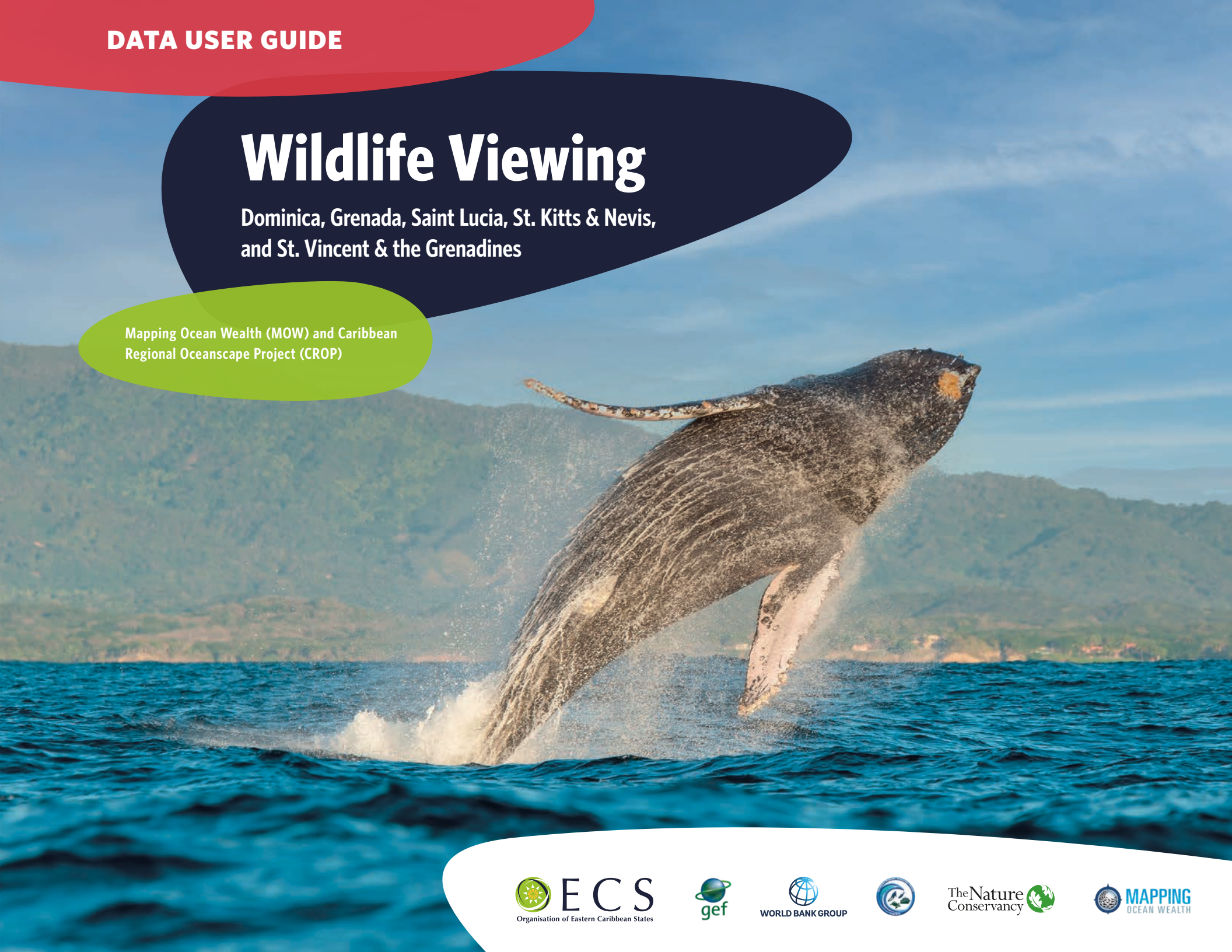
DATA USER GUIDE

Wildlife Viewing

Dominica, Grenada, Saint Lucia, St. Kitts & Nevis, and St. Vincent & the Grenadines

Mapping Ocean Wealth (MOW) and Caribbean Regional Oceanscape Project (CROP)



ECS Organisation of Eastern Caribbean States

gef

WORLD BANK GROUP

The Nature Conservancy

MAPPING OCEAN WEALTH

ABOUT THIS PROJECT

The Global Environment Facility (GEF) and the Organisation of Eastern Caribbean States (OECS) Commission, in partnership with the World Bank, is implementing the Caribbean Regional Oceanscape Project (CROP) to improve systems and put relevant structures in place in an effort to foster a Blue Economy and to promote greater consideration of the ecosystem functions and services which the ocean provides for member states. The project timeline was October 2017 - December 2021. Under this project, The Nature Conservancy used the Mapping Ocean Wealth approach to develop ecosystem service models and maps for the five CROP countries in the Eastern Caribbean.

