Implementing & Monitoring the Sustainable Development Goals in the Caribbean: The Role of the Ocean
Saint Vincent and the Grenadines
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Implementing and Monitoring the Sustainable Development Goals in the Caribbean: The Role of the Ocean

WORKSHOP REPORT

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Contents

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WORKSHOP SUMMARY

The workshop on "Implementing and Monitoring the Sustainable Development Goals in the Caribbean: The Role of the Ocean" was held on January 17-19, 2018 at the Beachcombers Hotel in Saint Vincent. The implementation of the seventeen Sustainable Development Goals (SDGs) of the United Nation's 2030 Agenda for Sustainable Development (United Nations, 2015) poses socio-economic and cultural problems to society that are difficult or nearly impossible to solve because of incomplete or contradictory knowledge, the number of people and opinions involved, the large economic burden associated with progress towards a solution, and the interconnected nature of these problems with other problems. The iterative development and implementation of transformational policies to reach the SDG targets hinges on knowledge derived from data related to the state and trajectory of the Earth system. Likewise, validating these policies and monitoring progress towards the SDG Targets depends observations of the human and non-human environment.

The challenges faced by Small Island Developing States (SIDS) in the execution of the 2030 Agenda are closely linked with the ocean surrounding these states. Human interactions with the Earths life-support system have impacted the physical, chemical, and biological state of the ocean and triggered distinct trends in the ocean system and its functional position in the Earth's life-support system. The trends in marine ecosystems, ocean circulation, the global water cycle, and sea level have many impacts on human communities and influence progress towards most of the goals. For SIDS, the changing ocean poses a complex challenge, and many of the observational requirements will be related to the changing ocean.

The goal of the workshop was to better understand the role of the ocean for the implementation of the Agenda, and to identify the ocean-related knowledge needs of societal actors engaged in this implementation. The workshop aimed at linking the efforts that a wide range of stakeholders in the Caribbean SIDS are making towards the implementation of the 2030 Agenda to required ocean observations and to engage in the co-creation of the knowledge supporting these efforts. These requirements, where possible, were matched to existing data sets and services to create the knowledge needed by the governments and the people in the Caribbean SIDS, and gaps were identified and addressed where such products do not exist or were not accessible.

The workshop was organized as a collaborative effort of GEO Initiatives, governments of the Caribbean SIDS, United Nations Agencies, and regional non-governmental organisations. It brought together 42 participants from sixteen countries. The participants represented a broad range of societal stakeholders in Caribbean SIDS, with representatives of governmental departments and agencies, intergovernmental organizations and United Nation's agencies active in the Caribbean, regional and local non-governmental organizations, businesses and academia. Collaborating with the governments and NGOs in the SIDS and participating in their efforts to implement the 2030 Agenda is a novel avenue for those providing Earth observations to better understand what ocean observations are required and what products are available to inform decisions. The workshop facilitated a dialogue between the governments and people of the Caribbean SIDS, regional organizations, and experts about ways to facilitate progress with knowledge. This dialog benefited from having a very diverse audience comprised of many different organizations, private, public, and governmental. One of the great benefits was that it was not overwhelmed by one type of representative.

The workshop structure followed a design-based approach to participatory modeling. It starts with a community agreement on the challenges and the goals that are to be reached, and identifies the knowledge needed to make progress toward these goals. Agreeing on specific targets to reach and indicators to measure progress provides a basis for identifying those social, economic and environmental variables that need to be monitored. For these variables, requirements for the monitoring can be specified, and these requirements can then be matched with existing observations and data products. In cases where a matching is not possible, gaps can be identified.

The opening session introduced the view of key stakeholder sectors (governments, scientific experts, earth observation providers) on the challenge of implementing the 2030 Agenda. The following two session introduced the approaches taking in different SIDS, and the interdependencies of the large set of goals, targets and indicators. The next three sessions were intended to progress through the identification of the variables to be observed, the specification of observational requirements, and the matching of these requirements to available products. The final session provided a summary and an outlook on next steps. Within the sessions, presentations of different stakeholders and panel discussions were combined with table discussion rounds and matching group discussions. The presentations provided overviews of efforts made by the different stakeholder groups. The panel discussions combined brief presentations of the panelists and discussions of the panels with the participants. In the two table discussion rounds, the participants split up into five groups discussing table-specific topics. For each round, a round-specific set of questions had been prepared to be considered by each table. The fieldtrip had the goal to introduce the participants to three spe-

cific issues related to SDGs, namely the role of private businesses in addressing invasive species such as the lionfish, the role of NGOs in promoting the preservation of ecosystems, including the prevention of plastics and other pollution, and efforts to enable a transition to an organic agriculture.

For each session, the participants were asked to submit so-called 2+2 Forms, in which they were asked to identify two points that under each of two headings. The headings related to the topic of the session and in general asked for what was working and what presented a challenge within the topic of the session.

A fieldtrip during the first day had the goal to introduce the participants to three specific issues related to SDGs. During three site visits, the role of private businesses in addressing invasive species such as the lionfish, the role of NGOs in promoting the preservation of ecosystems, including the prevention of plastics and other pollution, and efforts to enable a transition to an organic agriculture were high-lighted.

The deliberations emphasized that the SIDS face a set of common threats, including sea level rise, increasing sea surface temperatures, ocean acidification, coral reef bleaching, plastics and micro-plastic pollution, mangrove and sea grass bed disappearance, coastal erosion, invasive species (including Sargassum and Lionfish), damage from cruise ships and intensive tourism, water and terrestrial pollution, land reclamation and conversion, ocean floor and sand mining, onshore development, a lack of sufficient fish stock agreements and treaties and of enforcement, a general decline in health of marine waters and ecosystems. The workshop participants acknowledge that the implementation of the SDGs requires a broad societal effort engaging all sectors and stakeholder groups. Designated "geospaces for SDGs" can provide places where the SDGs can be brought to the people to get their buy-in. Consciousness of the SDGs can be impacted through integrated information. Progress towards the implementation is hampered by a disconnect between theory and implementation and a broken link between scientific expertise and policy-making. Governmental departments often work in silos, which is in conflict with the deeply interconnected nature of the SDGs. The monitoring of progress suffers from complex monitoring requirements and reporting processes, which are not well understood. Throughout the deliberations, the role of an ocean-based economy for the Caribbean and the sustainable development in this region was emphasized by participants.

The identification of priority information needs and related essential variables to be monitored and the specification of observational requirements for these variables during the workshop reached only a very initial stage. This hampered the effort of matching requirements to products at the workshop and will be further developed in a white paper on the role of the ocean for SDG implmentation and monitoring in the Caribbean SIDS. The participants assessed the attempted matching as very valuable and identified the need to link the pre-matching steps better to the matching.

Among others, follow-on activities to further develop the concept of the geospace and to support the establishment of pilot geospaces in Caribbean SIDS were recommended. The geospace was identified as a potential demonstration project to illustrate the value of Earth observations as part of integrated information at the local scale. Pilot projects were recommended that would tailors information products related to sargassum and oil spill monitoring and forecasting to the specific needs of the Caribbean SIDS and improves accessibility and usability of these products.

1 Workshop Goals and Scope

1.1 2030 Agenda and Earth Observations

Many governments are working on the execution of the United Nation's 2030 Agenda for Sustainable Development[1] (United Nations, 2015). The implementation and monitoring of the seventeen *Sustainable Development Goals (SDGs)*[2] of the Agenda pose wicked problems (Levin et al., 2012) to society. Wicked problems are social or cultural problem that are difficult or impossible to solve because of incomplete or contradictory knowledge, the number of people and opinions involved, the large economic burden associated with progress towards a solution, and the interconnected nature of these problems with other problems (Conklin, 2006). All of this applies to making progress towards the SDGs: Knowledge on how to make progress towards the SDGs is incomplete and contradicting, reaching the SDGs even on a local level involves the whole of society, making progress requires a rethinking of economy (UNRISD, 2016), and the goals are strongly interconnected and there are many interactions between the individual goals that are variable across different economic, social, and cultural settings. For example, poverty (SDG 1) is linked with education (SDG 4), nutrition (SDG 2) with poverty, the economy (SDG 8) with nutrition, and so on. Poverty in California is grossly similar but discretely different from poverty in Angola, and there is no practical set of characteristics that defines poverty.

Monitoring progress towards the SDG Targets presents its own challenge: It is hard and maybe impossible to measure success with wicked problems individually because they impact one another. However, in the case of the SDGs, a crucial input for assessing progress is geospatial data of the both the human and non-human environment. Likewise, the (iterative) development of transformational policies that can facilitate progress towards the SDGs hinges on knowledge derived from data related to the state and trajectory of the Earth system. Responding to this need, one of the three engagement priorities of the *Group on Earth Observations (GEO)*[3]) is the support of the 2030 Agenda. At the core of this engagement priority is the GEO Initiative "*Earth Observations in Service of the 2030 Agenda for Sustainable Development (EO4SDGs)*"[4]. The GEO Initiative "Oceans and Society: Blue Planet"[5] has a focus on the SDGs, particularly SDG 14 "Life Below Water". Other GEO Initiatives, Community Activities and Foundational Tasks support the 2030 Agenda in various ways, and they are in need of a better understanding of the observational requirements to serve the 2030 Agenda. Identifying the observation needs for the co-creation of the knowledge for policy development and monitoring of SDGs can build on approaches developed to address wicked problems (Conklin, 2006; Brown et al., 2010). Within this setting, a transdisciplinary systems approach that considers the data needs of all SDGs provides a basis for compiling those observation needs that are essential for executing the 2030 Agenda.

1.2 Implementing the SDGs in Small Island Developing States

The governments cannot implement the SDGs without the people, and they cannot implement them for the people; they have to implement them with the people. This necessitates to bring the SDGs to the people in a way that demonstrates the benefits of the 2030 Agenda to the people. The government in *Saint Vincent and the Grenadines (SVG)* uses a "geo space for SDGs" concept to create ownership for the SDGs in communities. Earth observations, knowledge derived from Earth observations, and other data are fundamental in this effort. Most of the knowledge relevant to SDG implementation in the *Small Island Developing State (SIDS)* relates in one way or another to the surrounding ocean.

1.3 The Ocean and SDGs

The challenges faced by the SIDS in the execution of the 2030 Agenda are closely linked with the ocean surrounding these states (Fig. 1). In these locations, for almost all of the SDGs, there is a strong interconnection with SDG 14. Moreover, in the SIDS, reaching most of the SDGs requires ocean-related policies and actions.

[1] See https://sustainabledevelopment.un.org/post2015/transformingourworld.
[2] See https://sustainabledevelopment.un.org/sdgs.
[3] See http://www.earthobservations.org.
[4] See http://eo4sdg.org/.
[5] See http://www.geoblueplanet.com.

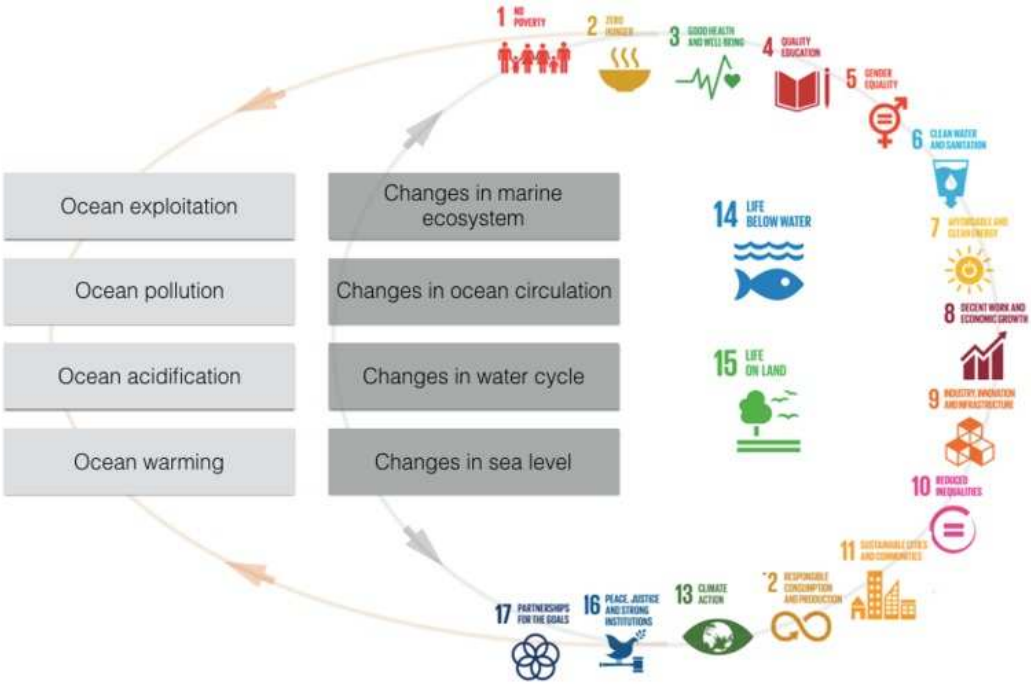

Figure 1. Ocean and SDGs. Human interactions with the *Earth's life support system (ELSS)* have impacted the physical, chemical, and biological state of the ocean and triggered distinct trends in the ocean system and its functional position in the ELSS. The trends in marine ecosystems, ocean circulation, the global water cycle, and sea level have many impacts on human communities and influence progress towards most of the goals. For SIDS, the changing ocean poses a particular challenge.

1.4 Scope and Participation

The workshop aimed at a dialogue between the governments and people of the Caribbean Small Island States about their efforts to implement and monitor the SDGs and, by monitoring this dialogue, to extract knowledge needs, which then can be related to data needs. The collaborate effort brings together governments and people of the Caribbean Small Island States, Earth observation providers, scientists, United Nations Agencies active in the region, and regional non-governmental organizations with the goal to link on-going efforts to implement and monitor the SDGs in the Caribbean Small Island States to required ocean observations and engage in the co-creation of the knowledge needed by those engaged in SDG implementation. The overarching goal is to fully map the requirements for ocean observations serving the implementation and monitoring of the SDGs. Working with, and monitoring the dialogue of those engaged in implement the 2030 Agenda is a novel avenue to better understand what ocean observations are required and what products are available to inform their decisions. In a co-usage effort with the SIS governments, these requirements will be used to match existing data sets and services to the requirements and to engage in a co-creation process for the required knowledge.

The workshop was organized in the context of a project supported by NASA that aims to engage with governments to identify knowledge needs and ocean observation requirements related to SDG implementation and monitoring, match these needs and requirements to existing products, identify gaps, and inform relevant GEO components about the findings. It also had the goal to initiate the development of a demonstration pilot for the 2018 GEO Plenary.

2 Workshop Approach and Format

2.1 Design Basis

The workshop utilized a design-based approach to participatory modeling (Fig. 2), which starts with a community agreement on the challenges and the goals that are to be reached, and identifies the knowledge needed to make progress toward these goals. Agreeing on specific targets to reach and indicators to measure progress provides a basis for identifying those social, economic and environmental variables that need to be monitored. For these variables, requirements for the monitoring can be specified, and these requirements can then be matched with existing observations and data products. In cases where a matching is not possible, gaps can be identified. The workshop program also acknowledge the fact that there is no simple answer to question of what data are needed and useful. Those engaged in societal efforts often don't know what data would help them, and those collecting data often don't know what the data could be used for in society.

Consistent with this approach, the first three sessions introduced the view of key stakeholder sectors (governments, scientific experts, earth observation providers) on the challenge of implementing the 2030 Agenda, the approaches taking in different SIDS, and the interdependencies of the large set of goals, targets and indicators. A fieldtrip during the first day connected the SDGs to local real-world problems. The next three sessions were intended to progress through the identification of the variables, the specification of observational requirements, and the matching of these requirements to available products. The final session provided a summary and an outlook on next steps.

2.2 Format

Within the sessions, presentations of different stakeholders and panel discussions were combined with table discussion rounds and matching group discussions. The presentations provided overviews of efforts made by the different stakeholder groups. The panel discussions combined brief presentations of the panelists and discussions of the panels with the participants. In the two table discussion rounds, the participants split up into five groups discussing table-specific topics. For each round, a round-specific set of questions had been prepared to be considered by each table. The fieldtrip had the goal to introduce the participants to three specific issues related to SDGs, namely the role of private businesses in addressing invasive species such as the lionfish, the role of NGOs in promoting the preservation of ecosystems, including the prevention of plastics and other pollution, and efforts to enable a transition to an organic agriculture.

For each session, the participants were asked to submit so-called 2+2 Forms, in which they were asked to identify two points that under each of two headings. The headings related to the topic of the session and in general asked for what was working and what presented a challenge within the topic of the session (Table "2+2 Questions").

2.3 Lessons Learned

In the implementation of the workshop, the participatory modeling approach was incompletely followed through. Participatory modeling necessitates a holistic moderation and facilitation that ensures the inter-linkage between the different parts of the event. Facilitation is normally assigned to an external skilled facilitator. However, the workshop was based on the traditional concept of expert session chairs, which turn out to be less well suited for the participatory modeling approach. For each session, a pair of co-chairs had compiled a program according to a somewhat independent view on their session and given preference to what they wanted to achieve for their session. The tying together of the sessions did not take place to the extent required for participatory modeling. Moreover, in several sessions the majority of the time was allocated to expert presentations, limiting the time stakeholders could develop a joint understanding of their information needs.

The lack of overall moderation of the workshop and skilled facilitation resulted in a deviation of the actual outcomes from those intended and a disconnect between the indiviudal sessions. Moreover, there were insufficient tools for capturing the deliberations constantly and have the outcomes available in electronic form for everybody at the end of each session. In several of the later sessions, participants asked for input that should have been the output of previous sessions, but these outputs were not available.

The experience with the workshop underlines the importance of the approach and at the same time provides amble evidence concerning the necessary implementation. This experience will inform future follow-on partipatory modeling activities.

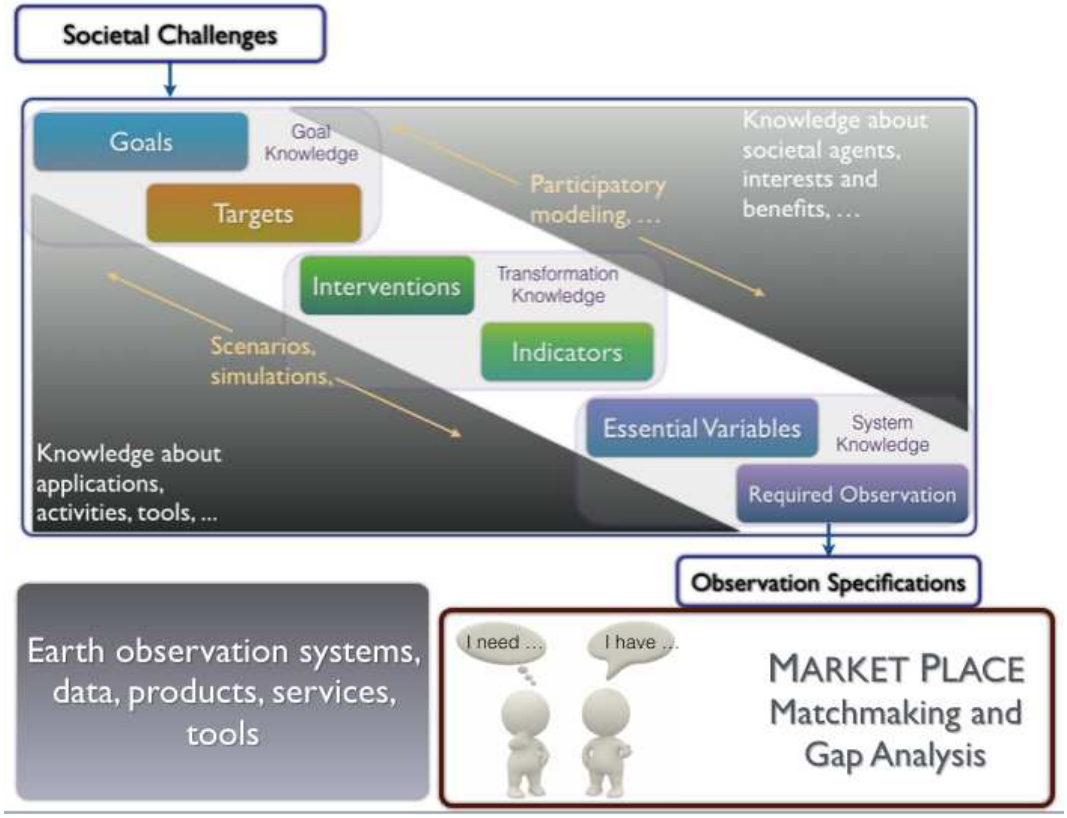

Figure 2. The workshop program was informed by a design-based approach to participatory modeling developed by Plag et al. (2016). The goal-based approach to the identification of essential variables starts from agreed-upon societal goals and targets (goal knowledge) and utilizes system knowledge to identify those system variables that are essential for the development and validation of the transformation knowledge required to make progress toward the targets. Observational requirements for these essential variables are a crucial input for the matching of these requirements to existing products, as well as the detection of gaps where a match is not possible. The opening session and the first two subsequent sessions focussed on creating a joint understanding of the challenges as well as the goals and targets (goal knowledge). Session 3 was intended to identify a subset of essential variables for both the development of policies to achieve the targets and to quantify the indicators (transition knowledge). The intended outcome of Session 4 was a set of observational requirements that could either be matched in Session 5 to existing products or identified as gaps (system knowledge). From Plag et al. (2018).

