooperation in R&I at the European Commission, stressed that the event aims to foster EU-Caribbean and research cooperation and thus stimulate the participation of the Caribbean research actors in the Horizon Europe research and innovation programme and other EU-related programmes for marine cooperation.

The key note intervention was delivered by Milton O. Haugton, Executive Director of the Caribbean Regional Fisheries Mechanism presenting on the Caribbean research priorities and needs- see below- that were validated by the participants of the workshop and discussed in the thematic working groups.

Sustainable Aquaculture Development

- Collaborative research aimed at developing sustainable aquaculture / mariculture practices
- Studying the feasibility of aquaculture/mariculture - identifying suitable species, optimizing production methods, and addressing environmental and socio-economic impacts – integrated multi-trophic aquaculture (IMTA)

Stock Assessment and Ecosystem-based Fisheries Management

- Comprehensive fisheries independent survey of the living marine resources & state of environment of the EEZ
- Comprehensive stock assessments for key fish species to determine their population status and health & support harvest control strategy & effective fisheries management measures

- Research on ecosystem-based fisheries management - consider the entire ecosystem and its interconnections, rather than individual species, to ensure sustainable fish stocks and protect the marine environment.

Bycatch Mitigation

- Bycatch of non-target species, including mammals, turtles is a significant concern in some countries
- Research and technologies to reduce bycatch in fishing operations is necessary for sustainable fisheries

Illegal, Unreported, and Unregulated (IUU) Fishing & Fisheries Crime

- Investigate the extent & impacts of IUU fishing, develop strategies to combat these unlawful activities, which undermines sustainable fisheries management, contribute to overfishing & degradation of ecosystems

Marine Biodiversity Conservation

- Identifying and protecting critical habitats including mangroves for fish & other marine species.
- Studying migration patterns and behaviours of key marine species.
- Assessing the impact of human activities on marine biodiversity
- Evaluate the effectiveness of existing Area-based management systems & identify opportunities for improved effectiveness & expanding the network to safeguard critical habitats and marine species.

Coral Reef & Mangrove Health and Resilience

- Monitoring and assessing the health of coral reefs & mangrove forests.
- Studying factors contributing to coral bleaching and strategies for mitigation.
- Investigating coral & mangrove resilience and restoration techniques and their effectiveness.

Marine Pollution & Plastic Waste

- Studying the sources, extent and effects of pollutants & contaminants in marine environments.
- Monitoring and mitigating the impact of pollution including plastic pollution
- Studying transfer of contaminants from marine environment to marine organisms and humans
- Developing strategies for sustainable waste management.

Climate Change & Ocean Acidification Impacts

- Investigate the effects of climate change including warming waters, sea-level rise, ocean currents & chemistry, increased frequency of extreme weather events on marine ecosystems and species,
- Study the extent and effects of ocean acidification of key species and ecosystems
- Improved understanding of these impacts is essential for developing adaptation strategies
- Renewable energy and energy efficiency in the fisheries sector

Sargassum

- Understand the ecological and biological factors influencing Sargassum blooms
- Assess the impact of Sargassum influx on coral reefs, seagrass beds, and other marine ecosystems & marine biodiversity, including fish and invertebrate populations
- Evaluate the socio-economic & health risks and impacts of Sargassum on fisheries and coastal communities

- Develop strategies to mitigate the economic and social consequences of Sargassum influx
- Research on uses, product development & valorisation of Sargassum –e.g. fertilizer, bio-fuels, bioplastics, building material
- Investigate potential source of carbon sequestration

Economics, Cultural & Socio-Ecological Systems

- Study the economic, social & cultural aspects of fisheries & marine resource use to understand the livelihoods of coastal communities and the interactions between human activities and marine ecosystems
- Development of methodologies to include local communities and underrepresented stakeholders in the decision-making process.
- Bridge the gap between bottom-up indigenous knowledge and social innovations with top-down national and regional science and technology development programmes.