CROP Project Overview:
https:/oecs.org/en/crop

Map Viewer:
maps.oceanwealth.org/oecs

Introduction and Summary of Methodology

Overview

The Caribbean is more dependent on the travel and tourism sector than any other region worldwide. This sector is almost entirely focused on coastal areas, notably through beach-based activities, cruise tourism and in-water activities including sailing, and diving, and other vessel-based activities. Wildlife tourism is still considered a niche market in most of the Caribbean, but one with a diverse consumer base and a high potential for growth. Stakeholder feedback indicates that wildlife tourism around birds and marine mammals, (i.e. whales and dolphins) is an important draw for tourists visiting CROP countries and also warrants more consideration for the perspective of sustainable tourism development.

The opportunity to see whales and dolphins in the wild is a clear draw for many of the CROP countries, especially Dominica, where sperm whales inhabit the country's deep offshore canyons. The Eastern Caribbean is also home to interesting and diverse avifauna, with many species of potential interest to experienced birdwatchers, and many more that are enjoyed by occasional or opportunistic birdwatchers. Despite this, like many aspects of nature-dependent tourism, map-based data depicting the distribution of these activities across the region have never been generated.

Data used to map these activities were derived from a combination of crowd-sourced information—eBird, TripAdvisor and Flickr—complemented by participatory mapping and survey data from charter vessel operators and stakeholder information and guidance. Results are maps of birdwatching and whale and dolphin watching intensity for CROP countries, as well as several complementary summary statistics intended to further emphasize the importance of these sectors to the region's economy.

This is the first time that these activities have been so extensively mapped at the regional scale. We believe that the results are of considerable use for better understanding the value of nature-based tourism, applicable to management, that they will enable a broad range of users from the public to industry to government to better plan and manage both the tourism industry and any other active sectors within the blue economy.

This is the first time whale and dolphin watching and birdwatching activities have been so extensively mapped at the regional scale.

This work furnishes stakeholders with detailed data and maps for two of the most important social and economic sectors in these countries.

Purpose of the Guide

We have developed this guide so that individuals who are interested in downloading, analyzing, and applying the data for projects within the five countries covered by this project (Dominica, Grenada, Saint Lucia, St. Kitts and Nevis, and St. Vincent and the Grenadines). While these datasets were originally developed to complement the marine spatial planning processes undertaken under the Caribbean Regional Oceanscape Project (CROP), we describe a range of possible applications across multiple sectors, along with practical advice on the methodology, interpretation and caveats surrounding these datasets. More details about the model including links to technical reports can be found at Oceanwealth.org/project-areas/Caribbean/crop/wildlife-viewing.

Regional Policy Relevance

In 2013, the OECS Heads of Government endorsed the Eastern Caribbean Regional Ocean Policy (ECROP). In 2019, the ECROP was revised to align with the UN Agenda 2030 for Sustainable Development – SDG 2030. The CROP is designed in alignment with ECROP (2013) and has an overall objective to develop and implement integrated ocean governance policies to leverage sustainable public and private investment in the waters of OECS member states and other participating Caribbean countries. The first component of the CROP project is to strengthen ocean governance through the development of National Ocean Policies (NOPs) and Coastal and Marine Spatial Plans. The work described in this project falls under the subcomponent 2.1 of the CROP: Strengthening knowledge and capacity building.

The ecosystem service modelling work was undertaken in parallel with the development of the coastal and marine spatial plans under CROP, meaning that the ecosystem service model results were not available during their planning process. Nevertheless, this work furnishes stakeholders with detailed data and maps for two of the most important social and economic sectors in these countries – tourism and coastal fishing. Such data can now be incorporated into the MSP process and this should be a priority as part of the finalization of these, or indeed any future, plans.