Recommendations for future activities include continuous engagement with local stakeholders through electronic means in order to collect relevant information to identify priority issues and related information needs. Expert consultations with local stakeholders should include an analysis of information needs and identification of example data sets and products that can meet these needs. Earth observation experts should be consulted to develop specific requirements for data and information such as spatial and temporal resolution. These activities would provide valuable information for in-person participatory modeling events.

Table 1. 2+2 Questions. Participants were asked to submit 2+2 Forms after each session indicating key points they identified in response to the session-specific questions given in the table.

Session 0: Opening Session	This is where progress is being made:	These are major challenges:
Session 1: The 2030 Agenda for Sustainable Development in Caribbean Small Island States (SIS)	This is where progress is being made in the implementation:	These are major challenges for the implementation:
Session 2: Interdependencies and Interactions of SDGs, Targets and Indicators in Caribbean Small Island States	This is where progress is being made in understanding the interactions and interdependencies:	These are major challenges in addressing the interactions and interdependencies:
Session 3: Ocean-related variables and indicators essential for SDG implementation and monitoring in Caribbean Small Island States	This is where progress is being made in the identifying the variables and indicators:	These are major challenges for the identification of variables and indicators:
Session 4: Observational requirements for ocean-related variables and indicators	This is where progress is being made towards specifying observational requirements:	These are major challenges in specifying observational requirements:
Session 5: Matching users, requirements and products	This is where progress is being made in matching stakeholders, requirements and products:	These are major challenges for the matching of stakeholders, requirements and products:
Session 6: Improving availability of Earth observations in service of SDG implementation in Caribbean Small Island States	This is where progress is being towards improving availability of Earth observations for stakeholders:	These are major challenges for improving the availability of Earth observations for stakeholders:

3 Workshop Proceedings

The opening session set the stage for the workshop. After welcome notes from the government of Saint Vincent and the Grenadines delivered by the Hon. Saboto Caesar, Minister of Agriculture, Forestry, Fisheries, Rural Transformation, Industry and Labour, and the GEO communicated by Dr. Douglas Cripe, the Session featured a number of keynotes providing insight into the interface between science and governance in the SIDS and the particular challenges faced by the SIDS. A keynote reflected on the implementation of the Blue Economy, which seeks to establish a sustainable use of marine resources as a component to the economies of the SIDS. Adopting a Blue Economy was seen as aligned with targets of the 2030 Agenda for Sustainable Development. The final keynote discussed the contribution of Earth Observations to the implementation and monitoring of the SDGs.

Session 1 on "The 2030 Agenda for Sustainable Development in Caribbean Small Island States" facilitated a dialogue between governments and people of the Carribbean SIDS about the challenges of executing the 2030 Agenda in each of the SIDS. Linking these challenges to a "geospace for SDGs" implementation brought a local perspective into the deliberations. The first two presentation presented the efforts made by the governments in Montserrat and the British Virgin Islands, and the next presentation gave an overview of the work of a local NGO in Saint Vincent and the Grenadines. Subsequently, the three panelists provided insight into the challenges and efforts from the point of view of UN agencies and regional intergovernmental organizations. At the end of the session, a common understanding of the core problems started to emerge (see next section), and knowledge needs to address these problems were identified.

A Field trip brought the participants to three locations including Serenity Dive in Calliaqua, South Coast, Sans Souci beach, and a natural farm at Sans Souci. The fieldtrip illustrate aspects of living on a SIDS and interacting with the Ocean. At Serenity Dive, the participants were introduced to the challenges coastal areas in Saint Vincent are exposed to and the work done in scuba diving courses to raise awareness of the fragility of the marine environment. At San Souci beach, issues with a large amount of waste deposited on the beach by the ocean were pointed out. This waste, which to a large extent consists of many forms of plastics originating in different and often far-away parts of the globe poses risks to the leatherback turtles during their brief visits to the beach for nesting. The visit to the natural farm provided insight in the opportunities this approach to agriculture opens up.

On the second day, the program started delayed because a participant delegation had been invited to meet with the prime minister, Hon. Dr Ralph Gonsalves. Initially, the framework for the matching session was introduced. Subsequently, Session 2 focused on "Interdependencies and interactions of SDGs, Targets and Indicators in Caribbean Small Island States." This session focus on the interconnected nature of the SDGs and the problems presented by SDGs to society, which are characterized by the potentially large economic burden associated with progress towards the SDG Targets, as well as the challenge that those attempting to solve the problem are to some extent causing the problem. In two initial presentations, the interdependencies of SDGs were discussed and a framework for the implementation of SDG 14 was presented. The next presentation provided local examples of issues that hamper preservation efforts. In the subsequent panel discussion, the panelist addressed different aspects of SDG implementation from the viewpoints of trade, GEO initiatives, international science organizations and regional NGOs. The speakers in the session acknowledge that most of the SDGs address the socio-economic and environmental systems based on land, and that both the human and non-human environment in SIDS is crucially dependent on the surrounding ocean. While this dependency is grossly similar it is discretely different in the different SIDS, and both the similarities and differences were elaborated on. After the presentations and panel discussion, the participants then split up for a table discussion round. Five table specific topics were addressed, including (1) Science Support for SIS Governments; (2) NGO and Private Sector Contributions to SDG Implementation; (3) Fisheries, Food Security, and Life Under Water: SDGs 2 Versus SDG 14; (4) Blue Growth and Poverty: SDG 1 versus SDG 14; (5) Education for Sustainability, Justice, and Equality. The outcomes of these discussions were reported back to the plenary.

Session 3 considered "Ocean-related variables and indicators essential for SDG implementation and monitoring in Caribbean Small Island States." and merge existing scientific knowledge with the understanding of the societal problem of making progress towards the SDGs in Caribbean SIS developed in the first two sessions. The initial presentation gave an overview of work done by experts to identify Essential Ocean Variables (EOVs) and showed examples of observation efforts to monitor these variables. The goal was to include those variables and indices that characterizing the physical, chemical, and biological state and trends of the ocean that are essential for both the development and validation of policies in support of SDG implementation and needed for the monitoring of progress towards the targets and more sustainability. Subsequently, a second table discussion round took place discussing five topics, including (1) Supporting a Sustainable Blue Economy - SDGs 8, 9, 10, 12, 13; (2) Food and Water Security, Health, Poverty - SDGs 1, 2, 3, 6; (3) Maritime Transportation, Fisheries, Pollution, Marine Biodiversity -

Implementing SDGs 14, 15; (4) Ocean and Safe and Thriving Communities - SDGs 7, 10, 11, 12, 13; (5) Climate Change, Biodiversity, and the Ocean SDGs 13, 14, 15. Again, the outcomes of the table discussions were reported back to the plenary.

At the end of the second day, Session 4 focused on "Observational requirements for ocean-related variables and indicators." The original goal of the session was to develop a set of requirements for high-priority variables that specify the necessary spatial and temporal resolution and coverage, accuracy, and latency that are consistent with what those applications require that could make use of the observations. After an initial presentation introducing the "GEO Blue Planet Initiative," the following four presentations addressed observational needs in the areas of health and safety, ecosystem health, industry activities, and fisheries. The final presentation provided insight into the role local businesses can play in making progress towards the SDGs. Unfortunately, the time was insufficient to actually compile a list of requirements to be passed on to Session 5.

On the third and last day of the workshop, Session 5 made an attempt on "Matching users, requirements and products." In a novel co-usage effort, the participating experts in Earth observation worked with the stakeholders engaged in SDG implementation to match, where possible, observational requirements to existing data and products. Because there was no comprehensive list of observational requirements, the main purpose of this session was to explore approaches to the co-usage of products and the co-creation of knowledge with these products. Prior to examining potential matchmaking opportunities, the plenary discussed what types of users and stakeholders require data and visualization products in a plenary discussion and broadly grouped them as Decision Makers; Information Providers; Monitoring, Regulation and Enforcement; Educational Institutions; Industry; and Local Resource Users. The importance of a gap analysis was emphasized, and an approach to a thorough gap analysis was reviewed in a presentation by Dr. Plag. The participants then split up into three moderated groups focusing on (1) the knowledge and information needs of decision makers, (2) information providers and (3) those engaged in monitoring, regulations and enforcements. Other main stakeholder groups identified included educational institutions, industry, and local resource users, but the needs of these groups were not addressed. The original goal of these matching groups was to demonstrate the use of the data and products to generate relevant knowledge. However, without a detailed list of observational requirements, the group deliberations focused more on priority information needs and the process of matching. The lack of overall moderation of the previous sessions led to a deviation of the actual session outcomes from those intended and a disconnect between the indiviudal sessions. It was realized that a more "neutral" moderation of the deliberations in previous session by an experienced external facilitator would have been an advantage compare to moderation by either Earth observation providers or societal stakeholders. The absence of a list of observational requirements as input for the matching required to postpone the matching until such a list is available.

For the final Session 6 on "Improving availability of Earth observations in service of SDG implementation in Caribbean Small Island States," the experience of Session 5 provided a basis to discuss options for improving the service Earth observations and derived products can provide to the execution of the 2030 Agenda. Six presentations addressed the questions of how regional an international organizations can collaborate with local and national efforts to ensure that governments and the people have access to the required ocean-related Earth observations and the capacity to utilize these observations for the creation of the needed knowledge. Concerning the local action, the implementation of the geospace for SDGs was at the center of the deliberations. Demonstrating the relevance of Earth-observation derived information for this geospace was identified as the candidate for a demonstration project to be presented to the GEO Plenary in Fall 2018. In two concluding remarks, the participants were urged to stay engaged and contribute to the development of the geospace concept and the implementation of geospaces in the Caribbean.

4 Workshop Findings

4.1 Comments on Workshop Participation, Format, and Deliberations

The concept of having a mix of scientists, earth observation experts, and decision and policy makers was appreciated by the participants. It was pointed out that it is seldom the case where either of the two groups have an equal opportunity to dialogue and exchange in formal and informal venues. The deliberations benefited from having a very diverse audience comprised of many different organizations from the private, public, and governmental sector. It was noted positively that the participation was not overwhelmed by one type of representative.

Recommendation: It is strongly recommended to replicate the same broad and well distributed diversity of stakeholders in follow on workshops.

The design basis and participatory modeling approach for the workshop program was the "goal-based approach" to the identification of essential variables and observational requirements, and the subsequent matching and gap analysis (see Section 2 for details). In this approach, each session builds on the outcomes of previous sessions. There were many positive comments on the structure of the workshop program and the underlying design principle. However, there the necessary overall moderation of the workshop and a facilitation ensuring that each session was providing the outcomes required by subsequent sessions was lacking. Instead, the indivdiual sessions were chairded by expert co-chairs, which developed their session to some extent independently of the other sessions. Moreover, a lack of tools to capture the session outcomes in real-time and make them available to the follow-on session resulted in some dupplication of discussions and breaks between the lines of reasoning from workshop start to end.

Recommendation: It is recommended that future workshops also apply a "goal-based design" to the program development and ensure the interlinkages between sessions through a coordinated chairing and management of all sessions through an experienced neutral team of moderators.

Allocation of time for expert presentations compared to deliberations between stakeholders was also commented on. In most sessions, most of the time was allocated to expert presentations. The panel discussions also did not provide for much of an actual exchange during the formal sessions, as the panelists presented their often extensive material instead of the moderators urging a broader plenary discussion. This led to two parallel set of presentations with very little time for actual discussion. As a result, too much of the time during the moderated sessions was spent on listening to presentations. Participants commented that this was a missed opportunity to have had a more in depth discussion based on the main presentations that preceded the panels.

Recommendation: It is recommended that for future workshops experienced but non-expert facilitation be utilized for panels and group discussions and potentially also for plenary sessions.

Using experienced neutral panel and group discussion moderators would ensure more time for deliberations as these moderators would not themselves be interested in presenting their work or the work of their respective institutions. Therefore, a neutral panel or single moderator not coming from the two principal stakeholder groups would move some of the difficult discussions that are required to bridge both understanding of the respective constraints of each group and charting a way forward to close the gap in the science-policy domain leading to better decision making based on scientific fact and not conjecture.

The table discussions in Sessions 2 and 3 and the matchmaking deliberations in Session 5 were found to be extremely useful and they more closely resembled the expectation of a dialogue between various stakeholder groups. The smaller and more intimate setting allowed for free-flowing discussion around the issues based on the guiding questions that were provided. In most of these smaller group deliberations, the participants were able to identify key needs that SIDS have at a more granular level than what would have been possible during the plenary sessions.

In general, the workshop was constrained by time limitations. Had there been more time to develop a common understanding based on the discussion, a likely outcome would have been a more robust set of recommendations that could guide the Earth observation agenda and the need for reform in the science-policy framework and required adoption of recommendations on a recurrent basis. This is the guidance required to improve decision making on behalf of the people of the region.

Recommendation: It is recommended to increasing the time that is allotted to deliberations in table discussion rounds and or breakout sessions so that the participants have more time to develop concrete and practical suggestions that would guide where technical, financial and human resources would be deployed in the future.

4.2 Status of Implementation and Monitoring of SDGs in Caribbean SIDS

The individual SIDS are making efforts at national level to implement and monitor the SDGs. These efforts are not yet well coordinated between SIDS, and they are negatively impacted by a number of challenges and threads. Regionally, efforts are made by a number of reginal and global intergovernmental organizations to support the SIDs in their efforts.

The common themes in the SIDS that emerged from the discussion included:

- The 2030 Agenda for Sustainable Development has, at its heart, the motto: "Leave no one behind, " which should form a guiding principle as action plans are developed to strengthening institutional frameworks, embedding recommendations into cabinet policy papers.
- Common threats faced by the SIDS include sea level rise, increasing sea surface temperature, ocean acidification, coral reef bleaching, plastics and micro-plastic pollution of the ocean, mangrove and sea grass bed disappearance, coastal erosion, invasive species (in particular Sargassum, and lionfish (Ballew et al., 2016)[6], damage from cruise ships and intensive tourism, water and terrestrial pollution, land reclamation and conversion, ocean floor and sand mining, onshore development, insufficient signatories and enforcement of fish stock agreements and treaties, general decline in health of marine waters and ecosystems.
- Among the SIDS of the Caribbean, there is limited capacity for data analysis and data sharing and as a result there is a lack of data in support of evidence-based decision and policy-making. Data sharing especially from the private sector (oil and gas companies) is very low.
- The SDG reporting process is not well understood.
- A great potential for citizen science exists, especially with respect to in-situ monitoring of the oceans (for example, scuba divers, fishing and other commercial vessels, reporting from NGOs) but tools to utilize this potential are lacking.
- The small size of the SIDS and their economies poses high costs for public services and governmental activities on the population and economies. Thus, regional coordination of implementation and monitoring of SDGs is crucial to reduce the associated costs.
- The government ministries across the region are largely operating in silos, and tools for interdepartmental coordination and collaboration are needed.
- The SIDS need to learn about international/regional/national instruments that could be leveraged, and there needs to be greater public awareness and involvement.

Critical issues identified during the deliberations include:

- Science in support of SDGs in the Caribbean is being done by a variety of organizations; yet there is a disconnect between this science, the government and society.
- There is a challenge with continuity: when governments change, national priorities also change, and these priorities are not often well defined.
- Indicators for SDG14 are largely in Tier 3 (i.e., no internationally established methodology or standards are yet available for the indicator, but methodology are being developed and tested and standards will be available in the future). This does not make these indicators very implementable at the present. In addition, they may not be applicable across countries. This requires the need for proxies or analogous indicators.
- There are conflict between SDG 14 and other SDGs, which in most cases will take priority because of direct human needs. These conflicts are the result of interdependence and interferences between SDGs. For example, SDG 2 can be in conflict with sustainable fisheries. For coastal health (SDG 3), there can be a disconnect between land processes and coastal problems.
- Data access is still an issue because of data formats or data no being usable, discoverable, or applicable.

[6] See https://www.nature.com/articles/srep32169.

- The value and benefits of the SDGs has to be put in terms of human capital. Valuation of coastal assets has to be done in the language of policy makers; it also has to resonate with people.

- The term citizen science means nothing to the regular citizen and engaging citizen in scientific efforts requires translation and communication. There is a striking disconnect between scientists and citizens, and scientists who want to engage in SDG implementation need to bridge this disconnect.

- A large gap exists for urgently needed integrated environmental and socio-economic databases.

There was clear request for more scenario-based modeling in support of policy making. The scenario-based model outputs exploring proposed policy impacts should be available to inform decision and policy making. The need to package the information from such modelling into a language decision-makers can understand and utilise was recognized.

The use of satellite observations in combination with artificial intelligence for maritime monitoring was considered important particularly for SDG 14 implementation. Equally important is the need for data to be provided in resolutions meeting the needs of local situations and capacities.

The complex SDG interlinkages require considerable capacity enhancement at national and regional levels, and there is a need for knowledge sharing across governmental departments and between the SIDS in the region. The role of ECLAC for knowledge sharing across the region was emphasized.

Recommendation: It is recommended that a workshop be organized under the lead of ECLAC to develop a knowledge platform on land, water, and ocean governance and the linkage with poverty and livelihood sustenance.

Given the different interpretations of poverty and the region's predisposition to disasters, defining poverty in each of the SIDS is an important task. Identifying which SDG targets can set criteria for poverty in each country and identifying what national plans exist to respond in the different sectors (for example, considering vulnerabilities and relationship with the ocean as well as resilience to climate change) would be another important outcome of the workshop.

A number of ideas to move SDG implementation forward were expressed during the deliberations:

- It was suggested to identify 'SDG champions' at the national or individual level and thus put a face on prioritized SDGs to which the people can have a connection. Currently, there is a disconnect between SDGs and people and the goals are not something tangible. While there are efforts that already exist in terms of localization of SDGs and connecting SDGs with communities, little has been done at the SIDS level.

- A valuation of natural capital including ecosystem services needs to be done to put this capital in context for decision makers and the population.

- Scenario-based planning may provide an opportunity to visualize what different avenues of change may result in. However, scenarios have to be tailored to local conditions.

- There is a lot of regional complexity and heterogeneity, and this constitutes the need of an overarching coordinating mechanism, such as ECLAC does for economic development. National and regional interfaces that promote interaction between countries are needed.

- It was considered important to reach out to international companies which deliver and transport products to SIDS to promote responsible practices. For example, products wrapped in plastic contribute to plastics pollution and a reduction of plastic is needed, as there is no recycling facility anywhere in the Caribbean islands. The question was posed whether a regional recycling facility could be installed. It is important to sensitize the population to the problem and provide alternatives. The alternative has to be sustainable.

- Strategies need to be developed to sensitize the population for the challenges to the SDGs and raise awareness of the SDGs. Examples mentioned including races or events to educate the public. An overwhelming percentage of the worlds population still doesnt know that the SDGs exist and efforts are being made to reach them. Utilize impact and evidence-based examples that demonstrate the day-to-day relevance down to the individual level affecting everyone is of importance.

- A lack of implementation was detected. The implementation process has to be bottom up and voters have to create the pressure on the politicians, and for this the people have to understand the needs and identify with them.

- It was suggested to use local talents to promote awareness (for example, a local artist could draw logos).
- There is a need to build a feedback tool for reporting on success stories and support capacity building. It was suggested that GEO could have a role in this.

The deliberations identified a number of areas that need further consideration:

- Human capital needs to be at the center of the SDGs.
- Ties that exist locally and internationally should be strengthened.
- Many of the SDGs require international cooperation because the challenges often arise outside individual SIDS or implementation requires regional actions.
- Many of the SDG indicators mean nothing to the individual SIDS or may not be applicable. In these cases, the question is what proxies can provide similar or analogous information.
- Implementing the required change can be hard, especially when they are in conflict or contradicting tradition. Finding ways that respect traditions while promoting change is a challenges.
- It was considered important to involve communities from the start and to respect that communities don't want to be told what to do. SDG implementation has to start at the small scale. These points are in strong favor of the geospace approach.
- Funding for SDG implementation is an issue, and funding from governments is almost nonexistent.
- A compelling economic case has to be made for sustainability through time. In other parts of the world, businesses are already involved in SDG implementation and also in following more sustainable practices. Examples from these models could be transported to the SIDS and adapted to their needs.
- Data has to be fit for purpose. This implies that costs to collect, manage and administer have to be low, and the data to address the needs of the target community. An example of fit-for-purpose data focused on land pointed out is the fit-for-purpose land administration guiding principles for country implementation by Enemark et al. (2016).

The workshop participants identified a number of questions that need further thought:

- How easy is it to find and engage local scientists, artists, and other human capital by outside entities to encourage the use of local resources and promote awareness?
- What is the value of the natural capital to the average person? This needs to be defined.
- Capacity building is needed, but what type? Who needs it? What happens after training?
- How far does capacity building go when the infrastructure is not there? There is a question about the usefulness of training in developed countries, and applicability of that training when trainee returns home.
- What are the reasons that are hindering progress towards the goals?
- How can the people be connected better to the national efforts?
- How can the lack of data be addressed? How can data sharing and data access/sharing be promoted in the region. What is necessary to enable data sharing without compromising sensitive information?