Ocean Governance and Policy Research

- Analyse the effectiveness of existing sustainable use, conservation & management policies and governance structures, and identify areas for improvement to ensure the implementation of sustainable practices
- Study to facilitate improved partnerships and engagement with local communities

The core of the event was the discussion on four key topics to address the regional marine challenges and to develop answers, which are briefly described below and detailed in the minutes of the workshop.

Under the topic 1 “**Community resilience and climate change**” the importance of community-led initiatives and programmes and a bottom-up strategy as well as knowledge and capacity building and long-term funding were stressed. The experts recommended to foster collaboration between scientists, communities and governments, to empower indigenous groups and to promote EU-Caribbean exchange programmes in order to follow up on what was learned and to provide support.

In the discussion on 2 “**Healthy ecosystems for SDG 14**” the opportunities for cooperation were reflected, e.g. the establishment of regional research agendas, partnerships with regional and national organisations (funding agencies, academics), the development of regional platforms and databases, transboundary cooperation as well as regional and international conferences for information sharing and establishing international networks. The experts recommended to first compile the findings from a survey on EU-Caribbean marine cooperation, which was set up in the frame of the above-mentioned study on marine research, as they may help define the next steps towards marine research cooperation.

Another discussion offered Marine Spatial Planning (MSP) as a tool to respond to the topic 3 “**Fostering societal reliance on oceans**”. The experts proposed to map and collect data from all sectors and discussed how the EU could potentially support the MSP process. They agreed that the [Organisation of Eastern Caribbean States \(OECS\)](#) is in a good position to advance sub-regional discussions. Participants further suggested the added value of an annual Caribbean Blue Economy Stakeholder Conference (CSC), where different actors will gather to exchange best practices and will foster the creation of partnerships for future collaborations.

Under the approach to the topic 4 “**Ocean observation for governance**” a key research topic was outlined: “Improve the region’s capacity to understand and foresee seismic, weather, climate and biological risks by raising the efficiency and quality data collection, integration and analysis for en-

hancing ocean governance.” The experts suggested to invest in capacity building and training programmes in key areas and proposed a research strategy in European and Caribbean collaboration in the field of ocean observation for governance.

The detail of this group discussions is included in the annex as it has very valuable ideas on the **strengthening of Caribbean Research Area, the access to data and infrastructures and the science-policy interface that were ratified by the participants as main challenges** for marine research cooperation in the region and with EU.

The 2nd day of the workshop was dedicated to a detailed presentation on the European strategy for research and innovation and the funding opportunities under the Horizon Europe programme, and on regional funding mechanisms for research and capacity building in the Caribbean (see section on stakeholders). It is important to note that the workshop created the opportunity to hold several one-to-one meetings between the participants, where they potential collaborations in future calls were discussed.

It was clear at the end of the workshop the complete alignment between the four key topics mentioned above and the EU Mission Restore Our Ocean and Waters by 2023 as well as the All-Atlantic Ocean Research and Innovation Alliance Declaration. The participants were committed to further explore potential synergies and develop ideas for EU-Caribbean joint actions in the near future. The parallel discussions led to the expression of interest of the OECS to signing the AAORIA Declaration, which is of strategic importance for Marine research international cooperation.

The outcomes of this workshop were presented by the team leader in the high-level meeting of the **EU-CELAC Joint Initiative on Research and Innovation that took place on 28-29 November 2023 in Brussels** and were very welcomed by the senior officials from the LAC region which shall also support the connection of the Caribbean within the broader LAC STI system.