At the simplest level these models and maps enable the discernment of critical areas of current use of natural resources and form a core background for stakeholder discussion and debate. The same information can also be used in the projection of future use options, including the potential costs and benefits of different uses and activities in coastal and marine waters. A key element of MSP is that such planning needs to be cyclical and ongoing, rather than a static, one-off, process. This means that information can be continually added or updated to future planning cycles, along with knowledge of new opportunities or risks.

Methodology and Definitions

Birdwatching

The key single data source for modelling the intensity of birdwatching and understanding key species was eBird. This is a citizen science data repository for birdwatchers managed by Cornell Lab of Ornithology, with more than 100 million bird sightings contributed annually by "eBirders" around the world (https://ebird.org/). eBird observation points were accessed through the Global Biodiversity Information Facility (GBIF) online data portal. Further understanding of the importance of different species, including aspects of rarity, endemism, and interest was developed using data from BirdsCaribbean and the IUCN Red List.

Birder footfall

Birder footfall visualizes birdwatching tourism density within each country. This map was developed from eBird observation data. This data was first cleaned with the removal of points that had non-specific locality names (e.g. 'Dominica', 'Saint Lucia'), if these points fell near the centroid of the island or otherwise appeared to be associated with a random location, rather than a likely area to record a bird observation. A grid of 500 x 500m cells was then generated spanning the entire region, from Saint Kitts and Nevis to Grenada. Using this grid, eBird observations were then summarized to "total observer days" (TOD), representing a count of the number of days in which observers had reported birds from that grid cell. Within each cell, only one observation was counted per observer per day, preventing double-counting where there were multiple observation uploads in a cell. The birder footfall layer shows the total observer days over the full time-period of the dataset (with 93% of observations from 2000 to 2018, and the remainder representing historical observations or non-dated observations).

Species importance

The species importance layer was developed to account for the fact that the birder footfall layer may be biased towards areas of heavy tourism/accommodation centers, and to capture the idea that there are a number of "must see" birds that will have a higher perceived value for many tourists. To capture these, we developed a weighting of species importance, scoring species importance based on key metrics that might encourage birdwatchers to travel to see.

Four broad attributes were used to select and weight species importance: charismatic interest, abundance, threat status and endemism. For the purpose of this study, birds of charismatic interest were identified based on input from local stakeholders and partners as well as information from Caribbean Birding Trail – although lacking a clear definition these are the species that are most frequently listed both by birdwatchers and in site or country descriptions, and are intended to capture birds that are likely to be a draw for birdwatchers. The remaining three categories were based on *BirdsCaribbean's Birds of the West Indies Checklist* (Gerbracht & Levesque 2019),

with IUCN status obtained from the IUCN Red List (www.redlist.org). Each species was assigned a score of one or zero, while an overall score of "species importance", was obtained by assigning and summing these scores for each species. Final scores (0-4) indicate species importance to the birdwatching industry. Any species with a total species importance score of at least 1 is considered a "key species."

	Score of 1	Score of 0	Source
Abundance	Uncommon, rare, very rare, extinct, or extirpated species	Common or fairly common	BirdsCaribbean's Birds of the West Indies Checklist
Charismatic Species	Identified as a species of charismatic interest	Not identified as such	Local experts, Environmental Protection in the Caribbean (EPIC), Caribbean Birding Trail
Endemism	All species that are endemic to the region (either West Indies, Lesser Antilles, or a specific country)	Not endemic	BirdsCaribbean's Birds of the West Indies Checklist
IUCN Status	All threatened species (Vulnerable, Endangered, or Critically Endangered)	Near Threatened or Least Concern	BirdsCaribbean's Birds of the West Indies Checklist & IUCN Red List of Threatened Species (www.iucnredlist.org)

The species importance map was then developed similarly to the birder footfall map, using the eBird observation data and the same 500 x 500m grid, but instead, using species importance scores to develop a map of key species observation intensity. Similar to footfall, observations were counted once per species per day from a single observer in any grid cell (i.e. if one person saw 5 species in one location in one day, it would count as 1 TOD but 5 species observation counts; if one person saw 5 of the same species of parrot, it would be 1 TOD and 1 species observation count). The species observation counts were then multiplied by the weighted species scores to generate a total species importance score per grid cell.

Whale and Dolphin Watching

The multi-step approach to mapping the value of whale and dolphin watching involved two key steps. The first was the development of a map showing the overall spatial footprint of the activity. A key component of this work was an information gathering exercise in each country where some 17 whale and dolphin watching operators provided information on their business, including mapped locations of whale and dolphin watching areas and information on the size of their operations and costs of trips.