4.3 Essential Variables for the SDG Implementation and Monitoring

The expert-based approach to essential variables has led to a well-developed set of *Essential Ocean Variables (EOVs)*. However, the link of these EOVs and their suitability for the SDG implementation and monitoring has not been assessed in detail.

Concerning the data needed to support implementation of the SDGs, it was found that there is no simple answer to this question. In several table discussions, it was underlined that data characterizing the physical, chemical and biological state of the ocean are relevant. Data that helps to characterize potential hazards, provides early warning for developing hazardous events or potentially hazardous long-term trends should have priority. It was pointed out that remote sensing in the ocean is different from land in that for the ocean subsurface data is needed, which requires in situ mapping and monitoring of sub-surface variables and three-dimensional data set and basemaps

Data that support the quantification of indicators should have priority. It was emphasized that there is a need for socio-economic data, particularly those data that help to understand the economic value of the marine data, which is relevant to eco-system based management, eco-system health and natural capital valuation. For poverty and health, socioeconomic analyses are needed. For health, transdisciplinary linkages are important to answer questions such as when are people getting sick and what they are doing.

The absence of data could inhibit decision making, as politicians may use it as an excuse not to make decisions. There is a need to identify the purpose of data. An important purpose is safeguarding human health. This needs baseline pollution data, and impact data that is region specific.

As a result of the workshop deliberations, the need for more work on identifying a prioritized set of essential variables for SDG implementation and monitoring was confirmed. Likewise, developing a set of observational requirements for these variables is a task largely remaining to be done.

4.4 Matchmaking and Gap Analysis

The match-making session was considered a key part of the workshop. The main outcome of the session was an assessment of the approach used. As mentioned above, the participants were split up into three groups addressing the knowledge and information needs of (1) decision makers, (2) information providers and (3) those engaged in monitoring, regulations and enforcements. In hindsight, the splitting up of the matchmaking groups according to stakeholders was a diversion from the goal-based approach of the workshop, which would have used sets of essential variables and associated observational requirements in an attempt to match these requirements to products. In the three matchmaking groups the stakeholder groups focused on were not well represented and could not clearly specify the variables essential for them or the observational requirements.

Ideally, the basis for the matchmaking would have been a list of observational requirements for a subset of the essential variables. This list would have been used in either a market place setting or a country-specific grouping. For the market place setting, stakeholders associated with specific requirements would have moved through different provider tables to find products meeting their requirement. For a country-specific approach, representatives of countries would have taken their set of observational requirements to different providers to discuss options for products that would meet their requirements.

The matching deliberations in the three groups had no clear requirements to match against products. Therefore, much of the discussion remained at a very descriptive level and did not result in actual matchmaking. To some extent, countries were able to highlight areas that needed response. It was found important that there is a focus on enabling countries to identify how they will undertake their monitoring, which is their responsibility and they need to define what can work in their own contexts. It would have been helpful to have concrete partnerships identified from the groups where actors responsible for monitoring indicated what or with whom they would like to pursue further discussions.

The development on information products for the regions was discussed to some extent. The need for pilot projects tailoring existing Earth observation products to the needs of policy and decision makers in the Caribbean SIDS was recognized. Such project could demonstrate the value of the products and increase their accessibility and usability.

Recommendation: A pilot project should be set up that tailors information products related to sargassum and oil spill monitoring and forecasting to the specific needs of the Caribbean SIDS and improves accessibility and usability of these products.

4.5 Geospace for SDGs

The concept of the geospace for SDGs as a place where hands-on practices for the implementation of the SDGs can be developed and validated was supported by the workshop participants as a means to demonstrate that the implementation can be done over a large space. It was underlined that implementing the geospace first in Saint Vincent and the Grenadines and then in other locations in the Caribbean would make the region a voice of all SIDS in the world.

Recommendation: It is recommended that national and international stakeholders engage in the further development of the geospace concept and support the implementation of a first such geospace in Saint Vincent and the Grenadines as a joint state-based and grass-roots effort.

Recommendation: It is recommended that a follow-on workshop be organized to further detail the geospace concept, information needs, and practical approaches. A core principle for the geospace is the creating of consciousness of SDGs in the population through integrated information supporting actions. Working out specific examples of how Earth observation data can support implementation of SDGs at Goal or Target levels and inform policies would be beneficial.

4.6 Regional Activities

The importance of regional collaboration and coordination was emphasized throughout the workshop. The list of regional organizations engaged in aspects of SDG implementation and monitoring is long and there is a need to improve coordination and the flow of information between these organizations and the SIDS. A web-based facility linking all activities and enabling knowledge sharing was considered an important step towards improved coordination.

The need for a better linkage between science, research and monitoring activities in the region and improvements of the interface to decision and policy making was also identified. A joint platform to facilitate this linkage and interface would be an important activity. Building this around several geospaces in the Caribbean should be considered in the development of the geospace concept.

4.7 Interregional Activities

It was noted that the majority of the Caribbean SIDS are not members of GEO. It was found that GEO could provide valuable support to the Caribbean SIDS. It was recommended that the SIDS consider potential benefits for them in joining GEO to leverage the convening power in tackling the many issues outlined during the workshop. In particular, the fact that *Economic Commission of Latin America and the Caribbean (ECLAC)* is a Participating Organization in GEO could be utilized in the further development of the geospace.

A greater participation of the SIDS in AmeriGEOSS¿ should be encouraged. The formation of a CaribGEOSS might be considered. For the development of the Geospace for SDGs, participation of GEO Initiatives is highly valued and needs to be facilitated.

It was also recommended that the *Committee on Earth Observation Satellites (CEOS) Open Data Cube (ODC)* at the regional level would be explored as an option to be utilized for the geosapce.

For the Caribbean SIDS, it would be of value if a best practices should be established of how GEO Members are reporting against the SDGs (which ministries, what process, how tier elevation works) and how they are utilizing Earth observations in their reporting.

It was found that help is needed in the region and at national level with issues such as maritime security.

The potential role for GEO to play in supporting the implementation of geospaces with Earth observation should be investigated and a demonstration project to be featured at the GEO-XV Plenary should be developed. The question was raised whether AmeriGEOSS and GEO could play a role in facilitating regional platforms to aggregate and easily distribute fit-for-purpose data. This should include practices to visualize data and support to ensure that products reach communities. Supporting the development of a CaribGEOSS could be an important step towards this goal.

4.8 Recommended Follow-Up Activities

Concerning the reporting on SDGs, it was discussed that a 'Country Status Report' should be developed that identifies knowledge, information and data needs for each SIDS and thus accelerates a demand-based pull component and not the current technology-based push component. There is a need to understand at what level the countries receive science support, what their capacities and where there are gaps. The 2+2 Forms submitted during the workshop can help to populate a first version of such reports. However, there is a need to follow-up with a request for a brief "Country Status

Report." Each SIDS could quickly put together a report, in which the current monitoring structures are described. The report should provide information on the monitoring level aspired for, the variables being monitored, the available tools and information, the challenge areas that need support, and what kind of support or tools are needed. The report also should provided "data about data" and assess what data exists and its quality and how it is managed and accessed. Questions to be addressed include: Is there a constitutional right to make available public information? If new data sources are needed, can these be secured and is there an enabling environment for this within the country and between countries? The report also would identify each SIDS' national priorities and indicate the status of the existing ecosystems and services that support the relevant sectors (including marine and fisheries but also water-use and land-use sectors). Where are sector data and how are they accessed? Are there mechanisms for cross-sector sharing? The report should include list of studies undertaken including known impact studies and stock-taking exercise. If possible, the legal and policy instruments governing the management and regulation aspects should be listed.

An effort should be made to find funding to do an exhaustive review of the international, regional, and national instruments, as well as national plans. An assessment of the implementation mechanisms, planning, monitoring should be carried out. This should include the trading agreements or frameworks regionally and in each country, as well as the frameworks for sharing information and for technology transfer.

In following up on the matching session, it would be important to ask the representatives of the countries to provide quick summaries of which aspects of the monitoring they felt their countries need support for. They should indicate specifically what kind of tools and systems they felt could be useful for them to address these needs.

Recommendation: It is recommended to develop a template for a "Country Status Report" considering the specific challenges of SIDS and to ask the governments of the Caribbean SIDS to prepare these reports for further analysis to improve the science, earth observation and knowledge support they need to achieve the SDGs in their country.

Recommendation: It is recommended that the synergies among SDGs be further explored via evidence-based examples (positive and negative).

Recommendation: It is recommended that relevant partner join in an effort of developing a feedback tool for knowledge-sharing concerning implementation efforts and solutions as a means to support capacity building.

A number of specific steps were identified that can translate into follow-up actions in the region:

1. There is a need to focus on capacity building in the region and in sensitizing communities to the SDG's and their importance to their daily lives, and the geospace is an important action to address this.

2. There is a need to develop national frameworks for monitoring and evaluation of SDG indicators, and the SIDS are in need of support for this. Particularly for the Type III indicators support is needed and international effort on these indicators should be urged to demonstrate the application of satellite data using demonstration sites in the Caribbean SIDS.

3. A regional framework for the SDG 14 indicators should be developed.

4. Scientists and researchers need to be 'educated' in government policy-making mechanisms to better understand how their research can inform better policymaking. Regional institutions could facilitate this education.

5 Workshop Recommendations

5.1 Follow-on Workshops and Participatory Modeling Events

It is recommended that

- in follow-on workshops and participatory modeling events a similar broad and well distributed diversity of stakeholders be replicated;
- future participatory modeling events also apply a "goal-based design" and engage external experienced facilitators to ensure the inter-linkages between different parts of the event;
- for future workshops experienced but non-expert moderation be utilized for plenary sessions, panels and group discussions;
- the time that is allotted to deliberations in table discussion rounds and breakout sessions be increased so that the participants have more time to develop concrete and practical suggestions that would guide where technical, financial and human resources would be deployed in the future.

5.2 Geospace for SDGs

It is recommended that

- national and international stakeholders engage in the further development of the geospace concept and support the implementation of a first such geospace in Saint Vincent and the Grenadines as a joint state-based and grass-roots effort;
- a follow-on participatory modeling event be organized to further detail the geospace concept, information needs, and practical approaches. A core principle for the geospace is the creating of consciousness of SDGs in the population through integrated information supporting actions. Working out specific examples of how Earth observation data can support implementation of SDGs at Goal or Target levels and inform policies would be beneficial.

5.3 Follow-on Activities

It is recommended that

- a pilot project be set up that tailors information products related to sargassum and oil spill monitoring and forecasting to the specific needs of the Caribbean SIDS and improves accessibility and usability of these products;
- a workshop be considered that brings together stakeholders in lionfish to discuss improved monitoring, options for population control and the development of potential economic activities utilizing lionfish as a food resource;
- a workshop be organized to design and develop a knowledge platform on land, water, and ocean governance and the linkage with poverty and livelihood sustenance;
- a template be developed for a "Country Status Report" considering the specific challenges of SIDS and to ask the governments of the Caribbean SIDS to prepare these reports for further analysis to improve the science, earth observation and knowledge support they need to achieve the SDGs in their country;
- the synergies among SDGs be further explored via evidence-based examples (positive and negative);
- relevant partner join in an effort of developing a feedback tool for knowledge-sharing concerning implementation efforts and solutions as a means to support capacity building;
- best practices be established of how GEO Members are reporting against the SDGs (which ministries, what process, how tier elevation works) and how the GEO community can support SIDS in meeting the reporting requirements that depend on utilizing Earth observations;

- those issues be identified where immediate Earth-observation support is needed in the SIDS, including issues such as maritime security;
- a strategic plan be developed for an increased engagement of the Caribbean scientific community in the implementation and monitoring of the SDGs.

A Workshop Organizers

The workshop was organized in a broad collaboration of GEO Initiatives, governments of the Caribbean Small Island Developing States, United Nations Agencies, and regional non-governmental organisations.

A.1 Workshop Program Committee

- Hans-Peter Plag, Old Dominion University, IEEE, GEO Blue Planet Initiative (Co-Chair)
- Paul DiGiacomo, NOAA, GEO Blue Planet Initiative (Co-Chair)
- Emily Smail, NOAA, AquaWatch, GEO Blue Planet Initiative (Co-Chair)
- Hon. Saboto Caesar and Jai Rampersad, Saint Vincent and the Grenadines
- Lorna Inniss, Monica Borobia-Hill, Christopher Corbin, Caribbean Environment Programme - UN Environment
- Danielle Evanson, UNDP, Lorenzo Harwood UNDP and OECS
- Rose Alabaster, GEOGLOWS
- Douglas Cripe, GEO Secretariat
- Argyro Kavvada, NASA, EO4SDGs
- Frank Muller-Karger, University of South Florida, MBON/GEOBON
- Gabrielle Canonico, NOAA, MBON/GEOBON
- Rene Garello, OES/IEEE
- Alan Evans, International and Strategic Partnerships Office, National Oceanography Centre, Southampton
- Martin LeTissier, Shona Paterson, FutureEarthCoasts

A.2 Local Organizing Committee

- Hon. Saboto Caesar (Chair)
- Jai Rampersad
- Louise Mitchell
- Hans-Peter Plag

A.3 Partners supporting the effort

- Group on Earth Observations components:
  - AMERIGEOSS
  - AquaWatch
  - EO4SDGs
  - GEO Secretariat
  - GEOGLOWS
  - MBON
  - Oceans and Society: Blue Planet
- Intergovernmental Organizations:

  - Alliance of Small Island States (AOSIS)
  - Caribbean Community Climate Change Center (CCCCC)
  - IOCARIBE-GOOS
  - United Nations Development Programme for Barbados
  - Organization of Eastern Caribbean States (OECS)
  - UN Environment - The Caribbean Environment Program
- Governments and Governmental Organizations:
  - National Oceanic and Atmospheric Administration (NOAA)
  - National Aeronautic and Space Administration (NASA)
  - Saint Vincent and the Grenadines
- International Organizations:
  - IEEE/Ocean Engineering Society (OES)
  - FutureEarthCoasts
- Other Partners:
  - Mitigation and Adaptation Research Institute (MARI), Old Dominion University (ODU), USA
  - Tiwah UG, Germany.

B Workshop Participants

The workshop brought together 40 participants from sixteen countries (Fig. 3, and two additional participants contributed remotely to the workshop. The participants represented a broad and diverse range of stakeholders engaged in the implementation of the SDGs (Fig. 4).

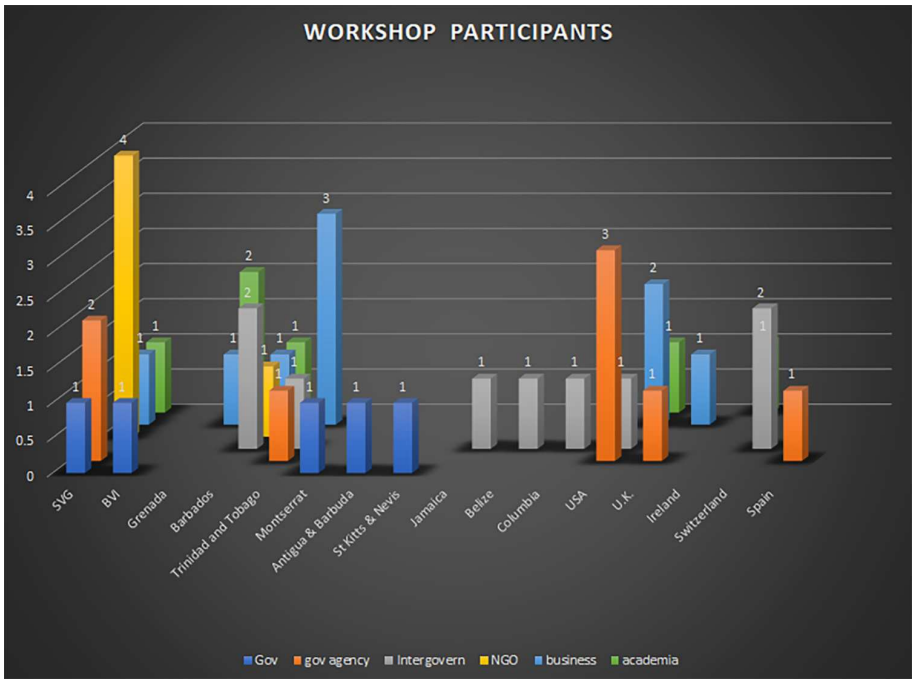

Figure 3. Workshop participants came from 16 countries and represented different societal groups including governments, governmental agencies, intergovernmental agencies, *Nongovernmental Organizations (NGPs)*, businesses and academia.

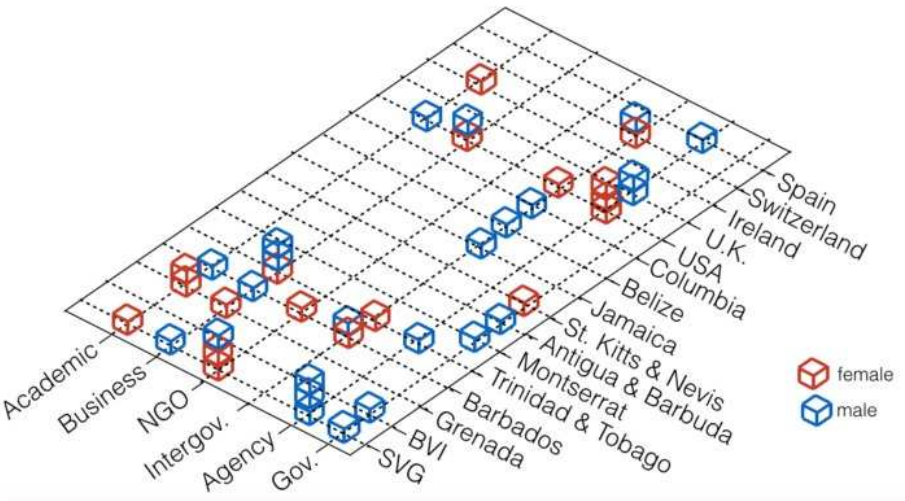

Figure 4. The distribution of workshop participants across societal groups and gender was balanced and societal agents were well represented.

Table 2. List of Workshop Participants.

Name	First name	Position	Organization	City	Country
Alabaster	Rose Osinde	Co-Chair of GEOGLOWS	GEOGLOWS	Geneva	Switzerland
Blackman	Chad	International Trade Advisor and Trade Law Specialist	International Trade		Barbados
Browne	Jamal		National Parks Rivers and Beaches Authority	Kingstown	Saint Vincent and the Grenadines
Caesar	Saboto	Honorable Minister	Ministry of Agriculture, Forestry, Fisheries, Rural Transformation, Industry & Labour, Government of Saint Vincent and the Grenadines	Kingstown	Saint Vincent and the Grenadines
Charles	Kate	CEO	Ocean Spirits Inc	St Georges	Grenada
Corbin	Christopher	Programme Manager, Pollution and Communication	UN Environment CEP	Kingston	Jamaica
Cripe	Douglas	GEO Work Programme Coordinator	GEO Secretariat	Geneva	Switzerland
Deane	Sade	National Coordinator	CYEN	Christ Church	Barbados
Dubrie	Artie	Sustainability Officer	ECLAC	Port of Spain	Trinidad and Tobago
Evans	Alan	Head, International & Strategic Partnerships & Marine Science Policy Adviser	International and Strategic Partnerships Office, National Oceanography Centre, Southampton	Southampton	U.K.
Evanson	Danielle	Programme Manager, Climate Change and Disaster Risk resilience	UNDP	Christ Chruch	Barbados
Gopaul	Nazeer	Director	Coastal Dynamics Limited	Maraval	Trinidad and Tobago
Harewood	Lorenzo	Technical Administrative Assistant	UNDP	Christ Church	Barbados
Haughton	Milton	Director	CRFM		Belize
Herberg	Stina	Director	Richmond Vale Academy	Chateaubelair	Saint Vincent and the Grenadines
Hoflund	Raven	National Coordinator	WIDECAST	Kingstown	Saint Vincent and the Grenadines
Johnson	Hyrone	Director	Maritime Administration	Kingstown	Saint Vincent and the Grenadines
Jules	Celeste	Consultant	SVG Government	St. Augustine	Trinidad and Tobago
Jules-Plag	Shelley	President	Tiwah UG	Norfolk	USA
Kanhai	Attish	Science Officer	Institute for Marine Affairs	Chaguaramas	Trinidad and Tobago
Kavvada	Argyro	Coordinator	NASA	Washington, D.C.	USA
Lord	James	Director	SusGren	Clifton, Union Island	Saint Vincent and the Grenadines
Lorenzoni	Laura	Program manager, ocean biology and geochemistry	NASA	Washington, D.C.	USA
Mahon	Robin	Professor Emeritus	Centre for Resource Management and Environmental Studies (CERMES), University of the West Indies	St. Michael	Barbados
Martin	Vaughn	CEO	Serenity Dive	Calliaqua	Saint Vincent and the Grenadines

Table 2: Continued.