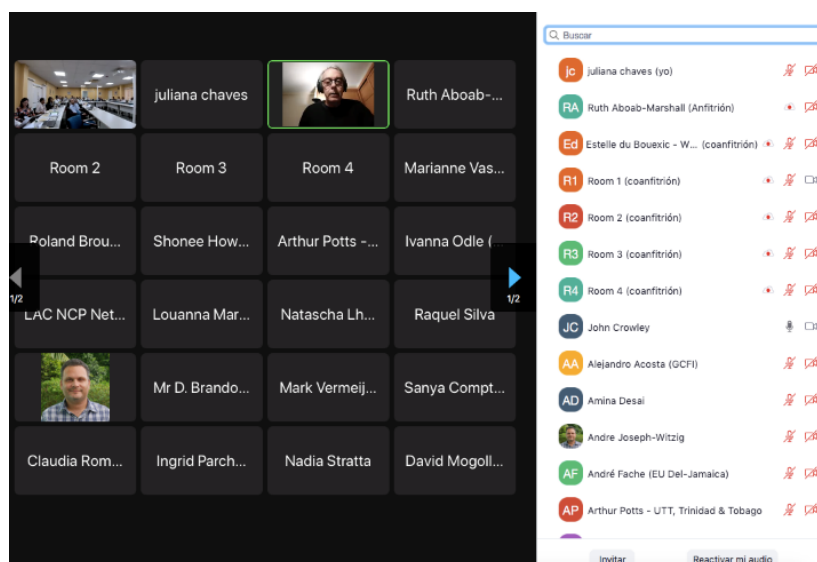


Photo 3. Online participation to Validation Workshop

6 Final Conclusions and Recommendations

The study combined various methods as required to map the high diversity of the region and the broad spectrum of marine related research:

- 1) Desktop research including a detailed bibliographic and bibliometric study
- 2) An on-line survey with 71 respondents from 19 territories in the Caribbean and EU
- 3) A total of 77 semi-structured interviews both on-line and presential during the field visits of which 11 are regional and international bodies with expertise and specific mandate for international cooperation
- 4) Missions to 9 territories, including institutional visits and
- 5) the organization and facilitation by the team leader of two validation workshops: the national workshop in the University of Santo Domingo (Dominican Republic) 3rd April with 13 participants and the final international workshop in UWI- Barbados with 35 in situ and 90 online participants

Therefore, during the 9 months of the action undertaken by the two experts in the consortium, almost 300 stakeholders have been consulted to co-define the Caribbean marine research and capacity building priority needs and actor to foster the cooperation with the EU.

Moreover, the final workshop did provide opportunity for the in-situ participants to discuss on future research project proposals in future Horizon Europe calls as well as strategic alliances from international and regional organisations. OECS decided to join AAORIA during the workshop as announced in the Senior Officials JIRI summit in Brussels on the 28th of November and there is a follow up meeting among the AAORIA, IOCARIBE, EC being discussed for 2024.

The **main conclusions (I) and recommendations (1)** from this extensive consultation are listed below:

- I. Blue economy, especially contributions from Biodiversity and Ecosystem services in the region is severely threatened by local (coastal pollution, overexploitation of populations) and global (climate change) causes while protection and policy response- also in terms of R&D investments- remain below the desired levels.
- II. The low level of GERD in the region is mirrored by a relatively low level of scientific critical mass, science outputs, intraregional research partnerships, and incipient STI policies. Therefore, national science, technology and innovation systems in the Caribbean remain weak compared to more developed countries and even in comparison to some emerging economies. There are also concerns with the dominant external financing mechanism and brain drain. The widespread use of demand-driven competitive funds may result in a wide dispersion of projects with low funding, the prioritization of short-term projects subject to political cycles and insufficient attention to research areas that address long-term and national challenges.⁴⁶
- III. **The top priority for the research community on the Caribbean in the last two decades are⁴⁷ according to the documents produced: 1) fisheries and aquaculture with 978**

⁴⁶ Economic Commission for Latin America and the Caribbean (ECLAC), Science, technology and innovation: Cooperation, integration and regional challenges (LC/TS.2022/156), Santiago, 2023.) <https://hdl.handle.net/11362/48683>

⁴⁷ SCOPUS search on the 11th December 2023

documents produced followed by 2) Ecosystems and biodiversity (858 documents) and 3) **Ocean and climate, mitigation or adaptation** with 756 documents.

- IV. The momentum to increase cooperation in R&D is created. The UN Decade for oceans science for Sustainable Development 2021-2030 has a specific call to African and Caribbean SIDS -as presented in the Barbados workshop- on Sustained Ocean Observations and predictions within a multi-hazard context including Climate and Ocean, Pollutants observatory, understanding accumulated impacts of multiple stressors on the ocean, Sargassum and Harmful algal blooms, Marine Spatial Planning and blue school curriculum and Ocean literacy. The Declaration of the EU-CELAC Summit 2023 the following actions and commitments are acknowledged by member parties:

*20. We encourage actions and commitments for the **protection, conservation, restoration and sustainable use of the oceans** in view of the 2024 'Our Ocean Conference' in Greece, and the third UN Ocean Conference hosted by Costa Rica and France in Nice in June 2025, preceded by a high-level event on Ocean Action in Costa Rica in June 2024.*

*21. We recognize that the issue of **sargassum** significantly impacts the economies, marine flora, fauna, and fishing activities of the entire Greater Caribbean region. We understand the urgent need to present this situation to the United Nations General Assembly, seeking its declaration as a regional emergency.*

- V. The scientific community is willing and able to respond to this call for more Ocean Science. There is a strong and vibrant human resource willing and capable of collecting and analysing evidence to support the sustainable use of marine resources in a renewed blue economy. There are key regional leading actors in climate resilience as UWI CERMES Barbados, or marine biology as CIBIMA-UAS in Dominican Republic, IMA and SPAW RAC in Guadeloupe for marine biodiversity and community resilience; the INTEC in the Dominican Republic and the University of the Antilles specialized in pollutants, including biotic as Sargassum and algal blooms; CIMAB, REMPEITIC on marine pollution and emergencies, among others that shall be benefiting for the EU cooperation to enhance the capacities and provide evidence for policy making in line with the regional and international agreements commitments. They could become centres of excellence hosting the regional/international networks to articulate research around the key research prioritized identified for the region, providing joint infrastructures and scientific capacity to address common challenges.
- VI. There is a feeling among scientists that the evidence they collect does not have sufficient impact on their governments, in particular in countries with fossil fuel-based economies. The science policy interface needs to be supported. When the science-policy interface is weak and not aligned, researchers are not producing the kind of evidence (multi/interdisciplinary) needed for policy decisions.
- VII. Research in the region faces several challenges, mainly associated with access to finance and career opportunities (brain drain), to infrastructures such as data collection devices, data sets, and the capacity to store and analyse data. From donors it expects funds and expertise/capacity building to overcome these challenges and implement a research agenda that is aligned with locally perceived needs, especially for SIDS.

- VIII. Research is seen as key to improve sustainable use of marine biological resources as part of Blue Economy and Climate change resilience strategies: Marine Spatial planning is a basic tool that required data in order to effectively plan and implement the commitments of the blue bonds program initiated by Belize or Barbados.
- IX. **Strengthening of Caribbean Research Area (intraregional cooperation) and the access to data and infrastructures as well as capacity and tools for analysis of data appears as big challenges** for marine research cooperation in the region and with EU. Similarly, the subregion needs to further promote intraregional cooperation within the Caribbean and the broader LAC region, as it has much lower R&D investment levels (GERD) and scientific critical mass than the LAC region.
- X. The survey results, see below, prioritized funding, SIDS cooperation, research labs and infrastructures and capacity building as top actions to support the marine research in the Caribbean region.