Name	First name	Position	Organization	City	Country
Mitchell	Louise	Founder	Saint Vincent and the Grenadines Preservation Fund		Saint Vincent and the Grenadines
Morrall	Clare	Professor, Deputy Chair, Department of Biology, Ecology and Conservation, Assistant Dean of Academic Affairs,	St. George's University	St. George's	Grenada
Mykoo	Wayne	Lt. Cdr., Deputy Director Maritime Affairs and External Relations & Antigua and Barbuda Depart. Of Marine Services	Merchant Shipping (ADOMS)	St Johns	Antigua & Barbuda
Nisa	Zahidah Afrin	United Nations Nippon Fellow	Japan Fellowship programme on Human Resources Development and Advancement of the Legal Order of the Worlds Ocean		Grenada
Paterson	Shona	Scientist	FutureEarth Coasts, UCC	Cork	Ireland
Plag	Hans-Peter	Professor, Ocean, Earth and Atmospheric Sciences; Director, Mitigation and Adaptation Research Institute (MARI)	Old Dominion University, Innovation Research Building I	Norfolk	USA
Ponteen	Alwyn	Chief Fisheries and Ocean Governance Officer	Ministry of Agriculture, Trade, Lands, Housing and the Environment	Brades	Montserrat
Rampersad	Jai		HRUM Box LTD	Arima	Trinidad and Tobago
Roberts	Julian		International and Strategic Partnerships Office, National Oceanography Centre	Southampton	U.K.
Smail	Emily	Scientific Coordinator	GEO Blue Planet Initative (NOAA/UMD)	College Park	USA
Smith Abbott	Joseph	Deputy Secretary	Ministry of Natural Resources & Labour, Government of British Virgin Islands	Road Town, Tortola	British Virgin Islands
Toro	Cesar	Head	UNESCO-IOC Office for IOCARIBE	Cartagena	Columbia
Trinanes	Joaquin	Scientist	NOAA		Spain
Ward	Thema	Physical Planner Officer	Depart. of Physical Planning, Natural Resources, and Environment	Charlestown	St. Kits & Nevis
Wilson	Andrew	CEO	National Parks Rivers and Beaches Authority	Kingstown	Saint Vincent and the Grenadines
Wilson	Doug	Scientist	Caribbean Wind LLC	College Park	USA
Zubcevic	Irena	Chief, SIDS, Oceans and Climate Branch	Division for Sustainable Development, Department of Economic and Social Affairs, United Nations	New York	USA

C Program

C.1 January 16, 2018

1800 - 1900:	Registration
1900 - 2100:	Informal No-Host Ice-Breaker

C.2 January 17, 2018

0730 - 0830:	Registration
0830 - 1020:	Opening Session — Co-Chairs: Dr. Hans-Peter Plag and Danielle Evanson
0830 - 0840:	Hon. Saboto Caesar: Welcome
0840 - 0845:	Dr. Douglas Cripe: Welcoming Message from GEO
0845 - 0850:	Dr. Hans-Peter Plag: Goals of the Workshop
0850 - 0910:	Chad Blackman: Implementing the 2030 Agenda for Sustainable Developments in the Caribbean Small Island States: Challenges and Opportunities
0910 - 0935:	Dr. Clare Morrall: Science Support for Policy Development for the Implementation of the SDGs
0935 - 1000:	Dr. Irena Zubcevic (remotely): The Potential of the Blue Economy: Increasing Long-term Benefits of the Sustainable Use of Marine Resources for Small Island Developing States and Coastal Least Developed Countries
1005 - 1025:	Dr. Argyro Kavvada (remotely): Earth Observations in Service of the United Nations 2030 Agenda for Sustainable Development
1025 - 1045:	Coffee Break
1045 - 1245:	Session 1: The 2030 Agenda for Sustainable Development in Caribbean Small Island States — Co-Chairs: Jai Rampersad, Dr. Julian Roberts
1045 - 1050:	Co-Chairs: Introduction to the Session
1050 - 1110:	Alwyn Ponteen: It Takes A Global Village — Strengthen SDG Implementation in the Caribbean: Turning Passion for the Ocean into Powerful Partnerships
1110 - 1130:	Joseph Smith Abbott: SDGs in British Virgin Islands
1130 - 1145:	Dr. James Lord: NGOs and SDGs: The Example of SusGren
1145 - 1245:	Panel: Regional challenges in SDG implementation and monitoring — Panel members: Lorenzo Harewood, UNDP; Cristopher Corbin, UN-CEP; Milton Haughton, CRFM
1245 - 1330:	Lunch Break
1330 - 1730:	Fieldtrip — Chair: Louise Mitchell
1330 - 1730:	Field trip: Living on a Small Island State and Interacting with the Ocean. 1. Visit to the site of Serenity Dive in Calliaqua, South Coast. 2. Sans Souci beach - major nesting site for leatherback turtles. 3. Visit a natural farm at Sans Souci.
1900 - 2100:	Workshop Dinner

C.3 January 18, 2018

0930 - 1000:	Doug Wilson, Dr. Emily Smail: Introduction to Matching Framework
1000 - 1040:	Session 2: Interdependencies and interactions of SDGs, Targets and Indicators in Caribbean Small Island States — Co-Chairs: Danielle Evanson, Dr. Hans-Peter Plag
1000 - 1005:	Co-Chairs: Introduction to the Session
1005 - 1035:	Dr. Julian Roberts and Alan Evans: Interdependencies between SDG's and their implementation: The Challenges faced by Small Island State Governments and across the region
1035 - 1100:	Lucia Fanning and Dr. Robin Mahon: Implementing the Ocean Sustainable Development Goal in the Wider Caribbean: State of Play and Possible Ways Forward
1100 - 1115:	Coffee Break
1115 - 1245:	Session 2: continued — Co-Chairs: Danielle Evanson, Dr. Hans-Peter Plag
1115 - 1130:	Louise Mitchell: Sustainable use of natural resources: preservation and conservation
11:30 - 1215:	Panel: Towards responsible consumption and production in thriving and healthy communities: The link to the Ocean — Panel Members: Chad Blackman (International Trade), Rose Alabaster (GEOGLOWS), Dr. Shona Paterson (Future Earth Coasts), Sade Deane (CYEN)
1215 - 1245:	Table discussions: Stakeholders and SDG Implementation For questions to be considered, see G.3.1 **Table Topics for Round 1:** 1. Science Support for SIS Governments (Dr. Clare Morrall, Dr. Robin Mahon) 2. NGO and Private Sector Contributions to SDG Implementation (Dr. James Lord, Kate Charles) 3. Fisheries, Food Security, and Life Below Water: SDGs 2 Versus SDG 14 (Milton Haughton, Zahidah Afrin Nisa) 4. Blue Growth and Poverty: SDG 1 versus SDG 14 (Dr. Julian Roberts, Celeste Jules) 5. Education for Sustainability, Justice, and Equality (Stina Herberg, Shelley Jules-Plag)
1245 - 1330:	Lunch Break
1330 - 1430:	Session 2 continued — Co-Chairs: Danielle Evanson, Dr. Hans-Peter Plag
1330 - 1400:	Table discussions: Stakeholders and SDG Implementation continue
1400 - 1440:	Table reporting
1440 - 1540:	Session 3: Ocean-related variables and indicators essential for SDG implementation and monitoring in Caribbean Small Island States — Co-Chairs: Zahidah Afrin Nisa and Milton Haughton
1440 - 1510:	Laura Lorenzoni: Ocean and sustainability-related variables: The example of ocean biology and biochemistry
1510 - 1520:	Discussion
1520 - 1610:	Table discussions: Ocean variables relevant to sustainability and 2030 Agenda Implementation Questions to be considered see H.2.1 **Table Topics for Round 2:** 1. Supporting a Sustainable Blue Economy - SDGs 8, 9, 10, 12, 13 (Alan Evans) 2. Food and Water Security, Health, Poverty - SDGs 1, 2, 3, 6 (Rose Alabaster, Emily Smail) 3. Maritime Transportation, Fisheries, Pollution, Marine Biodiversity - Implementing SDGs 14, 15 (Attish Kanhai, Thema Ward) 4. Ocean and Safe and Thriving Communities - SDGs 7, 10, 11, 12, 13 (Dr. Shona Paterson, Artie Dubrie) 5. Climate Change, Biodiversity, and the Ocean SDGs 13, 14, 15 (Dr. Laura Lorenzoni, Cesar Toro)
1610 - 1620:	Coffee Break
1620 - 1700:	Session 3 continued — Co-Chairs: Zahidah Afrin Nisa and Milton Haughton
1620 - 1700:	Table reporting
1700 - 1830:	Session 4: Observational requirements for ocean-related variables and indicators — Co-Chairs: Francisco Chavez and Emily Smail
1700 - 1715:	Dr. Emily Smail: Summary of ocean and sustainability-related variables
1715 - 1735:	Dr. Joaquin Trinanes: Observational requirements for variables related to human health and safety
1735 - 1750:	Cesar Toro: Observational requirements for variables related to ecosystem health
1750 - 1810:	Nazeer Gopaul: Observational requirements for variables related to industry activities
1810 - 1825:	Milton Haughton: Observational requirements for variables related to fisheries applications
1825 - 1840:	Vaughn Martin: Supporting observations with citizen science and crowd-sourcing

C.4 January 19, 2018

0900 - 1030:	Session 5: Matching users, requirements and products — Co-Chairs: Chris Corbin and Doug Wilson
0900 - 0915:	Dr. Emily Smail and Doug Wilson: Matchmaking
0925 - 0945:	Dr. Hans-Peter Plag: Gaps in sustainability-related knowledge, products, and observations
0945 - 1030:	Matchmaking supporting SDG Implementation and Monitoring: 1. Information Providers. Moderator: Chris Corbin. Stakeholder activities to be considered include: – National/Regional Weather Services – Intergovernmental organizations (CARICOM, UN Agencies, etc.) – Statistical Offices – Research institutions/academia – CLO (Community Liaison officers) – National/Regional Human Rights Institutions – Media/Public Relations/Communications – Environmental/Conservation NGOs – Regional Conservation Groups – International Conservation Groups 2. Monitoring, Regulation and Enforcement. Moderator: Doug Wilson. Stakeholder activities to be considered include: – Maritime and port authorities – National offices of disaster services – Search and rescue – Oil spill response – Natural disasters – Regional/subregional coordination/management bodies – Marine Protected Area creation and Management 3. Decision Makers. Moderator: Dr. Emily Smail. Stakeholder activities to be considered include: – Planning and environment departments – Coastal resilience planning – Permitting – Ministries of finance/budget – Parliamentarians – Marine Protected Area creation and Management – Donor funding agencies
1030 - 1100:	Coffee Break
1100 - 1230:	Session 5: continued — Co-Chairs: Chris Corbin and Doug Wilson
1100 - 1230:	Matchmaking supporting SDG Implementation and Monitoring
1230 - 1330:	Lunch Break
1330 - 1400:	Session 5: continued — Co-Chairs: Chris Corbin and Doug Wilson
1330 - 1400:	Summarizing Matchmaking Experience
1400 - 1630:	Session 6: Improving availability of Earth observations in service of SDG implementation in Caribbean Small Island States — Co-Chairs: Dr. Douglas Cripe and Dr. Hans-Peter Plag
1400 - 1420:	Jai Rampersad: SDGs in the Caribbean
1420 - 1440:	Artie Dubrie: Integrating geography and statistics to assist public policies for SDG implementation
1440 - 1500:	Lorenzo Harewood: UN: Supporting national actions through regional collaboration
1500 - 1520:	Rose Alabaster: Water, Food, and Safe Environment: The Role of the Ocean
1520 - 1540:	Dr. Douglas Cripe: GEO: Facilitating the creation and use of knowledge
1540 - 1600:	Dr. Laura Lorenzoni: Opportunities for new and improved observations
1600 - 1620:	Saboto Caesar: What would help us most: The view from the Small Island State Governments
1620 - 1630:	Dr. Hans-Peter Plag: Closing Remarks: Where do we go from here?

D Opening Session

Co-Chairs: Dr. Hans-Peter Plag, Danielle Evanson

The opening session set the stage for the workshop. After welcome notes from the government of Saint Vincent and the Grenadines delivered by the Hon. Saboto Caesar, Minister of Agriculture, Forestry, Fisheries, Rural Transformation, Industry and Labour, Government of Saint Vincent and the Grenadines, and the GEO[7] communicated by Dr. Douglas Cripe, the Session featured a number of keynotes providing insight into the interface between science and governance in the Caribbean SIDS and the particular challenges faced by the SIDS. A keynote reflected on the implementation of the Blue Economy, which seeks to establish a sustainable use of marine resources as a component to the economies of the SIDS. Adopting a Blue Economy was seen as aligned with targets of the 2030 Agenda for Sustainable Development. The final keynote discussed the contribution of Earth Observations to the implementation and monitoring of the SDGs.

Opening the workshop, Hon. Minister Caesar noted that the workshop was about solving problems that many in the SIDS had nothing to do with. He emphasized that there was often a disconnect between the theory and implementation, so we need to come up with relevant solutions, grounded in practical actions. A way to do this is to implement SDGs in a small space, a "geospace for SDGs" where practices can be developed to bring the SDGs to the people and to prove that the implementation can be done over a large space. He stated that in Saint Vincent and the Grenadines such a geospace will be implemented in a joint state-based and grass-roots effort.

In the welcoming note from GEO, Dr. Douglas Cripe, GEO Secretariat informed the participants that GEO now has a mandate from the United Nations to supply Earth observations for the SDG monitoring process. In his considerations on the challenges and opportunities concerning the implementation of the 2030 Agenda in the Caribbean SIDS, Mr. Chad Blackman, Trade International, asked the question of what leadership and guidance for SDGs is provided by policy makers and recommended that the lessons learned from the Millennium Development Goal process should be taken into account. He considered the core question of what are some of the major hindrances that can interfere with sustainable growth in the Caribbean and what does compliance with the 2030 Agenda mean for the average person. He saw an urgent need for capacity building of community builders and leaders to enable them to bring the process to the local level. At that level, it is important to see the private sector, NGOs, and government through the lens of SDGs. He went on to make the point that the Caribbean is a special case because of the significant impacts by climate change already now affecting major sectors (such as agriculture and tourism). Funding is required to address these impacts and also to provide healthcare for new emerging disease. The role of the ocean for the SDGs particularly in the SIDS was well recognized and regionally accepted plans for utilizing resources are in place. Mr Blackman emphasized the need to ensure the sustainability of the SDG implementation, which requires mindfulness of business on potential impacts on communities. He saw the need for SDG champions for the Caribbean and recommended to create a regional SDG implementation index for that monitors where the countries are at and suggested that the Caribbean is developed as a SDG success story to be replicated elsewhere. He concluded that this cannot be business as usual and that future generations will judge the present one harshly if we fail to act.

Discussing the interface between science and policy making, Dr. Claire Morrall, St. George's University, Grenada, emphasized the importance of the ocean area, which is much larger than the land space for Caribbean SIDS. There are some links between academics, governments, statutory bodies, NGOs, and regional and international agencies, but much of the science advice is provided by "parachute scientists" brought in on a case-by-case basis. She saw the need for increased partnering with local scientists. Scientists often have limited understanding of the policy process, and knowledge transfer between science and policy making is currently not as valued in society as science and research by themselves are. She also saw a challenge in a distrust of science and a rejection of science that has some level of "inconvenience". Dr Morrall used a number of examples from the Grenadines network of marine protected areas to illustrate her points. Dr. Irena Zubcevic, UN-DESA introduced the concept of Blue economy, which promotes "economic growth, social inclusion, and preservation or improvement of livelihoods while at the same time ensuring environmental sustainability of oceans and coastal areas." The goal is a decoupling of socioeconomic development through oceans-related sectors and activities from environmental and ecosystems degradation. The blue economy comprises "diverse components, including established traditional ocean industries such as fisheries, tourism and maritime transport, but also new and emerging activities, such as offshore renewable energy, aquaculture, seabed extractive activities, and marine biotechnology and bioprospecting." She emphasized that the ocean and the related resources are a fundamental base upon which economies and culture of many SIDS and coastal Low-Income Developing Countries

[7] See http://www.earthobservations.org.

Figure 5. Workshop participants. The workshop brought together 42 participants from sixteen countries representing a wide range of stakeholders. The workshop benefited from having a very diverse audience comprised of many different organizations, private, public, and governmental and from not being overwhelmed by one type of representative.

Figure 6. Mr Chad Blackman, Trade International, Barbados saw the need for SDG champions for the Caribbean and recommended the development of a regional SDG implementation index.

Figure 7. Dr Claire Morrall, St. George's University, Grenada, pointed out that scientists often have limited understanding of the societal decision and policy making processes, which hampers the scientific knowledge transfer into these processes.

(LDCs) are built. The ocean is also central to them implementing the SDGs. She explained that a blue economy can "provide SIDS and coastal LDCs with basis to pursue a low-carbon and resource-efficient path to economic growth and development designed to enhance livelihoods for the poor, create employment opportunities, and reduce poverty." However, SIDS and coastal LDCs often lack capacity, skills and financial support to better develop their blue economy. In view of these challenges for the SIDS and coastal LDCs, partnerships can be looked at as a way to enhance capacity building. Giving an overview of the work the GEO EO4SDGs Initiative, Dr. Argie Kavvada displayed the efforts made at country level to utilize Earth observations for the quantification of the SDG indicators. Examples illustrated the need to combine traditional Earth observations with socio-economic data. She also presented efforts in capacity building through web-based seminars and training programs. She concluded that the "integration of statistics with geospatial information and Earth observations is necessary to enable informed decision-making and an integrated approach to support the development of informed policies and national leadership. Participation of all stakeholders, including civil society and the private sector, is essential to ensure access to reliable, unbiased, accurate, timely, accessible and disaggregated information to ensure that no one is left behind. The sharing of knowledge, experiences, and lessons learned across countries is vital to help scale successful methods, share best practices and respond to the 2030 Agenda."

E Session 1: The 2030 Agenda for Sustainable Development in Caribbean Small Island States

Co-Chairs: Jai Rampersad, Dr. Julian Roberts

This session facilitated a dialogue between governments and people of the Caribbean SIDS about the challenges of executing the 2030 Agenda in each of the SIS. Linking to "Geo space for SDGs" (GSSDG) for the implementation brought a local perspective into the deliberations. The first two presentation presented the efforts made by the governments in Montserrat and the British Virgin Islands, and the next presentation gave an overview of the work of a local NGO in Saint Vincent and the Grenadines. Subsequently, the three panelists provided insight into the challenges and efforts from the point of view of UN agencies and regional intergovernmental organizations.

The presentations and panelist statements provided answers to questions including: What are the core challenges? Who is doing what? What are the responsibilities? What knowledge is needed? Where is knowledge on the ocean needed? What data is used and what gaps are known? What science support is available?

At the end of the session, a common understanding of the core problems started to emerge, and knowledge needs to address these problems were identified.

E.1 Presentations

Alwyn Ponteen, Government of Montserrat, pointed out that Montserrat being an overseas territory of the U.K. is not considered a SIDS. It has a "Sustainable Development Plan (SDP) 2008-2020" that was developed within the framework of the Millennium Development Goals (MDGs). Being an overseas territory Montserrat. This SDP has the overarching planning and policy document to guide Montserrat to a future of sustainable development. Today, several ministries are involved in the SDG implementation. There is a challenges with transition in ministers, a lack of continuity with policy makers and the ministries working in silos. There is also a lack of clear priorities or competing priorities and limited capacity for evidence-based policy making. Data sharing can be an issue and funding (60% subsidized by the UK) can be limited. A three step approach is used for improving governance, management & sustainable utilization of Montserrats ocean resources to achieve SDG 14 Targets. As a case study, he presented a gap analysis related to fisheries and the sustainable use of marine resources in Montserrat. Necessary steps include the improvement of legal framework for sustainable management, governance and use of the ocean resources; enhanced data collection and management infrastructure systems; and the transfer expertise and skills from the South Atlantic UK Overseas Territory to Montserrat. Joseph Smith Abbott, government of the *British Virgin Islands (BVI)*, emphasized the radical change caused by the 2017 hurricanes and outline the impact this has on the implementation of the SDGs. The loss of roughly 25% of the population and most of the islands' infrastructure requires a thorough recovery plan, which is currently in the public domain for comments. An important questions is how to build resilience for a future where such extreme events continue to occur. The theoretical framework for this appears to be available but implementing it in a real-world case is a totally different challenge. The vision of the BVI for recovery "is a stronger, smarter, greener and better BVI that is more resilient and sustainable. That means a BVI that is economically vibrant, socially cohesive, environmentally sustainable, structurally resilient and adhering to the principles of good governance and the rule of law." Mr Smith Abbott emphasized the ecosystem threats resulting from extreme events, including among others high sea surface temperature causing coral bleaching, terrestrial pollution, sand mining and onshore developments. The development of a Blue Economy is important, and BVI is looking into a transition of the current economic fisheries zone into an economic exclusive zone. The BVI do not have an ocean governance and are looking into identifying who the key stakeholder would be for regional and international partners. He reported on a several activities to support implementation of the SDG 14, including natural capital assessments articulated by the UK Joint Nature Conservation Committee (JNCC) and considered how they would be integrated SDG planning and implementation.

Dr. James Lord, *Sustainable Grenadines Inc. (SusGre)*, provided a view from a local NGP. SusGre found the Grenadines network of *Marine Protected Areas (MPAs)* and produced a multi-use zone for the Grenadines. SusGre also coordinates biophysical monitoring across these MPAs and completed and assessment of ecosystem health in the Grenadines. He pointed out issue with microalgae growth and low herbivorous fish populations. SusGre has a focus on education and provides training to MPA personnel, including a Junior Ranger program, training for fisherfolk in drop-line fishing, and use of lobster pots, and engages in social marketing campaign. As an example of challenges from infrastructure developments, he illustrated the impact of failed marine construction on Ashton Lagoon. SusGre is looking for partnerships at regional level and for national support for projects. Ideas for collaborations include the multi-use zoning plan that could be considered for marine spatial planning in other countries, sustainability of offshore

Figure 8. Mr Alwyn Ponteen, government of Montserrat, underlined the importance of a global community approach for implementation of the 2030 Agenda in small societies as the one in Montserrat.

Figure 9. Dr. James Lord, Sustainable Grenadines Inc. illustrated the benefits of network collaboration for the collection of comprehensive environmental data.

fisheries research, and effective approaches to tackle nutrient pollution in the Grenadines. Collaboration could also help to spread the use of educational resources.

E.2 Panel Discussion

The Panelists include Christopher Corbin (UN-CEP), Lorenzo Harewood (UNDP) and Milton Haughton (CRFM). It was moderated by Dr Julian Roberts (Blue Resources, U.K.) and Jai Rampersad (RHUM Box LTD, Trinidad). The Panel considered the presentations made by Mr Alwyn Ponteen (Montserrat), Mr Joseph Smith Abbott (BVI) and Mr James Lord (Sustainable Grenadines).

Figure 10. The Panel on regional challenges in SDG implementation and monitoring include (from right) Christopher Corbin (UN-CEP), Lorenzo Harewood (UNDP), Dr Julian Roberts (Blue Resources, U.K.), Milton Haughton (CRFM), and Jai Rampersad (not in picture).

Lorenzo Harewood, *United Nations Development Program (UNDP)* Barbados, explained that he works on poverty while supporting environmentally sustainable growth. He is looking at trends for poverty, financing for development, and economic shocks. Challenges in the region are the need to strengthen national capacity, awareness and ownership at national and local levels, and verifying priorities, and addressing budgetary and financial challenges. Chris Corbin, *United Nations Environment Programme (UNEP)*, Jamaica, pointed out that his office provides function on behalf of the Caribbean as the Secretariat of Cartegena Convention. Capacity building and training is a primary focus. He identified a need for a more systematic analysis of what training is needed and how the training will be used after and indicated that there may be a need for institutionalized training at the national level. With respect to communication and awareness, he sees an increased use of social media and social science but also the question of how to distill important information out of the overload of information and how to get verified information for decision making. He recognized challenges in the fact that some countries have visions and goals related to the SDGs, while others don't. Different ministries have different priorities. Question related to how policies are being assessed and multidisciplinary approaches are developed, and how to break down those silos. He ephasized the need to talk the language of ministries of finance. Long-term sustainability is important and need to link to jobs. He also saw the need to incorporate ecosystem based management, i.e., connections between pollution, habitats, and fisheries. Milton Haughton, *Caribbean Regional Fisheries Mechanism (CRFM)*, Belice, underlined the economic and community importance of the marine environment. Challenges arise from the uncertainty associated with climate change, ocean acidification, dead zones and deoxygenation, and coastal erosion. The changes in species distributions and fish stocks constitute challenges for traditional fisheries. The capacity for monitoring of activities and enforcement of regulations is limited. The complex system requires an understanding of the changes as a basis sound decision making. He suggested the inclusion of citizen science should be considered. He urged for an increase in cross sectoral governance for coastal and marine resources and pointed out that only 6 countries are parties to the UN fish stocks agreements, a key agreements for management of marine agreements. He also want a increased public support and involvement.

The Panel clearly recognized the fact that Caribbean countries are characterized by a large marine area to land area ratio, meaning that the marine areas represent a significant opportunity for development. The Panel identified a number of critical gaps and challenges facing the region, in terms of the implementation of the SDGs. A key challenge is the lack of capacity and the need for training and capacity building. This is felt across all sectors of the SDGs. In this

regard, the Panel noted the importance of regional institutions in providing both capacity building and the provision of technical support.

This notwithstanding, there remain challenges in achieving full cooperation between different agencies, which is hampering the regions ability to fully realize the potential that is available. Agencies still have a "silo mentality" and this needs to change. This manifests itself inter alia in a lack of an integrated response to address inter-related challenges. There are some good examples of how these challenges are being overcome but if we are to implement the SDGs holistically we need a more "strategic vision" that looks and both national and regional priorities and transcends sectoral interests.

The important role of education and communities was clearly identified by the Panel and it was felt that too little focus is given to the knowledge and role of local communities. It was recognized that we cant continue Business as Normal and therefore there is a need to find a way to make the SDGs relevant to local communities, not just NGOs and decision makers. How do we make the SDGs LOCAL Development Goals?

The Panel also recognized that there is a need to change the focus of the messaging on SDGs to one centered on economic development. In this regard the Panel felt that a key stakeholder, that is often overlooked, should be the Minister of Finance, since it is they who have the ability to determine budget allocation and to understand the economic implications of different development pathways. There is a need to change the current focus to focus on "Development" more holistically.

In the specific case of fisheries, the Panel acknowledged the critical importance of this sector to coastal communities throughout the Caribbean. The sector struggles due to a number of significant challenges, including:

- Lack of capacity
- Poor governance leading to poor resource management practices
- Lack of data for decision-making
- Lack of monitoring and enforcement

The ongoing issue of IUU highlights the need for closer inter-agency and inter-country cooperation and collaboration, particularly at the regional level. There is also a need to reform the current regulatory frameworks to address legal gaps for enforcement.

The Panel recognized the critical need for science support for policy development. There is a need for the scientific community to better understand government decision and policy-making processes to better understand how science and research can inform policy development.

One key gap identified by the Panel relates to indicators and targets under the SDGs. The indicators for monitoring achievement of targets, particularly under SDG 14, are still largely missing. There is no conceptual framework or methodology for how to collect data to support monitoring if SDG implementation.

A key challenge is the lack of national frameworks for monitoring and evaluation of indicators. UNEP is looking at a region-wide framework under the Regional Seas Programme based on what indicators are routinely monitored and how these can link to improved governance.

Improving indicators is an iterative process with the need for capacity building and alignment. This highlights the important role that the scientific/research community can play in SDG implementation

E.3 Recommendations from Session 1

1. Need to focus on capacity building in the region and in sensitizing communities to the SDGs and their importance to their daily lives;
2. Need to develop national frameworks for monitoring and evaluation of SDG indicators. This must include the development of a suit of indicators, including addressing the Type III indicators. One option for this would be to use some local examples to demonstrate the application of satellite data to monitor certain indicators;
3. Scientists/researchers need to be educated in government policy-making mechanisms to better understand how their research can inform better policymaking. This would be a good role for regional institutions to facilitate;
4. Develop a framework of indicators for SDG 14 one suggestion presented ruing the workshop was simply to adopt the existing GOOS indicators.

F Fieldtrip

Chair: Louise Mitchell

The scope of the fieldtrip was to illustrate aspects of living on a SIDS and Interacting with the Ocean. The fieldtrip visited three locations:

1. Visit to the site of Serenity Dive in Calliaqua, South Coast.
2. Sans Souci beach - major nesting site for leatherback turtles.
3. Visit a natural farm at Sans Souci.

At Serenity Dive located in the Calliaqua area on the South coast of Saint Vincent, Vaughn Martin gave an overview of the challenges coastal areas in Saint Vincent are exposed to and summarized the work done in scuba diving courses to raise awareness of the fragility of the marine environment. Serenity Dive is engaged in school projects, especially educating youngsters on scuba diving and having them assist with beach and underwater clean ups. Work has also been done along with the fisher folks within the Calliaqua Area, and 25 of them were certified as part of a sustainable livelihood project. They were to use this new skills to aid in the eradication of the lionfish and in turn sell to nearby restaurants/resorts as a way of earning extra money. The staff at Serenity Dive, is very involved in Lionfish culling and as part of this activity goes to a monthly lionfish fry that earns extra money. They created a local market for for themselves and get get orders for lionfish on a regular basis outside the monthly fish fry.

Mr Martin listed a number of problems faced by them:

1. The dumping of plastic oil bottles and bags into the water by the local fishermen.
2. The dumping of extra debris that originates from upstream down river when there is heavy rainfall.
3. Locally, it is not known where to send valuable lionfish data collected over time and how it is being used.

At San Souci beach, Robin Hoflund and Louise Mitchell pointed out issues with a large amount of waste deposited on the beach by the ocean. This waste, which to a large extent consists of many forms of plastics originating in different and often far-away parts of the globe poses risks to the leatherback turtles during their brief visits to the beach for nesting. Likewise, activities on land impact the beach and expose the turtles to risks and disturbances. The recent changes in extreme weather events further puts stress on the beach environment.

The visit to the natural farm operated by the Saint Vincent and Grenadines Preservation Fund provided insight in the opportunities this approach to agriculture opens up. It also emphasized the inherent conflict between the nearby conventional farms and the natural farming area, particularly through the wide-spread use of pesticides impacting the natural farming area.

Figure 11. At Serenity Dive, Louise Mitchell and Vaughn Martin gave an overview of the challenges coastal areas in Southern Saint Vincent are exposed to and the education scuba divers receive. Scuba divers have a good knowledge of the coastal seas and are good candidates for participating in citizen scientists projects to collect observations.

Figure 12. San Souci beach on the East coast of Saint Vincent mainland is a major ecologically valuable nesting beach for leatherback turtles. The beach had been cleaned only two months before the visit and plastics and other waste from all over the world had reassembled in a short time.

Figure 13. At San Souci beach, the sand available to turtles for nesting is narrowed by erosion, which is expected to increase as sea level increases. The waste deposited on the sand poses a threat to the turtles.

Figure 14. At the natural farms, Louise Mitchell informed the participants about the approach of the farm to an organic agriculture. The surround traditional agricultural areas pose a challenge to the farm as many of the chemical procedures used there also impact the area of the natural farm.

G Session 2: Interdependencies and interactions of SDGs, Targets and Indicators in Caribbean Small Island States

Co-Chairs: Danielle Evanson, Dr. Hans-Peter Plag.

This session addressed the wicked problem presented by SDGs to society and focus on the interconnected nature of the SDGs. Key characteristics are the potentially large economic burden associated with progress towards the Targets, as well as the challenge that those attempting to solve the problem are to some extent causing the problem. In a transdisciplinary dialogue, the role of the ocean for the interconnected SDGs was characterized taking into account the many interdependencies between the SDGs. The session considered that most of the SDGs address the socio-economic and environmental systems based on land, and that both the human and non-human environment in SIDS is crucially dependent on the surrounding ocean. While this dependency is grossly similar it is discretely different in the different SIDS, and both the similarities and differences were elaborated on. The goal was to identify those applications and tools that are used in generating knowledge addressing the interdependencies across boundaries between SDGs, government departments and societal sectors.

G.1 Presentations

The session started with two presentations, the interdependencies of SDGs were discussed and a framework for the implementation of SDG 14 was presented. The next presentation provided local examples of issues that hamper preservation efforts. In the subsequent panel discussion, the panelist addressed different aspects of SDG implementation from the viewpoints of trade, GEO initiatives, international science organizations and regional NGOs. The participants then split up for a table discussion round.

In the first presentation, Dr Julian Roberts underlined the importance of the interactions between SDGs and identified the risk of perpetuating silos for the SDGs if these interactions are not accounted for. He also saw a risk of focusing on oceans only under SDG 14. Using the example of unsustainable fishing and pointed out that fish that are not seen as prize fish are wasted. This causes an increase in processed imported food with considerable side effects. He asked the question of how the ocean impacts all of the SDGS. He saw challenges in the small size of the SIDS and their economies with the costs of public services being is very high per capita. This results in large challenges for socio-economic planning amplified by the low GDP across the region. He also discussed a number of key challenges including plastic marine debris, impacts of tourism, shoreline protection due to coral reef degradation, and the cumulative loss of mangroves. Sudden shocks due, for example, to hurricane and coral bleaching amplify these challenges. The long-term trends in, for example, ocean acidification and distribution of fish species due to changes in sea-surface temperature will adversely affect the tropical belt. These trends can lead to discontinuities. Alan Edwards gave an overview of the support provided by the *Commonwealth Marine Economies Programme (CME)*. The U.K. hydrographic office provides relevant data for region, and the National Oceanographic Centre provides information for value added products. Many of the CMS outcomes are relevant for SDG 14 indicators. Dr Robin Mahon gave an overview of the report on "Implementing the Ocean Sustainable Development Goal in the Wider Caribbean: state of play and possible ways forward" co-authored by Lucia Fanning and Robin Mahon. This report focuses on the role of regional ocean governance[8] for the SDG 14 implementation and is the result of literature reviews, phone interviews and surveys. A total of more than 26 regional organizations were found to be relevant for SDG 14 implementation in the wider Caribbean. He emphasized the need for regional coordination of the translation of previous activities under the new framework of SDG 14. He saw major challenges to overcome in the implementation of SDG 14 in the wider Caribbean and opportunities to overcome them through a harmonized approach. He concluded that the engagement in *Caribbean and North Brazil Shelf Large Marine Ecosystems Project (CLME+)*[9] *Strategic Action Plan (SAP)* (CLME+, 2017) implementation[10] offers a considerable potential for integration of ocean affairs, nationally and into regional sustainable development policy.

In the subsequent discussion, it was pointed out that national focal points of the *Global Environment Facility (GEF)* have been endorsed but national officials have not nominated the SAP as a priority. It would be important to identify who at the national level is making the decisions. At regional level, coordination has been struggling for developing national intersectoral committees. Louise Mitchell, Saint Vincent and the Grenadines Preservation Fund, reported on a number of unsustainable practices. The government mines sand from beaches and sells it to the public, a practice that

[8] See https://www.cavehill.uwi.edu/cermes/projects/ocean-governance/index.aspx

[9] See https://clmeplus.org/.

[10] See https://clmeplus.org/sap-overview/

Figure 15. Dr Robin Mahon summarized the findings of a recent study paper on "Implementing the Ocean Sustainable Development Goal in the Wider Caribbean: state of play and possible ways forward".

Figure 16. Louise Mitchell contributed a view on the SDGs in the Caribbean from a preservation point of view and reported unsustainable practices as well as success stories.

leads to coastal erosion. Erosion mapping is required to document the impacts. The burning of tires for disposal leads to pollution and reduced air quality. In farming, chemicals that are banned in other regions (such as round-up) are often used, leading to severe impacts on ecosystems and other resources. Dumping of waste in rivers and the ocean adds to the pollution. Whale and cetacean hunting is also seen as having a negative impact on marine ecosystems. She then reported a few success stories, among them bans on turtles, cetaceans, and the use of Styrofoam. She concluded by pointing out that for national ocean policies there is often a disconnect between the written policies and what actually happens.

G.2 Panel Discussion

The panel in Session 2 addressed the role of the ocean for the SDGs on responsible consumption and production in thriving and healthy communities. The panelists were Chad Blackman (Trade International), Rose Alabaster (GEOGLOWS), Sade Deane *Caribbean Youth Environmental Network (CYEN)*, and Dr Shona Paterson (Future Earth Coasts). The panel was moderated by Danielle Evanson (UNDP), and Dr Hans-Peter Plag (ODU).

In his opening statement, Mr.Chad Blackman focused on food security and the impact of outside fishing in the region. *Caribbean Community (CARICOM)* provides licences for outside companies, and that is a challenge for the local fisheries. Ms Rose Alabaster introduce the GEO initiative GEOGLOWS, which has the mission "to connect the demand for sound and timely environmental information to the supply of data, information and knowledge about the Earths water system and to explore the science needed to achieve the goals". Referring to the oceans being a global commons, she underlined that it is a shared resource but in practice doesn't have an equal and collective responsibility. She emphasized that water is intrinsically connected to basic human rights and there is an obligation to all sectors of society to respect, protect and fulfil these rights. For SDG6, she discussed a wastewater monitoring ladder that could be used to assess the state of monitoring in the geospace. The ladder, which allows to start modestly, helps to protect

Figure 17. The panel in Session 2 focused on the role of the ocean for the SDGs on responsible consumption and production and health. The panelists were (from right) Chad Blackman (Trade International, standing), Rose Alabaster (GEOGLOWS), Sade Deane (CYEN), and Dr Shona Paterson (Future Earth Coasts). The panel was moderated by Danielle Evanson (UNDP), and Dr Hans-Peter Plag (ODU, not in the picture).

Figure 18. Rose Alabaster emphasized the role of human rights for the discussion of SDGs and focused on SDG 6.

water resources and allows the application of a ”polluter-pays” principle. She concluded by emphasizing that speed is needed if SDG6 is to be reached.

Ms Sade Deane commented on the health impacts of microplastics that are increasingly contained in food. The economic impact of marine debris is increasing and a basis to make a case for a reduction of plastics in all processes on land. She recommended that an environment be created that supports proper disposal of the waste and particularly plastics. Dr Shona Paterson gave a brief overview of the approach Future Earth Coasts is taking. Future Earth Coasts works in the context of international and intergovernmental agreements such as the 2030 Agenda, the UN World Conference on Disaster Risk Reduction, and the Paris 2015 agreement to address a list of challenges that impact the coastal area, including among others equity, justice, resilience, economic opportunities, infrastructure development, ecological management. She also mentioned the Ocean Acidification Africa network[11] as an example of efforts linking observations and information to societal actors.

The subsequent open discussion touched upon the impacts of damaging trades (e.g., dried seahorses) and unsustainably fishing practices. It was emphasized that a shift in social behavior is needed. There is also a needed for economic and political accountability. Tracking of marine debris and identification where the debris and pollution are originating should be a goal.

G.3 Table Discussion Round 1

G.3.1 Questions for Table Round 1

The first table discussion round focused on the contribution of various stakeholders to the SDG implementation. For each table topic and topical area, the participants were asked to consider the following questions:

1. What are the major sustainability challenges in your country or area/region, and which of those relate to the ocean?

2. Which of the SDGs are of highest priority in your country or area/region, and in which way are these linked to

[11] See https://www.oa-africa.net.

ocean?

3. Are there specific entities in your country or area/region that are responsible for the implementation of the 2030 Agenda and the SDGs?
4. To what extent is your country or group engaged in monitoring and reporting the SDGs and which entities are responsible for the monitoring?
5. How are you communicating the SDGs to the general public and ensuring that they are received in a positive manner to gain community support?
6. What are the challenges in implementing SDGs in a coordinated manner and how are interdependencies between the SDGs addressed?
7. What information is needed by your country or group to develop, amend, and implement policies and action plans for the SDGs and to monitor and report on the SDGs?
8. What ocean-related national, regional and international policies and agreements is your country or group participating in?

G.3.2 Tables Topics for Round 1

The participants grouped into five tables with the topics:

1. Science Support for SIS Governments
2. NGO and Private Sector Contributions to SDG Implementation
3. Fisheries, Food Security, and Life Under Water: SDGs 2 Versus SDG 14
4. Blue Growth and Poverty: SDG 1 versus SDG 14
5. Education for Sustainability, Justice, and Equality.

G.3.3 Table 1: Science Support for SIS Governments

Moderation and Reporting: Clare Morrall, Robin Mahon.

G.3.4 Table 2: NGO and Private Sector Contributions to SDG Implementation

Moderation and Reporting: James Lord, Kate Charles. Group Participants: James Lord, Kate Charles, Louise Mitchell, Raven Hoflund, Sade Deane and Danielle Evanson.

Question 1¿: What are the major sustainability challenges in your country or area/region, and which of those relate to the ocean?

- Sand mining activities illegal/legal
- Harvesting of endangered species illegal/legal
- No recycling facilities
- No waste management
- Need for partnerships to strengthen capacity
- Finance for NGOs and CBOs that is ongoing and secure to allow sustainable data collection

Question 2¿: Which of the SDGs are of highest priority in your country or area/region, and in which way are these linked to ocean?

- SDG4 education

- SGD1 poverty
- SDG8 employment opportunities
- SDG2 end hunger

Linked to the ocean as many communities rely heavily on the ocean to provide food and an income

Question 3: Are there specific entities in your country or area/region that are responsible for the implementation of the 2030 Agenda and the SDGs?

Many NGOs are starting to implement or include SDGs in their projects and have assumed responsible but there is a need for government ministries to take responsible and provide guidance to allow NGOs to be in line with government policies.

G.3.5 Table 3: Fisheries, Food Security, and Life Under Water: SDGs 2 Versus SDG 14

Moderation and Reporting: Milton Haughton, Zahidah Afrin Nisa.

Question 1: What are the major sustainability challenges in your country or area/region, and which of those relate to the ocean?