Top actions for strengthening research in the region

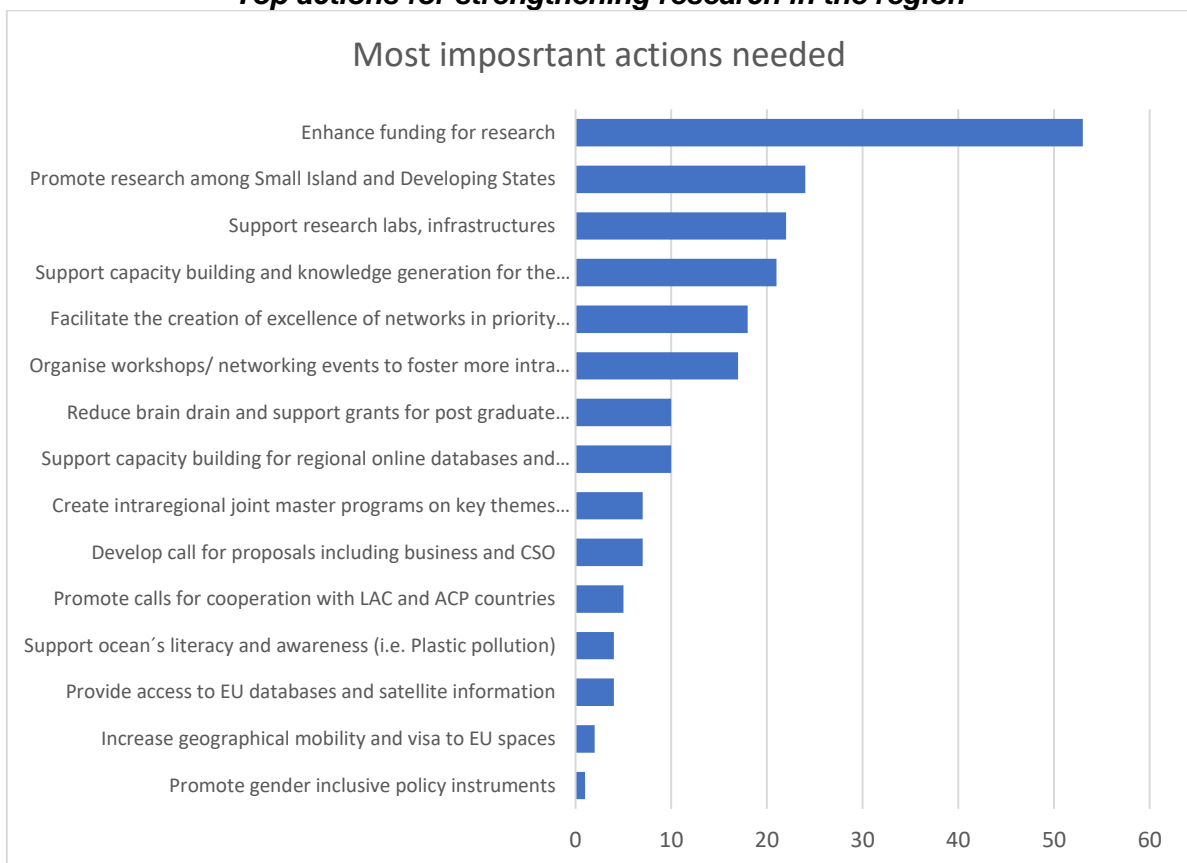


Figure 1.40: Survey results of Top actions for strengthening research in the region

The international workshop organised in Barbados, confirmed the above-mentioned conclusions and produced some complementary ones as listed below:

- 1) Marine Spatial Planning is an important tool for research and evidence-based policies and strategies, i.e. blue economy commitments by Belize of Barbados, that need to be further developed in the region. This could allow developing shared intraregional databases, access to external data and infrastructures (Copernicus among others), increase the monitoring tools and infrastructures or capacity building on the monitoring tools (including their maintenance in the sea) and analytic capacities.
- 2) There is need to better articulation and coordination of experts and institutions at the national, subregional and regional (LAC) level in order to create synergetic action and multidisciplinary actionable knowledge around priorities areas, as discussed in the workshop:
 - Community resilience and climate change
 - Healthy ecosystems for SDG 14 (marine biodiversity)
 - Fostering societal reliance on oceans through blue economy and ocean literacy
 - Ocean observation and governance
- 3) Capitalising in regional projects that mobilized experts i.e. the BIOPAMA JRC, Caribbean Protected Areas Gateway at UWI, SARG´COOP, the UNESCO IOC tsunami network or the Cartagena convention, regional **centres can be further supported through Horizon Europe and other cooperation funds with the Caribbean region to be empowered as coordinators for intraregional thematic research platforms supported by Virtual Research Environments**. The EOSC blue cloud concentrates aquatic expertise around Europe for Open Science research offering services, tools and data to access that could support a Caribbean sister platform as informed by the coordinators of the project.
- 4) In this same line, access to infrastructures, virtual (databases, computing services and tools for analysis) and physical (research vessels, boyos and monitoring satellites, sensors, etc) is the big challenge. These regional thematic platforms should be hosted in institutions, centre of excellence, that can attract researchers from the whole subregion, with access to joint infrastructures and data management tools, build regional databases, Open Science platforms and access to training and supporting services i.e. for project proposal developing for Horizon Europe and other funds.
- 5) The participation in Horizon Europe shall open to high income countries, as Barbados and all SIDS, that due to their boundary conditions- i.e. size, population and inequality levels- cannot benefit from the minimum critical mass of scientists, or not in all research areas, to produce the knowledge required for SDGs and national development plans. The program should also take into account the financial and administrative peculiarities of the countries and institutions allowing for more flexible frameworks in terms of prefinancing and payment conditions.

- 6) The precarious working conditions of researchers, especially early careers ones and women in particular, are also key to limit brain drain and create a thriving and supporting environment for researchers, women in particular.
- 7) These knowledge hubs shall also attract private funding and support knowledge transfer and policy advice. Creating trust among researchers and intraregional working networks requires long term funding and infrastructures as in the European Research Area and infrastructures calls of the Horizon Europe program that could be open to foster the Caribbean Research Area as part of the Widening participation and spreading excellence of the ERA channelled through the Outermost regions in the Caribbean.
- 8) EU-CAR cooperation should increase the excellent, inclusive, actionable and multi and interdisciplinary research (Sustainability science) is missing in the Caribbean and vital to address wicked problems combining complex challenges and affecting communities' livelihoods and opportunities for sustainable blue economies.
- 9) The need for social sciences in assessing the social impact of projects and ethically inclusion of social stakeholders and knowledges is key to reduce inequalities and poverty, main barriers to SDG's in the region.
- 10) Holistic oceans research should be further promoted, i.e. cumulative impacts of biotic and abiotic pollution and systemic emergency plans; social and environmental impact assessment across QH stakeholders for blue economy plans, extended and transboundary or beyond national jurisdiction MPAs network, among others. They are of key importance to sound policy development and will promote, by its nature, interdisciplinarity and mutual learning and cooperation in the Wider Caribbean Region. European partners can facilitate this dialog and support them based on their expertise, i.e. the Facility for Regional Policy Dialogue on Integrated Maritime Policy / Climate Change presented by Thanos Smanis in the Barbados workshop.

7 Final remarks

In the view of the team leader, the momentum is optimal and critical to increase the EU support to marine sciences cooperation with/within the Caribbean region. It will be very much welcomed by the regional scientific community and will substantially enhance not only, evidence-based policy design but also it provides access to international and regional networks, infrastructures and visibility to Caribbean researchers, that are currently disarticulated and working very isolated. By enhancing their working conditions, stability and prospect careers to fight brain drain- as well as their intra-regional opportunities for cooperation, the human capacity in the region will be able to better address national, regional and international development (and environmental) agendas. Therefore, the EU support shall catalyse regional efforts and partners that, - coupled with effective STI policy instruments in line with the UNESCO 2017 Recommendation on Science and Scientific researchers-, will increase the knowledge co-production and transfer required to empower Caribbean societies, in particular the most vulnerable groups, towards climate resilience and sustainable blue development. It is time for evidenced action, it is time for science.

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9 ANNEXES

Annex 1.	National Policies	<i>Excel File</i>
Annex 2.	Funding Resources	<i>Excel File</i>
Annex 3.	Workshop Minutes	
Annex 4.	Full Survey	<i>Word File</i>
Annex 4.1	Survey Results	<i>Excel File</i>
Annex 4.2	Institutions participating in the survey	<i>Word File</i>
Annex 5.	Validation workshop presentations and list of participants. https://eu-caribbean-marine-research.service-facility.eu/en/speakers-presentations	<i>Word File</i>
Annex 5.1	Conclusions from thematic group 4	<i>Word File</i>
Annex 6.	List of onsite participants	<i>In-text</i>
Annex 7.	List of online participants, registered by ZOOM – Table Excel	<i>Excel File</i>

Annex 6. List of onsite participants

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