- Health of the oceans and marine ecosystems that are being degraded, developmental activities such as oil and gas impacting natural resources
- Overfishing
- Climate issues and acidification & coral reef bleaching
- Institutional capacity and lack of data — Example: Trinidad oil company looking for fishers
- Monetary value of fishing industry does not estimated well and likely under valued
- Lack of understanding of the natural environment and how development impacts
- Belize banning of oil drilling and exploration
- Participation and access to information
- Gender considerations
- Enforcement is a challenge, legislators are slack, educational and awareness is important
- Monitoring, control and enforcement
- Stronger governance is needed
- NGOs come in with out information about cultures, existing regulations, existing state of the populations
- Communications, types of language, ”ban”
- Uncoordinated development, entire ramifications
- Challenge-sometime development is approved, need adequate

Question 3: Are there specific entities in your country or area/region that are responsible for the implementation of the 2030 Agenda and the SDGs? CRFM, OECS, Carricom, UK government & joing conservation committee. All agencies know what their responsibilities are, in principle, there should be a point person but there isn't necessarily a point person or committee in every country. **Question 4**: To what extent is your country or group engaged in monitoring and reporting the SDGs and which entities are responsible for the monitoring? There is engagement and interest, but there is a need for institutional coordination. There needs to be mapping at the country level on who they should be coordinating with. Mapping of who is doing what. **Question 5**: How are you communicating the SDGs to the general public and ensuring that they are received in a positive manner to gain community support? Belize had a consultation and what it means for the countries. Important thing is translating it for the man on the street,

more is needed in that area. How to get people to relate in their own planning and activity. How and why change and recognize things that they are already doing for best practices. **Question 7**: What information is needed by your country or group to develop, amend, and implement policies and action plans for the SDGs and to monitor and report on the SDGs?

- Fisheries landings, fish stocks, water quality, need broader oceanographic data, biological, physical data, information on the states
- Are interventions helping?
- Ecosystem based management data
- Socioeconomic data, fisheries landings, etc. - data may be existing but it's not locally available
- Mandatory data sharing and access for parachutes
- Time series - oceanographic data
- Monitoring changes in climate and ongoing changes in climate related activities
- Ocean acidification, there needs to be increased work on this, how this will impact fish stocks and corals
- Need a proper system and capacity building - one way this could be improved is to work with and through existing institutions
- Projects need to be embedded in institutions

Question 8: What ocean-related national, regional and international policies and agreements is your country or group participating in?

- Several policies in place, there are more that are needed, strengthened, additional fines, revising and updating them
- Eastern Carribean ocean governance policy
- Common fisheries policy
- Castries Declaration on IUU fishing
- St Georges policy on spiny lobster
- CCCCC has a strategy for climate change, fisheries has a plan for climate change.

G.3.6 Table 4: Blue Growth and Poverty: SDG 1 versus SDG 14

Moderation and Reporting: Dr. Julian Roberts, Celeste Jules.

Poverty levels in Caribbean countries vary significantly. But few, if any, lie below the $1.25 limit in Target 1.1. So we focused on vulnerability and inequality. Group 4 included Representatives from from SVG, A&B and T&T. Very different levels of employment 15-20%, 11% and 5% respectively. Therefore can't compare like for like and each country has different national priorities.

SVG has identified the need to reduce indigent poverty in coastal communities who suffer greater levels of poverty than inland communities, who rely on agriculture, which is more productive. Fishing is the mainstay for coastal communities in St Vincent while fishing and tourism support the Grenadines.

Group 4 concluded that coastal communities are more vulnerable to the impacts of climate change due to proximity to the coast. By contrast, these communities have an "in built resilience" that makes them stronger. This makes the linkage between SDG14, in terms of protecting and restoring coastal habitats, and SDG 1, in terms of vulnerability of communities to the impacts of climate change, particularly with respect to storm events, particularly relevant. Given recent events in the region, is this in the minds of decision makers?

Group 4 recognised the potential contribution that fisheries can make to poverty reduction, improving livelihoods etc. More sustainable fisheries can support better livelihoods. However, we need to recognise that simply improving fisheries isn't going to benefit everyone. Hard decisions and trade-offs need to be made to improve fishery sustainability and this will disadvantage some, at least in the short term. You need to understand that short-term pain will be needed to achieve long-term gain.

Recommendations of Table 4

1. Countries must recognise the clear linkage between poverty and declines in the health of oceans.
2. Countries need to recognise the specific vulnerability of coastal communities to declines in ocean health and the impacts of climate change. Strategies to address these vulnerabilities should be part of the overall strategy to address poverty.

G.3.7 Table 5: Education for Sustainability, Justice and Equity

Moderation and Reporting: Stina Herberg, Shelley Jules-Plag.

Climate compliance is missing from the education curriculum. There needs to be a shift in society from the teaching of only discipline related curriculum to a greater trans-disciplinary approach. Currently we are teaching for a discipline and not for solving problems in the world.

The laws that support sustainability are given a low priority. There is the continued observance of manifest destiny where human animals grow in conflict with the rest of the world resources.

SDG 1 — No poverty was considered the most important. Also SDG 4 — Quality Education was also considered a priority.

There are a number of organizations in each country that are part of the development process of achieving the SDGs. The place where there seems to be issues is a need for greater cooperation between the ministries so that each understands what the other is doing. Coordination is an issue. There is a need for an overall reporting agency. There is mainly sector planning and issues are not implemented jointly. There is a need to communicate and find ways for the SDGs to have resonance with the broader community.

Data is being collected in various disciplines but the SDGs are really requiring in many cases a different type of data collection. There needs to be a new infrastructure for data collection to incorporate the linkages between goals.

A challenge is that there are levels of the SDG governance. There are legally binding and voluntary groups. There are regional, national, international and sub-regional groups.

H Session 3: Ocean-related variables and indicators essential for SDG implementation and monitoring in Caribbean Small Island States

Co-Chairs: Zahidah Afrin Nisa and Milton Haughton.

This session aimed to merge existing scientific knowledge with the understanding of the societal problem of making progress towards the SDGs in Caribbean SIS developed in the first two sessions. The goal of the session was to use the knowledge needs identified in the first two session to co-create a prioritized inventory of those ocean-related variables and indicators that can inform the development and validation of sustainability policies in the SIS, and can help to engage the people in the implementation of these policies. The inventory aimed to include those variables and indices that characterizing the physical, chemical, and biological state and trends of the ocean that are essential for both the development and validation of policies in support of SDG implementation and needed for the monitoring of progress towards the targets and more sustainability. The initial presentation gave an overview of work done by experts to identify essential ocean variables and showed examples of observation efforts to monitor these variables. Subsequently, a table discussion round took place.

H.1 Presentations

Laura Lorenzoni discussed "Ocean and sustainability-related variables: biology and biochemistry." She emphasized the importance of having a prioritized list of variables essential for the development and validation of policies in support of SDG implementation and pointed out that there is already a list of EOVs[12] drafted by the *Global Ocean Observing System (GOOS)*[13]. She noted that there are different levels of "maturity" for each EOV, which impacts the capacity of employing that EOV for assessment. Important questions to consider include what is the existing observing capacity and what are the requirements for data and observing products needed to inform about ocean state. She went on to show the earth science missions that provide data for the EOVs and discussed a number of examples illustrating the value of the observations. Sea surface temperature and turbidity are linked to coral reef health. The *Sargassum Watch System (SaWS)*[14] provides near real-time products based on satellite imagery and numerically-modelled surface currents. Coupled chlorophyll and sea surface temperature products can provide information on potential fishing grounds, enabling management. The biodiversity-related EOVs support the understanding of changes in biodiversity and ecosystems, and *Marine Biodiversity Observation Network (MBON)*[15] is developing and end-to-end framework to define the relationships among physical, biogeochemical, and biological processes. She concluded by summarizing the chain of questions that need to be asked in developing observation platforms to address SDGs:

- What are the needs?
- What type of observing system is required?
- What phenomena are associated with the needs? (i.e. scales)
- What existing strategies and Earth Observing data can address the needs?
- What are the gaps?

In the subsequent discussion, it was pointed out that the EU-funded ConnectinGEO project reviewed the work on EVs carried out in all societal benefit areas of GEO, and that this work revealed different EV-concepts as well as different approaches for identification and validation of the EVs in each thematic area. It was pointed out that UNEP takes a leading role in assessing the state of pollution, while FAO is concerned about the state of fisheries. Concerning coral reefs, it was proposed to map resilient coral reefs by looking for sites that are less exposed to ocean warming or sites that have more resilient corals that are able to better withstand warmer waters.

[12] See http://www.goosocean.org.
[13] See http://www.goosocean.org/
[14] See http://optics.marine.usf.edu/projects/SaWS.html.
[15] See ¡a href="http://www.marinebon.org/

H.2 Table Discussion Round 2

H.2.1 Questions for Table Round 2

¡p¿The second table discussion round focused on the variables, and specifically ocean-related variables, that need to be known in order to generate knowledge in support of SDG implementation. The participants at each table were asked to consider the relevant questions from the following list: ¡ol¿ ¡li¿ Is science support available to your government or your group to assist in decision making related to the implementation, monitoring and reporting of the SDGs? ¡li¿ Are scenario-based approaches used to assess policy options and their potential impacts and to evaluate the policy impacts? ¡li¿ In your thematic area, what data are used to address the challenges for SDG implementation and to monitor progress? ¡li¿ What ocean-related data are available and accessible and what data are missing or not fit-for-purpose? ¡li¿ Are you aware of knowledge and capacity gaps impacting your efforts to make progress towards the goals? ¡li¿What practical steps would you recommend to address the knowledge and capacity gaps identified? ¡li¿What ocean-related variables should be monitored to support your efforts to implement and monitor the SDGs? ¡/ol¿

H.2.2 Table Topics for Round 2

The participants grouped into five tables with the topics:

1. Supporting a Sustainable Blue Economy - SDGs 8, 9, 10, 12, 13
2. Food and Water Security, Health, Poverty - SDGs 1, 2, 3, 6
3. Maritime Transportation, Fisheries, Pollution, Marine Biodiversity - Implementing SDGs 14, 15
4. Ocean and Safe and Thriving Communities - SDGs 7, 10, 11, 12, 13
5. Climate Change, Biodiversity, and the Ocean SDGs 13, 14, 15

H.2.3 Table 1: Supporting a Sustainable Blue Economy - SDGs 8, 9, 10, 12, 13

Moderation and reporting: Alan Evans; participants: Julian Roberts, Douglas Wilson, Joseph Smith Abbott, Robin Hoflund, Clare Morall.

Must not dismiss the need for soci-economic data and the value of marine data to understand the economic value. In particular for eco-system based management, eco-system health and natural capital valuation.

Access to independent data sets for validation of consultative efforts, such as EIA. Issue relating to scale and resolution.

Remote sensing in the ocean different to land in that for the ocean you need subsurface data — In situ mapping and monitoring of sub-surface variables. Need for 3-Dimensional data/basemaps

Absence of data could inhibit decision making, as politicians may use it as an excuse not to make decisions. Maybe employ the precautionary approach.

Need to build resilience into infrastructure by way of understanding whats required and using this to determine whether such investments is responsible, e.g. sea level rise/habitats maps . SDG9 and SDG14.

SDG8 and 9 — economic growth and infrastructure — MSP needs to be dynamic and adaptive by way of future forecasting, scenarios and updating data.

Whilst in an ideal word we need as much data of all marine variables. However in the real world key data would be those that provide data to support indicators for the most important issues for the state, each has its own priorities, so cynical targeting of data to address specific indicators may be inefficient and of no use. Maybe look at each countries Blue Economy essential ocean variables.

H.2.4 Table 2: Food and Water Security, Health, Poverty - SDGs 1, 2, 3, 6

Moderation and Reporting: Rose Alabaster, Emily Smail.

This table addressed selected questions: **Question 1**: Is science support available to your government or your group to assist in decision making related to the implementation, monitoring and reporting of the SDGs?

- In Trinidad and Tobago, the central statistical agency will collect information on food water security but it isn't at a level where it is answering questions sufficiently.
- Certain indicators have been traditionally monitoring, but the science support from universities informing or guiding those processes is limited. The national agencies depend on UN Water and other international bodies for methodologies, data sources. An issue is that some of those are at a macro level and not a customized level.
- SDGs first need to be integrated into national plans. Most islands lack capacity for monitoring and reporting. They aren't yet reporting on inwardly for national targets. First need to understand the baseline.
- The traditional sources of science in the West Indies haven't yet been tapped into in the region. There is a need for strategic engagement of science.

Question 2: Are scenario-based approaches used to assess policy options and their potential impacts and to evaluate the policy impacts?

- There is a disconnect between scientists and sustainability actors. It needs to be a asked what type of sciences is needed to provide the analysis for options.
- Scenario modeling is needed for decision making and also helps identify requirements for data/obs to collect that information.
- Decision and policy makers needs recommendations based on scenario studies. Available recommendations are typically for technocrats. The packaging of the recommendations is important.
- Required are specific and empowering recommendations. This would also helps to inform what data need to be collect.

Question 3: In your thematic area, what data are used to address the challenges for SDG implementation and to monitor progress?

- There is a lot of good data for water, temperature. Need to have more information on sanitation aspects. Reuse of sanitation - using satellite maps for built infrastructure. Land use.
- Urban agriculture, natural ways to deal with settlements. Natural wetlands.
- Regulatory bodies for health and detection. What are current sources of data? Once it has been identified what is going to do be done, observation needs can be defined. Examples discussed included monitoring of fecal matter and toxic waste for industries.

Question 4: What ocean-related data are available and accessible and what data are missing or not fit-for-purpose?

- Narrowing down of hot spots for satellite areas. For poverty and health, socioeconomic analyses are needed. For health, transdisciplinary linkages are important: when are people getting sick and what they are doing.
- There is a need to identify the purpose - it has been transitionally safeguarding human health
- Need a lot of baseline pollution data, impact data that is region specific.
- Data accessibility: impacted be a lack of freedom of information, and no right to access the information. What are data governance, data security?

Question 5: Are you aware of knowledge and capacity gaps impacting your efforts to make progress towards the goals?

- How to demonstrate the value added for things that don't generate direct revenue. This could use scenarios and underline the importance.
- Always be context based. There is a need for a more holistic way, outside of more immediate benefits.
- Information on impacts needs to available to the communities. Should be public so that the public can react.

Question 6: What practical steps would you recommend to address the knowledge and capacity gaps identified?

- What are we trying to solve?
- What format do we need the data in to communicate the issue?
- What is the framework the knowledge transfer? Is it flexible? Is it sustainable?
- Need information for micro-level decisions, too course?

Question 7: What ocean-related variables should be monitored to support your efforts to implement and monitor the SDGs?

- Information for fisheries, water quality, erosion potential, litter, impact on tourism.

H.2.5 Table 3: Maritime Transportation, Fisheries, Pollution, Marine Biodiversity - Implementing SDGs 14, 15

Moderation and Reporting: Attish Kanhai, Thema Ward.

Question 1: Is Science support available for decision making?

Answer: There is some support available for decisions making, however, many gaps exist. A lot of research is done by universities and private companies, however a lot of this data is not transferrable or in a usable form. More scientific data is available for land as opposed to the sea as the land is easier to investigate. This usually creates a land bias in decision making Data availability is also a problem as a lot of data is collected but not made available to the public.

A lot of data is not fit for purpose.

Question 6: What practical steps can be taken?

Answer: Create a central repository for the collection of data. A structured approach needs to be taken for the training of locals in data collection as small numbers of people are available for training in many cases. Different authorities also need to work together in order to share data. Traditional knowledge also needs to be captured. There needs to be a more integrated approach when seeking scenario based solutions. There needs to be a top down approach if necessary where high level departments force all sectors into a more integrated approach. There is need for a common vision where all sectors are included.

Question 7: What data is useful?

There was no simple answer to this question. Only three were identified: Sea surface temperature at a local level, Reef track health and coastal erosion in terms of beach profiling.

The roundtable also noted especially that for some smaller island states even though there are many projects to check and monitor sea level rise, a lack of funding or follow through sometimes creates issues. Unfortunately, although some governments hire private companies to carry out related research, it very often is not made mandatory or a requirement that data obtain must be handed over to government. Thus, valuable data that is pertinent to the governments' regular duties are not available. The table participants also agreed that coordination and an integrated structure should be in place especially in the Caribbean.

H.2.6 Table 4: Ocean and Safe and Thriving Communities - SDGs 7, 10, 11, 12, 13

Moderation and Reporting: Shona Paterson, Artie Dubrie.

H.2.7 Table 5: Climate Change, Biodiversity, and the Ocean SDGs 13, 14, 15

Moderation and Reporting: Laura Lorenzoni, Cesar Toro.

I Session 4: Observational requirements for ocean-related variables and indicators

Co-Chairs: Francisco Chavez and Dr Emily Smail

The goal of this session was to use the knowledge needs identified in the first two sessions together with applications to create this knowledge in the development of observational requirements for the prioritized ocean-related variables collected in Session 3. The original goal was to have a set of requirements for high-priority variables that specify the spatial and temporal resolution and coverage, accuracy, and latency that are consistent with what those applications require that could make use of the observations. After an initial presentation introducing the "GEO Blue Planet Initiative," the following four presentations, addressed observational needs in the areas of health and safety, ecosystem health, industry activities, and fisheries. The final presentation provided insight into the role local businesses can play in making progress towards the SDGs.

I.1 Presentations

Emily Smail introduced "Oceans and Society: Blue Planet" as an Initiative within GEO that focuses on coastal and ocean observations for societal benefit. She gave a brief overview of a cursory data inventory that had been produced for the workshop and gave examples of a few ocean information products that are used for management and informational purposes. Emily Smail also referenced efforts to develop essential variables for sustainable development that include essential ocean variables, social variables, climate variables and essential sustainable development goal variables. She introduced the speakers who addressed observational requirements various topical areas.

In his presentation "Observational requirements for variables related to human health and safety," Joaquin Trinanes introduced the NOAA CoastWatch/OceanWatch as program that provides integrated data and tools to scientists and other stakeholders to better understand the physical, biological, and chemical ocean processes. He introduced CoastWatch/OceanWatch products of relevance for the region including:

- ocean acidification product suites,
- tropical cyclone heat potential,
- vibrio monitoring and prediction tools, and
- ocean debris tracking.

He also informed participants about an Ocean Viewer produced by CoastWatch/OceanWatch and the AOML Physical Oceanography Division that provides data visualizations for satellite and in situ ocean and atmospheric data in the region. He added that there is a need for informed public-health decision making and the development of appropriate tools. He stated that the work on vibrio shows what can be done for other species and that there is a need for clinical data reports for vibrio and other marine infections to track outbreaks. He added that understanding how changing environmental factors impact clinical risk for outbreaks is an important focus area for the future.

Cesar Toro summarized "Observational requirements for variables related to ecosystem health." He introduced *International Oceanographic Commission (IOC)* as the UN mechanism for ocean science, ocean observations and services, data and information exchange and capacity building. He introduced GOOS as an IOC/UNESCO program that is a sustained global collaborative system for observations, modeling, and analysis of marine and ocean variables to support research and operational ocean services. He added that GOOS coordinates observations across the themes of climate, real-time services and ocean health. Cesar Toro stated that GOOS is working to develop EOVs and currently has a team working to identify biological and ecosystem EOVs based on a *Drivers-Pressures-State-Impact-Response (DPSIR)* process.

Cesar Toro further introduced the Ocean Health Index[16], which is a collaborative project between Conservation International, the National Geographic Society, the New England Aquarium, the National Center for Ecological Analysis and the Synthesis and the Sea Around Us project. It is an index that aggregates complex data into a single numerical score for every country. He stated that the Ocean Health index is a tool that can be used for ecosystem health analysis. The audience pointed out that the CLME website is working to provide a baseline for various ecosystems in the region.

[16] See http://www.oceanhealthindex.org.

Table 3. Summary of societal drivers and pressures identified and percentage of international bodies addressing each of them. From the presentation by Cesar Toro.

DRIVERS	%	PRESSURES	%
Knowledge : Science / Data Access	74	Loss of Resources: Habitats / Biodiversity	91
Sustainable Use: Biodiversity and Resources	74	Climate Change	48
Conservation: Biodiversity and Ecosystems	65	Pollution / Eutrophication	48
Development: Sustainable Economic Growth	61	Coastal Development	39
Capacity Building	57	Invasive Species	35
Improve Management: Integrated Ecosystem Approach	61	Solid Wastes	30
Threat Prevention And Impact Mitigation	35	Ocean Acidification	22
Food Security	26	Extreme Weather Events	22
Environmental Quality: Health	26	Noise	22
		Mining	9

Table 4. Proposed EOVs for Biology and Ecosystem health of marine ecosystems. From the presentation by Cesar Toro.

STATUS OF FUNCTIONAL GROUPS	HEALTH OF LIVING ECOSYSTEMS
Phytoplankton Biomass and Productivity	Seagrass Cover
Incidence of Harmful algal blooms	Macroalgal Cover
Zooplankton Diversity	Live Coral Cover
Fish Distribution and Abundance	Mangrove Cover
Apex Predator Distribution and Abundance	

It was stated that there are other assessments such as the UN World Ocean Assessment[17] and that there needs to be a summary and understanding of what other assessments are doing and where that data can be found.

In his talk on "Observational requirements for variables related to industry activities," Nazeer Gopaul introduced the main industrial activities in the Caribbean region as oil & gas exploration, port development and operations, marine transportation and trans-shipment, fishing and tourism. He stated that in Trindad and Tobago, the *Environmental Management Authority (EMA)*[18] operates under a *Certificate of Environmental Clearance (CEC)*[19] process for industrial activities (Figure 19). He stated that his company, Coastal Dynamics[20], generates models on waves on currents for use in dispersion modeling for drill cuttings and spill trajectories for clients. He added that there is a need for better monitoring systems for river discharges in the region. The CEC process in Trindad and Tobago produces geological data, biological data, physical data, chemical data and social/economic data.

According to Mr Gopal, the region lacks ground-based measurements for meteorological and oceanographic data. Specific data needs include wind, waves, sea level and river flow. He added that there is also a need to monitor airborne pollutant impacts on the marine environment. As sources of air pollution affecting ocean systems, Mr Gopal listed:

- Industrial sites
- Agricultural sites
- Marine operations; oil and gas, port, commercial marine traffic and transshipment and bunkering

[17] See http://www.worldoceanassessment.org.
[18] See http://www.ema.co.tt/.
[19] See http://www.ema.co.tt/new/index.php/legal/legislation/certificate-of-environmental-clearance.
[20] See http://coastaldynamics.com/.

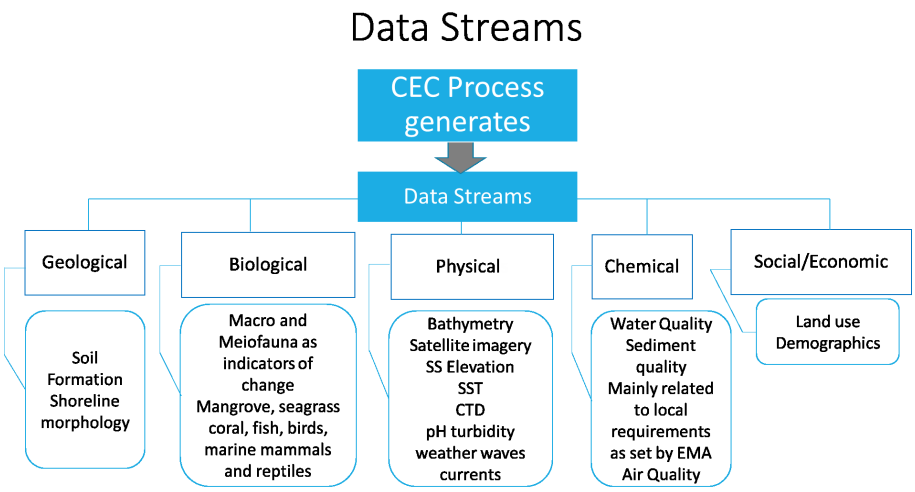

Figure 19. Overview of the CEC Process. From the presentation by Nazeer Gopaul.

He identified main parameters of concern:

- Particulate Matter (PM2.5 and PM10)
- Nitrogen Dioxide
- Nitric oxide
- Sulphur Dioxide
- Hydrogen Sulphide
- Volatile Organic Carbons
- Carbon Monoxide
- Ozone
- Metallic Substances (Cadmium and Lead compounds)
- Organic Substances (Formaldehydes and Ethylbenzene)

Mr Gopal stated that for sea level and sea level rise, there is no long-term quality controlled tidal/sea level monitoring system in the region. He added that his company does have an initiative to work on this. He added that some of the major challenges for the region are that the EMA does not share their data and that there is no prescribed standard for data collection or analysis. He outlined the below actions and challenges for data in the region. Local sources of data are available, however,

- there is a lack of standardized methods for data collection, storage and presentation;
- scales are many times not suitable for small scale applications;
- quality control of datasets is often insufficient;
- confidentiality of data and unclear data ownership hampers data sharing;
- limited accessible to public also impacts data sharing;
- enforcement of management plans and policies is needed;
- training and capacity building are required (continuous QA of the data and methodology as staff is not continuous);

- inter-agency and inter-regional collaboration and agreement and execution of policies and goals needs improvements;
- many sources not well known to local users, such as satellite derived data etc.;
- funding from the private and public sectors needs to be encouraged.

He closed by stating that data collection and dissemination needs to be done in a way that is not disrupted during government transition. It was also stated that there are a fair amount of plankton and benthic studies from where the oil and gas companies operate but that this information is not available to the community.

Milton Haughton addressed "Observational requirements for variables related to fisheries applications." He introduced challenges with marine fish production in countries within the CRFM[21]. He gave an overview of applicable management plans including the:

- Sub-regional fisheries management plan for flying fish in the Eastern Caribbean;
- St. Georges Declaration on Conservation, Management and Sustainable Use of the Caribbean Spiny Lobster;
- Joint Regional Queen Conch Fisheries Management Plan;
- FAD Fisheries Management Plan (Draft);
- Blackfin Tuna Fisheries Management Plan (Draft).

He stated that the main objective of fisheries management in the region is to achieve maximum sustainable yield. He added that for stock assessments, it is crucial to have data on fisheries landings, independent scientific surveys and biological data. He then gave an overview of oceanographic and socioeconomic data that is needed for ecosystem-based fisheries management.

- Oceanographic:
  - Primary production
  - Ocean currents
  - Ocean temperatures
  - Ocean oxygen
  - Salinity
  - Acidity (pH)
  - Nutrients
  - turbidity
- Socioeconomics of fishers:
  - Education levels of fishers
  - Fisher income
  - Fixed and operational costs of fishing

Mr Haughton stated that for SDG indicators 14.2.1 (proportion of national exclusive zones managed using ecosystem-based approaches) and 14.4.1 (proportion of fish stocks within biologically sustainable levels) the following information is required:

- 14.2.1
  - Percentage of stocks with ecosystem based-fisheries management plans
  - Catch and effort data for target species
  - By-catch data

[21] See http://www.crfm.net/.

  - Habitat information- e.g. habitat type, coverage & health critical fish habitats
  - Food webs - Predator prey relationships
  - Both the number of species and the distribution of biomass distributed among species

- 14.4.1
  - Percentage of countries with national data collection systems
  - Number of stock assessments conducted
  - Stock statuses known for commercially important species
  - Proportion of fish stocks within biologically sustainable limits
  - Need to understand population dynamics of stocks [Entry of young fish, growth, mortality, migration]
  - Recruitment
  - Size composition - Length-weight
  - Maturity (rates and weight at age in stock)
  - Growth functions
  - Fecundity
  - Mortality- fishing and natural
  - Biomass at age
  - Harvest parameters (gear selectivity, catchability)

He closed by giving an overview of challenges that SIDS face for assessing stocks including the high cost of data collection and surveys and limited human and institutional resources. He stated that single species models are difficult and data intensive and that it would be more feasible for countries with limited resources to pursue an ecosystem based approach. He added that to move forward, increased capacity, data sharing and compatibility of data for regional assessments was needed.

In the final presentation, Vaughn Martin talked about "Supporting observations with citizen science and crowd-sourcing." Mr Martin gave an overview of projects that his dive shop has been involved in including underwater beach clean ups, the installation of wave monitoring equipment on the windward coastline of St. Vincent and the PADI certification of fisherfolk in the region through a livelihoods grant. He added that his dive shop led the "Diving, another way of life" program to certify community college and secondary students.

He then gave an overview of the challenge of the invasive lionfish in the region stating that there is sporadic funding to do derbys to catch lionfish but interest drops when the funding drops. He stated that his dive shop has started a monthly lionfish catch and cookout in coordination with a local restraint ("We have to eat them to defeat them"). Mr Martin closed by giving an overview of some of the major challenges locals are facing in the region:

1. Debris flowing into the ocean after heavy rainfall through the river system that exits into the site for the Marine Managed Area.

2. Getting the fisherfolks more aware of the damages done to the reef by their nets. Not to mention spearfishing of juvenile fishes especially the parrot fish.

3. Lack of resources to police and implement rules and regulation necessary to ensure the success of these projects.

4. More information and collaboration needed between key stake holders and government organisations.

J Session 5: Matching users, requirements and products

Co-Chairs: Chris Corbin and Doug Wilson

In a novel co-usage effort, the participating experts in Earth observation worked with the stakeholders engaged in SDG implementation to match, where possible, observational requirements to existing data and products. The main purpose of this session was to explore approaches to the co-usage of products and the co-creation of knowledge with these products. The focus of this session was on identifying existing data, products and services that can support the ocean-related identified information needs of the Caribbean Small Island States for monitoring and implementation of the SDGs.

During Day 2 of the workshop, the participants had been introduced to a matchmaking framework (Section L. Prior to examining potential matchmaking opportunities, the workshop attendees discussed what types of users and stakeholders require data and visualization products in a plenary discussion. These were broadly grouped as Decision Makers; Information Providers; Monitoring, Regulation and Enforcement; Educational Institutions; Industry; and Local Resource Users. It was decided to focus the matchamking on the first three of these groups:

J.1 Priority Stakeholder/User Groupings Considered for Matchmaking Rounds

J.1.1 Group 1: Decision Makers. Moderator: Dr Emily Smail

Stakeholder activities to be considered include:

- Planning and environment departments
- Coastal resilience planning
- Permitting
- Ministries of finance/budget
- Parliamentarians
- Marine Protected Area creation and Management
- Donor funding agencies

J.1.2 Group 2: Information Providers. Moderator: Chris Corbin

Stakeholder activities to be considered include:

- National/Regional Weather Services
- Intergovernmental organizations (CARICOM, UN Agencies, etc.)
- Statistical Offices
- Research institutions/academia
- CLO (Community Liaison officers)
- National/Regional Human Rights Institutions
- Media/Public Relations/Communications
- Environmental/Conservation NGOs
- Regional Conservation Groups
- International Conservation Groups

J.1.3 Group 3: Monitoring, Regulation and Enforcement. Moderator: Doug Wilson

Stakeholder activities to be considered include:

- Maritime and port authorities
- National offices of disaster services
- Search and rescue
- Oil spill response
- Natural disasters
- Regional/subregional coordination/management bodies
- Marine Protected Area creation and Management

J.2 Priority Stakeholder/User Groupings Not Considered

Educational institutions:

- Curriculum development committees
- Research institutions/academia

Industry:

- Oil and gas
- Maritime transport
- Aquaculture/mariculture
- Hotel associations/tourism boards
- Marine and coastal construction consultants
- Sustainable Agriculture

Local Resource Users:

- Resource users
- Local fisheries organizations
- Local communities
- Local NGOs

While this effort resulted in a convenient grouping, there still exists variability within each of these groups and commonalities depending on specific country situations. There is a need for more comprehensive stakeholder mapping identifying specific data and information requirements for local, national, and regional priorities and within a specific thematic context, such as pollution, marine protected areas, etc. One might wish to consider if this is done first at a regional level and then in selected countries. It was emphasized that the (spatial) scale of decision and policy making needs to be linked to the scale of the information provided. A platform for knowledge sharing available for all different stakeholders would link parliamentary and inter-parliamentary bodies better to information and stakeholder groups. The need for more observation-related infrastructure including research vessels, surface and subsurface data collection, and data management systems was articulated.

Prior to splitting up in three groups, Hans-Peter Plag gave a talk on "Gaps in sustainability-related knowledge, products, and observations." He pointed out that the gaps we see depend on the goals as well as the perception we have, which in turn depends on the distance we have. Demonstrating the extreme scale of the rapid changes taking place in the planetary system over recent centuries and particularly during the last seven decades, he underlined the

importance of foresight and emphasized the challenge arising from epistemic gaps concerning the system's trajectory and possible thresholds and boundaries that might be crossed. He identified gaps in our understanding of the changes, as well as gaps in useful concepts. Using SDG2 as an example, he pointed out that giving the individual SDGs an identity and seeing the world through the eyes or lens of the SDGs could provide insight in what is needed for an SDGs to be successful. Summarizing the work done by other to understand the interdependencies between SDG14 and the other SDGs, he indicated that more work at the target level is need to better understand the synergies and conflicts between the individual targets. Starting from SDG2, he showed that many actions to increase food security can have negative impact on other targets and advocated for a holistic approach to the SDGs. He compared the goal-based approach to the determination of essential variables for SDGs that provided the structure for the workshop program to the widely used expert-based approach and discussed a number of gaps:

- There is a lack of an epistemology for the creation of transition knowledge from the current system state and trajectory to the desired future.
- There are no or insufficient integrated environmental and socio-economic databases.
- There is insufficient accounting for environmental variables in SDG indicators.
- To some extent, there is a missing link between SDGs and sustainability
- Tools and capacity to assess cross-SDG dependencies are missing.
- Tools for assessing cross-SDG impacts and policies are not available.
- Skills required for matching providers and policy makers are largely not available.
- Many of the essential variables for SDGs related to the built environment and are not measured or extracted from Earth observations.

The participants were then split into three moderated groups focusing on the knowledge and information needs of decision makers, information providers and those engaged in monitoring, regulations and enforcements. Other main stakeholder groups identified included educational institutions, industry, and local resource users, but the needs of these groups were not yet addressed. The original goal was to demonstrate the use of the data and products to generate relevant knowledge. The groups were asked to discuss data and information needs and consider if there is existing data and products to meet these needs. In cases were no matching products were known, the goal was to indicating gaps in observation, processing or capacity.

A cursory data inventory was provided to facilitate discussions along with a framework and requirements and matchmaking matrix (see Section L). The group deliberations focused more on the process of matching that the actual matching. It was also realized that a more "neutral" moderation of the deliberations by experienced independent moderators would have been an advantage compared to moderation by either Earth observation providers or societal stakeholders. The absence of one or more facilitators and the co-chairing of the sessions by subject-matter experts resulted in little overall moderation of the workshop. Moreover, there was a lack of efficient tools to capture the outcomes of deliberations in previous sessions constantly and have them available in electronic form for Session 5. As a consequence, Session 5 did not get a specific list of observational requirements to build on.

J.3 Matchmaking Group 1: Information Providers

Moderator: Chris Corbin

J.3.1 Introduction

While the need for several products relating to all the SDGs were mentioned, discussions focused on those products related directly to the implementation and reporting on Sustainable Development Goal (SDG) 14 on Oceans and those most related to achievement of this SDG.

It was suggested that the specific data user, target audience and reason for a given information need would inform the type of information product or products required and what would be most useful and relevant to a specific decision or policy making context. The following were highlighted as the major uses of data and information products by the stakeholders included in the list:

- Inform policy, legislative and institutional reforms at national level;
- Inform selection of policy options/responses and allow for more evidence-based decision-making at local community, national and regional levels;
- Inform local, national and in some cases regional development planning processes including areas such as: marine spatial planning, watershed and coastal zone management; land use and land capacity planning, national and sector development plans, risk reduction and disaster response planning;
- Inform the design and content of Public Awareness and Educational Programmes for various audiences and target groups;
- Use to assist in setting a baseline and for providing justification when developing grant proposals;
- Use to demonstrate programme and project achievements at multiple levels;
- Use in an Advocacy Role — mainly environmental NGOs; and
- Facilitate country reporting on the achievement of the SDGs, and other relevant Regional and Global Commitments including Multilateral Environmental Agreements.

Agencies working more directly with local communities see themselves involved in generating new and/or obtaining existing data, and then analyzing, interpreting and communicating relevant information based on the data to local communities to assist in participatory management processes including improving the management and/or use of natural coastal and marine resources. It was felt that other agencies — Government and Regional Technical Agencies also played a role in analyzing and interpreting scientific data for use and understanding by a broader audience including the media. Concerning the desired output from the generation and sharing of the data and information, the following were some of the expected outcomes identified:

- General awareness raising and increased knowledge about specific resource management issues;
- Encouraging attitudinal and behavioral changes among various publics and decision-makers;
- Promoting Calls to Action at individual, household, community, national, regional and global levels;
- Identifying new investment opportunities;
- Securing new funding and technical assistance to address data/information gaps and root causes of problems; and
- Identifying new employment opportunities and livelihood alternatives.

The group also felt that there were some significant national or institutional capacity limitations related to the generation, analysis, interpretation, packaging and dissemination of data and information products. These include:

- Data availability — quantity, quality, appropriateness
- Data accessibility — policies and laws on access to information
- Level of spatial resolution of data especially when used for local and/or national decision making;
- Timeliness of data to make real-time decisions;
- Information products for different uses and/or audiences especially those that integrate data from multiple sectors to be used as a decision-support tool or system;
- Data sensitivity: e.g. recreational water quality data and data that might negatively impact major economic sectors such as tourism might not be readily available.
- How is data availability linked to Human Rights and Security?

There are several ongoing and planned national, sub-regional and regional projects which call for the development of "State of" Reports and are generating data and information on a range of environmental variables. Some of these are promoting the establishment of data bases, clearing house mechanisms, decision-support tools, models, interactive maps etc. It is important that an analysis be carried out where such efforts have failed in the past - lack of sustainability — and how best to ensure that products developed are used in the decision-making process in the future. Most importantly, there is a need to generate data and information products that respond to the policy question(s) being posed. If funds available from these projects can be used more synergistically, this might result in tools and products that are more useful and avoid overlap and duplication.

J.3.2 Role of Regional Agencies and Intergovernmental Processes.

Regional and Sub-Regional UN and other Intergovernmental Agencies (CARICOM, OECS etc.) could play a pivotal role in promoting upscaling, replication and incorporation into regional decision-making processes. This could also contribute to greater synergies especially at the sector level and where there is a lack of coherence with regional, national and local development priorities. Examples include the role of UN in supporting countries in monitoring all the SDGs; the support of the UN agencies for a multi-country development assistance framework (MSDF) and specific Country Implementation Plans (CIPs); the role of Multilateral Environmental Agreements (MEAs) such as those under UN Environment Cartagena Convention where countries are required to report periodically on the state of the Caribbean Sea.

The following represents a few examples that were provided through the matchmaking analysis. It was generally felt difficult to go to the level of specificity asked for. However, some guiding principles were identified and immediate opportunities that might help in the further development of this process.

J.3.3 Guiding Principles

- Data and Information must be "Fit for Purpose"
- Data and information must be demand driven and assist in responding to specific decision-making questions and/or policy options and different scales and levels — regional, sub-regional, national and local/community;
- Issues of data quality assurance must be considered;
- Socio-cultural context must be considered in the design of products and mechanisms used for dissemination;
- Should build on existing frameworks, mechanisms, institutional mandates for data generation, analysis, reporting and dissemination;
- Must consider issues of sustainability — who maintains the data bases and keeps data updated?
- Encourage development of decision-support systems that integrate all the dimensions of sustainable development so that broader development issues are addressed.

J.3.4 General Analysis of Matchmaking Exercise

Type and Implementation Mechanisms: These varied widely from group to group and included:

- Formal or ad-hoc government committees which could be at the technical or political levels;
- Project Steering Committees often established only for large national projects;
- Meetings of Governing Councils, Boards etc. which covered NGOs, Statutory Bodies and Municipal Authorities;
- Intergovernmental Fora — Technical, High Level Policy or Ministerial usually for UN and other regional Intergovernmental bodies.

Geographic Coverage: This varied from local community to national to sub-regional (OECS) to regional to Global. It is important to note that regional organizations have varying and often overlapping geographical scope coverage and this will be important when engaging higher level political decision-making.

Temporal and Spatial Resolution: For data collected at a very local scale — high resolution data for management of the use of coastal and marine resources was viewed as very important. It was also felt that to convince decision-makers of the impacts of any given action — trend analysis and temporal resolution was needed. It was mentioned that there was value in the use of scenarios but the more they could be related to on the ground issues — the more likely they would be considered in a decision-making process.

Processing and Visualization: This was identified as a strong potential area for partnership and support. This reflected that most data were generated as reports and not always packaged into information products. Data also tended to be segmented and not integrated across multiple sectors to inform real decision making. Making linkages across socio-cultural, economic and environmental issues was critical.

Data availability: This was considered highly variable depending on type of data, country etc. Some NGOs mentioned that limited primary data on specific ocean related issues are generated by Government but rather by CBOs and NGOs. Others indicated that data is provided to Governments but there is no evidence that such data is being used to inform decision-making. Persons through there was some data not available at a national data level that could benefit from larger scale regional and/or global data sets especially on issues such as pollution.

Funding and Duration: Many monitoring programmes undertaken by Government are often underfunded and not sustainable. There is still a culture that does not always recognize the importance of environmental data in decision-making. Many programmes run by NGOs are voluntary and heavily dependent on external often grant and project funding. This leads to gaps data as well as varying methodologies, parameters etc.

J.3.5 Potential Opportunities

- Reporting Frameworks being established under the United Nations (lead by UNDP) relating to Multi country Development Assistance Frameworks (MSDFs) in the Caribbean;
- Development of Regional State of Pollution, State of Marine Habitat and State of Fisheries Reports under UN Environment, FAO and other regional agencies under projects such as CLME+ and BIOPAMA;
- Development of national and regional State of Environment, Marine Protected Areas, Coral Reefs and Mangroves by several agencies such as UN Environment, WWF, IUCN, The Nature Conservancy
- Ongoing or planned multi-country projects who have been tasked to develop data bases, clearing house mechanisms and decision-support tools for example in support of Ecosystem-Based Management Approaches in the Caribbean;
- Reporting Requirements for SDGs and in particular SDG 14 — UN ECLAC, CARICOM and various Statistical Bureaus
- Using existing regional technical and intergovernmental fora to demonstrate how data and information products can be used in a decision-making process — practical examples, case studies;
- Using already existing regional platforms e.g. on Nutrients, Marine Litter and Wastewater
- Supporting regional responses to topical issues e.g. sargassum, nutrient pollution (algal blooms), ballast water discharges, movement of sediment from large rivers and impacts on coastal and marine habitats and ecosystems; emerging issues — microplastics — movement and risk to fisheries and human health;
- Replicate and upscale the geospace for SDGs to be established in Saint Vincent and the Grenadines
- Promote greater involvement of Caribbean countries in GEOs; and
- Need to maintain and build on network and commitment of partners identified at the Workshop;

J.4 Matchmaking Group 2: Monitoring, Regulation and Enforcement

Moderator: Doug Wilson

J.4.1 Discussion Summary

This group prioritized data and information needs for Marine Protected Areas (MPA); Maritime and Port Authorities; and Disaster Services. Ultimately, the focus was limited to MPA Creation and Management. The discussion of the topic — observing needs for Monitoring, Regulation, and Enforcement, specifically for Creation and Management of Marine Protected Areas — had to organically move through local issues with MPAs (particularly enforcement) before being able to discuss observations.

In general, practitioners cannot jump immediately into discussion of requirements without considerable discussion of the nature of the activities themselves. To get the level of detail we were trying to achieve would have required a much longer and more focused preliminary process — but would have resulted in a more educated practitioner base. This should be considered for future workshops and in the follow up for this meeting.

The group also discussed and agreed that there is a lack of appropriate tools and framework to conduct end-to-end (observation-to-product use) activities. This includes both the actual tools (data, information, products, capacity, etc.) but an organized framework within which to work. The group Habitat for Humanity as an example (an established, organized framework capable of directing an activity supporting sustainable housing) which is necessary in addition to workers, materials, designs, funding.

J.4.2 Discussion of Marine Protected Areas

The agency or ministry for Marine Protected Areas varies by country in the Caribbean. MPA enforcement is critical to sustainability and is a legislative issue, requires an appropriate legislative framework in place. Traditional enforcement approaches require resources for monitoring. Community enforcement through identification and public shaming is effective in some areas but requires public sensitization.

Data for MPA Monitoring and Enforcement: For MPAs, baseline data is needed with appropriate resolution and quality for science-based management. Some specific data requirements include:

- Available and caught biomass by species
- Nutrient pollution
- Sediment traps
- Water quality
- Point source pollution

In general, SIDS need improved tools to collect data such as drones and planes for remote sensing data collection and less expensive, lower maintenance in situ sensors. There is also a need for apps that allow for easy collection of data and information and reporting by managers, citizens and engaged users. There is also a need for a data system to collect and organize information and deliver products. There are also basic policy and management hurdles to navigate for monitoring. In St. Vincent for example, there are no requirements for fishing boats to have ID numbers.

J.5 Matchmaking Group 3: Decision makers

Moderator: Dr Emily Smail

This group focused the discussion on data and information needs for decision makers. It was discussed that data and information tools are needed for informing planning processes, land use and risk reduction. There is also a need in the region for information about the baseline state of the environment for grant proposals from NGOs and local researchers. In general, it was agreed that the scale of products for decision makers needs to be linked with scale of decisions made on the local level. The region also needs a thorough analysis of the existing data and information in the region including where it is stored and if it is accessible.

J.5.1 Data Access and Sharing

One challenge in identify existing data to meet needs are the data sharing policies in the region. An example was given that the public health organizations collect data on water quality but do not always advertise it or share that data.

It was suggested that the Caribbean Environmental Health Institute may be an appropriate body for encouraging the open sharing of data related to public health such as water quality.

It was discussed that data and information providers also need to work with local community and government representatives to package data in a way that is not controversial to local culture or economic sensitivities. It was agreed that mechanisms for identify and sharing data are broad and include national, regional, and international networks that could be tied into.

The group discussed that there needs to be simpler tools for collection and aggregation of data. It was stated that there is a need for an organizational structure that is a framework for small island states and has a standardized capability that is easy to use.

J.5.2 Identifying and matching ocean-related user data and information needs

The group discussed that identifying requirements would be aided by sharing of experiences within the region and examples outside the region and proving case studies and example products and visualization tools. Specific data and information needs that were identified during the discussion are outlined below. An in depth matching of data and products with these needs will need to be completed following the workshop.

J.5.3 Ocean-related data and information needs

- Near real time data and time series data
- Sargassum monitoring and forecasting
- Parrotfish distribution an abundance
  - There is a "pass on parrotfish" initiative being led by a non-profit in the region. Some local people do not know what data this is based on and would benefit from information about the distribution and abundance of the species.
- Tools for ecosystem forecasts for species distribution
  - With climate change and other environmental pressures, there is a need for forecasting about predicted changes in species distributions for effective fisheries management policies.
- Fisheries alerts (likelihood of fish in certain areas, safety warnings)
- Data and information about the extent and change in ecosystems that provide protection from storm surge
- Data and information about beach and coastal erosion
- Conditions and predictions on lobster spawning for management purposes
- Tracking of the water from the Amazon River plume
  - There is concern in the region about the impacts of polluted water from the Amazon River on the Caribbean region given the mercury-based gold mining that goes on in the region. There was also a recent fish kill in the region from a fresh-water bacterium from the Amazon River.
- High level water quality products for warnings
  - The suggestion was made for a "brown water advisory" type product to alert the public that they should consider avoiding dirty water that may be contaminated similar to the alerts that are put out in Hawaii.
- Harmful algal bloom monitoring and forecasting
- Heavy metal monitoring
- Information on the impacts of volcanic ash on the water column
- Scenario based forecasting of land use on water quality
- Marine debris tracking and source identification
- Direction and strength of currents in the region

J.5.4 Other information needs

Decision makers need more scenario based information that take into account economic estimates of the environment. There also needs to be an ocean-related policy and framework mapping done for the region with a focus on tourism, disaster management and fisheries.

K Session 6: Improving availability of Earth observations in service of SDG implementation in Caribbean Small Island States

Co-Chairs: Dr Douglas Cripe and Dr Hans-Peter Plag.

The experience of Session 5 provided a basis to discuss options for improving the service Earth observations and derived products can provide to the execution of the 2030 Agenda. The main questions addressed was how regional an international organizations can collaborate to ensure that governments and the people have access to the required ocean-related Earth observations and the capacity to utilize these observations for the creation of the needed knowledge. Concerning the local action, the implementation of the Geo Space for SDGs was at the center of the deliberations. Demonstrating the relevance of Earth-observation derived information for this Geo Space was identified as the candidate for a demonstration project to be presented to the GEO Plenary in Fall 2018.

Jai Rampersad commented on "Sustainable Development Goals in the Caribbean," staring by reviewing pictures of damage resulting from hurricanes Irma in St Martin and Maria in Dominca, the 2010 earthquake in Haiti, coastal erosion in Trinidad and Tobago and concluded this review of pictures with examples of poverty and the increase in crime. For the SIDS, he emphasized a number of criteria that are related to specific challenges:

- Limited geographic size
- Extensive coastal areas
- Remote locations
- Fragile economies that are often dependent on narrow sectors
- Limited natural resources and access to fresh water and energy
- Small populations
- Weak institutional capacity
- Their small size in terms of geography, economy, and population, and their limited capacities render them vulnerable to external shocks.

Reviewing the achievements related to the Millennium Development Goals he pointed towards persisting challenges, including gender inequality, huge wage gaps, continuation of climatic change and environmental degradation, conflicts hamper human development, and the persistence of poverty and hunger. Referring to the Caribbean Human Development Report[22] "Multidimensional progress: human resilience beyond income" (Drayton et al., 2016), he summarized the main vulnerabilities with respect to environmental hazards and external economic shocks. The gender gap in terms of participation in the workforce was found to be still large, and there is a large inequality in access to education between the richest and poorest in the Caribbean. In terms of health care, there has been progress in the Caribbean. The economic impact of crime is estimated to be significant ranging between 2.8% and 4% of the GDP in CARICOM countries. High unemployment rates (which in general are higher for women than men) and child labor are challenges in most of the SIDS. Access to water is found to be good in most SIDS, except for Haiti. Several studies found that the Caribbean SIDS are among the worlds most vulnerable countries when it comes to the effects of climate change, and the cost of climate change due to hurricane damage, loss of tourism revenue and infrastructure has been estimated to increase from US$ 10.7 billion annually in 2025 to US$ 46 billion by 2100. Summarizing the challenges for the SDG implementation, he listed:

- The global economic crisis
- Declining foreign direct investment
- trade imbalances
- Increased indebtedness
- Lack of adequate transport, energy and ICT infrastructure networks

[22] See http://hdr.undp.org/sites/default/files/undp_bb_chdr_2016.pdf.

- Limited human and institutional capacity
- Inability to integrate effectively into the global economy
- Climate change
- Natural disasters
- The degradation of coastal and marine ecosystems and sea-level rise

Data collection and analysis in support of policy development is hampered by a lack of technical support, infrastructure, and financing, and there are inconsistencies, lack of accountability, monitoring issues and delays. Little to no ICT support and a lack of political directive added to this list. Referring to the Samoa Pathway (2014 outcomes), he presented a list of requirements to make progress:

- Enhance international cooperation, exchanges and investments
- Increased public and private investment in infrastructure
- Foster entrepreneurship and innovation and sustainable industrial development
- Development of the financial services industry
- Job Creation/ Technical support
- Improve working conditions
- Greater ICT integration
- Promote and enhance gender equality
- Set national regulatory and policy frameworks to improve transparency, accountability, and corporate social responsibility.

He also asked for decision making that integrates regional bodies (Caribbean/SIDS) in the domestic policy development and improves the assessment of each sovereign country's requirements with respect to the SDGs. He concluded by giving details on the proposed geospace in Saint Vincent and the Grenadines, which is a designated area that is selected with an intensified and organised effort to achieve the SDGs:

- 7,000 acres
- Parish, Town and or Constituency
- Cooperatives
- Surveys and Interviews conducted (Government Institutions)
- All applicable SDGs ranked (Scale 1 -10) based on current status vs 2030 expected outcomes
- Performance monitored on an annual basis
- Metrics are kept in line with achieving the SDGs outcomes by 2030

Artie Dubrie talked about "Integrating geography and statistics to assist public policies for SDG implementation" based on the work done by the ECLAC[23]. After introducing the ECLAC membership, she pointed out that ECLAC is strongly engaged in accelerating the SDG implementation in the Caribbean. Investigating the reasons for non-production of indicator data by Caribbean countries, that the lack of financial resources, technical capacity, prior need to produce indicators, and internationally agreed methodologies or combinations of these lacks were reasons for countries not reporting the indicators. She saw the need for a new development paradigm with equality and sustainability as drivers of growth and pointed out that moving toward a sustainable economic model, taking advantage from the environmental big push and the technological revolution, will provide a pathway to preserving the best of globalization and global interconnectedness, enhancing economic and environmental sustainability and empowering individuals and communities to strengthen social inclusion and multilateralism. A list of six pillars for action and cooperation included

[23] See https://www.cepal.org/en.

- High level: National institutional and inter sectorial architecture
- Integration of SDG into national planes, budgets including investments
- Strengthen capacities in statistics
- Implementation: financing, technology, commence, accountability
- Strengthening of regional architecture: for example on SGD of gender, planning, energy etc
- Working medium amongst government, industry (private sectors), citizens other stakeholders etc.

She emphasized the importance of making progress towards the integration of statistical and geospatial information in Latin America and the Caribbean, and presented a road map of six steps:

1. Complete the diagnosis on the integration of geography and statistics
2. Produce an official document with the results and analysis
3. Prepare a regional strategic plan for the integration of geography and statistics and geospatial information based on the Global Geospatial Statistics Framework, Agenda 2030 and the Census Round 2020.
4. Promote national plans for the integration of geography and statistics
5. Establish a data base of best practices and national experiences in the integration of statistical, and geospatial information

Ms Dubrie concluded her presentation with five steps to enhance cooperation and collaboration:

1. Implement the Mega Project based on the guidelines and specifications disseminated by UN- Global Geospatial Information Management for the Americas
2. Mainstream geospatial approaches into the working groups of the Statistical Conference of the Americas
3. Establish collaborative relationships with the global and regional community of Earth Observation
4. Articulate collaboration with regional organizations on geospatial matters
5. Promoting initiatives of collaborative work between government, academia and civil society.

Lorenzo Harewood discussed "Supporting national actions through regional collaboration," and he considered a strong commitment to regional cooperation mandatory for the success of the SDGs. Using the example of a rapid mapped assessment[24] carried out for Jamaica, he introduced the MAPS Framework that focuses on mainstreaming, acceleration and policy support. While there are some elements of functional cooperation in the region, including the Caribbean Catastrophe Risk Insurance Facility, the CCCCC, the University of the West Indies, and the CRFM, he saw the need for much more to be done to facilitate regional cooperation. Considering the question of how to do and improve knowledge sharing, he stated that the traditional North-South cooperation still has it value but South-South cooperation should be considered. In order to utilize the cross-sector, cross-region, and cross-discipline dialog the workshop has initiated, he saw the need for a platform to monitor the outcomes and impacts of the relationships that will be established. He concluded by saying that regional partnerships are not just a proponent of enhancing implementation, they are a necessity.

Rose Alabaster addressed the nexus of water, food, and environment. Based on the notion that food, water and a safe environment are human rights (expressed in the SDGs 2, 6, and 14, respectively) she stated the obligation to respect, protect and fulfil these rights and provided detailed thoughts on these aspects for the three rights. She saw significant synergies between the individual SDGs and the relevance of their implementation for the human rights. She emphasized that under the United Nations Declaration on the Right to Development, Article 2, the individual is the active subject, not the object, of economic and social development. The individual will ordinarily need useable resources (such as land, capital, labour), as well as knowledge. She underlined that the realization of individual rights (economic, social, cultural rights) take place at the lowest/smallest economic unit, i.e., the household. This

[24] See http://devinfolive.info/dashboard/Jamaica_vision2030/index.php.

Figure 20. Artie Dubrie reported on the work ECLAC is doing concerning integrating geography and statistics to assist public policies for SDG implementation.

Figure 21. Dr Douglas Cripe informed about the work GEO and CEOS are doing to support SDG implementation and monitoring with Earth observations.

puts emphasis on the female and male division of labour and control over production and consumption, and it creates obligations towards the elderly and disabled, who in traditional agricultural society were taken care of by their families, and in modern society must increasingly be borne by the state and, thus, by the national society as a whole. She pointed to the importance of social and economic data for safeguarding the policies.

Douglas Cripe discussed the role of earth observations for the creation and use of knowledge. He emphasized the importance of data sharing and gave examples of how increased data sharing resulted in large economic returns. Among the GEO initiatives, the EO4SDGs[25] initiative has the most pronounced focus on providing the Earth observations need to quantify the SDG indicators. He also mentioned the Foundational Task on "User Needs and Gap Analysis" which aims to establish a comprehensive overview of user needs in terms of knowledge and related observational requirements. He also mentioned the GEO efforts in branding, which utilizes the GEO label[26] and discussed in details the recent development for open data cubes promoted by CEOS[27]. Data cubes build capacity for users to apply CEOS satellite data and support GEO's and the United Nations' agendas.

Laura Lorenzoni considered in her presentation "Opportunities for new and improved observations" and to do so, she presented a few examples of NASA resources including ARSET, GLOBE, DEVELOP, the MBON Explorer and P2P. ARSET provides applied remote sensing training, which, for example, offers webinars on fundamental remote sensing[28] and coastal ocean[29]. GLOBE[30]¿ is an international science and education program. The DEVELOP National Program[31] brings groups of graduate students together to carry out projects that use Earth observations to

[25] See http://www.eo4sdg.org.
[26] See http://geolabel.info.
[27] See http://www.ceos.org.
[28] See https://arset.gsfc.nasa.gov/webinars/fundamentals-remote-sensing.
[29] See https://arset.gsfc.nasa.gov/land/webinars/coastal-oceans-2016.
[30] See https://www.globe.gov.
[31] See https://develop.larc.nasa.gov.

Figure 22. Rose Alabaster emphasized that many nations recognize the human right to a healthy environment.

address challenges in many environmental areas. The MBON[32] Explorer provides coupled global biological and environmental data and offers tools to generate infographics. Ms Lorenzoni concluded by recommending to become part of ongoing efforts and to take advantage of existing tools.

In his concluding speech, Hon. minister Saboto Caesar urged the participants to engage in the further development of the concept of geospace and to commit to participate in the implementation of the geospace in Saint Vincent. He emphasized the value of Geo-Design for informing spatial decision-making for urban and rural resilience and sustainability.

Closing the workshop, Hans-Peter Plag expressed his expectation that the concept of using a local geospace for SDGs to bring these goals to the people could turn out to be a main outcome of the workshop and be underlined the importance of keeping the momentum up in fully developing the concept and implementing geospace first in the Caribbean and then beyond. He indicated that the steps after the workshop would be to prepare a workshop report, and to use this report to finalize the white paper on the role of the ocean for SDG implementation and monitoring in the Caribbean. He identified the geospace as a candidate for a demonstration project for the GEO Plenary in Fall 2018. An important step informing the white paper would also be the analysis of the 2+2 forms submitted during the workshop. Dr Plag thank the members of the Workshop Program Committee for their support in developing the workshop program and the participants for taking out three days of their busy lives to come and contribute actively to the workshop. He acknowledge the funding provided by NASA, NOAA, the Commonwealth Marine Economic Program, Tiwah and ODU and stressed that the workshop would not have been possible without this funding. He also made the point that the hotel had provided excellent conditions for the workshop and thanked the hotel staff for their services and very pleasant interactions with the participants. He concluded by saying that the interaction and fruitful collaboration with the government of Saint Vincent and the Grenadines and in particular minister Saboto Caeser resulted in this unique opportunity of bringing this wide range of stakeholders together for a very productive dialog.

[32] See http://www.marinebon.org.

Figure 23. Workshop Participants during the final hours of the Workshop

L Matching Framework

A matching framework was proposed by Dr Emily Smail prior to the workshop. This framework distinguishes three levels for available products with a color-coding of green for mature products, yellow for pilot projects, and red for concepts.

Table 5. Framework for matching products to identified needs.

Readiness Level	Type (in situ, satellite, model, etc.) & Implementation Mechanism	Geographic Coverage	Temporal & Spatial Resolution	Processing & Visualization	Availability
Mature	Data, tool, service or product is the correct type for meeting user needs and is implemented in a way that meets user needs.	Data, tool, service or product is available for the required geographical region	Data, tool, service or product is available at the required temporal & spatial resolution.	Data, tool, service or product is processed and visualized in a way that meets user needs.	Data, tool, service or product is available in a way that meets user needs (e.g. openly available via web portal).
Pilot	Data, tool, service or product is the correct type or partially meets type need for meeting user needs and/or is not implemented in a way that meets user needs.	Data, tool, service or product is available for a portion of the geographical region	Data, tool, service or product is available but not at the required temporal & spatial resolution.	Data, tool, service or product is available but not processed and visualized in a way that meets user needs.	Data, tool, service or product is available but not easily accessible for users.
Concept	Data, tool, service or product type and required implementation mechanism has been identified.	Need for data, tool, service or product for a geographic region is identified.	Required temporal & spatial resolution for data, tool, service or product identified.	Required processing and visualizations identified.	Required availability of data, tool, service or product identified.

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Acronyms

BVI British Virgin Islands

CARICOM Caribbean Community

CEC Certificate of Environmental Clearance

CEOS Committee on Earth Observation Satellites

CLME+ Caribbean and North Brazil Shelf Large Marine Ecosystems Project

CME Commonwealth Marine Economies Programme

CRFM Caribbean Regional Fisheries Mechanism

CYEN Caribbean Youth Environmental Network

DPSIR Drivers-Pressures-State-Impact-Response

ECLAC Economic Commission of Latin America and the Caribbean

ELSS Earth's life support system

EMA Environmental Management Authority

EO4SDGs Earth Observations in Service of the 2030 Agenda for Sustainable Development

EOV Essential Ocean Variable

GEF Global Environment Facility

GEO Group on Earth Observations

GOOS Global Ocean Observing System

IOC International Oceanographic Commission

MBON Marine Biodiversity Observation Network

MPA Marine Protected Area

NGP Nongovernmental Organization

ODC Open Data Cube

SAP Strategic Action Plan

SaWS Sargassum Watch System

SDG Sustainable Development Goal

SIDS Small Island Developing State

SusGre Sustainable Grenadines Inc.

SVG Saint Vincent and the Grenadines

UNDP United Nations Development Program

UNEP United Nations Environment Programme