Locational information for whale and dolphin watching was further enhanced to include additional crowd-sourced data, geolocated photographs, and attraction locations from TripAdvisor. At all times stakeholder guidance was critical to inform and guide the process.

The intensity of activities within this footprint was then developed by weighting the onshore locations of charter operators by the number of reviews from TripAdvisor, and buffering these locations to 20k and 40km to account for maximum distances traveled for half and full-day trips.

A key component of this work was an information gathering exercise in each country where some 17 whale and dolphin watching operators provided information on their business.

AI/ML Methods

Microsoft Lobe (www.lobe.ai), a free, desktop AI/ML tool was used to classify photos from Flickr and TripAdvisor as having been taken on chartered whale and dolphin watching trips. The data used to train the model featured images of whales and dolphins taken from the vantage point of a vessel. Any images returned that featured dolphins at captive facilities were manually filtered out. The images returned were then standardized such that only one image per TripAdvisor user per attraction was counted (photo per attraction per member, or "PAM"), or, in the case of Flickr photos, to photo user days (PUDs) and plotted on a map. The PUD approach only allows the counting of one image per user per 500 x 500m grid cell on any day. TripAdvisor photos were then mapped as points based on the attraction to which they were linked, or, in the case of Flickr photos, to the location at which the photo was taken.

The web-based tool LightTag was used to label over 2,000 TripAdvisor reviews according to activities and elements described in each review. For whale and dolphin tours, we trained the model on reviews that mentioned phrases associated with whale watching trips (e.g. "whale watch", "humpback", "dolphin"). An expert team from Microsoft then applied a random-forest regression model to automatically classify the remainder of the reviews and return a list of reviews that matched each set of criteria. These were then mapped as points based on the attraction to which they were linked.

Data gathered during the participatory mapping exercise also enabled us to generate approximate data on tourism spending.

Developing intensity maps

To develop the offshore fishing intensity footprint, we applied a 5km buffer to the following layers and summed each buffered layer together:

- Whale/dolphin sightings in GBIF, sourced from DiveBoard and iNaturalist
- Flickr photos
- Participatory mapping points

The intensity map assumes that each departure location of whale/dolphin tours (i.e., shore-based locations of tourism operators) can be used to map a wider offshore area of the activity weighted by offshore factors. A point-based map of onshore operators was generated using data from TripAdvisor, supplemented by information from TNC staff based in the region to give **a total of 30 operators**. Each attraction was weighted using a score based on the number of TripAdvisor reviews (see above).

It was also assumed that vessels on tourist trips would reach to 20km from departure points on half-day trips and to 40km on full-day trips. To utilize the onshore data, the weighting for each departure point was spread to the offshore footprint with these 20km and 40km buffers. The two resulting maps, developed from onshore data and offshore data, were combined into one layer of offshore use intensity. These final maps were then smoothed across a zone of 2.5km, using a focal statistics tool to better represent the likely blurred boundaries expected in open water whale and dolphin watching.

Economic value

Data gathered during the participatory mapping exercise also enabled us to generate approximate data on tourism spending. From the survey results, we calculated for each country the average # of trips per week in both the high and low seasons and the number of months in the high and low seasons. By multiplying these values, we estimated the number of trips/year/operator. We then multiplied these by the average cost/trip recorded from the survey, and then that number by the number of operators by country in order to estimate the annual whale/dolphin expenditure, in $USD. Survey data were only available for Dominica, Saint Lucia, and St. Vincent and the Grenadines. Unlike other Mapping Ocean Wealth data products, these values are not distributed across the intensity maps. This was based on the fact that the activity takes places across a variety of benthic and pelagic habitats, rather than being tied to one specific habitat. Stakeholder consultations confirmed that this approach was appropriate.

Input Datasets

A summary of datasets used in the analysis is provided below. Users are encouraged to reference the technical report for additional details on sources and geoprocessing steps.

Birdwatching

Data Layer	Source
Bird Observations	eBird Combined from all years to 2018
Birdwatching locations	Consultations with Environmental Protection in the Caribbean (EPIC), Caribbean Birding Trail, The Nature Conservancy Personal communications with Stephan Durand, Forest Officer at the Forestry Division, Dominica, & Vaughn Francis, Tropical Adventures
Important Bird Areas*	BirdLife International
Protected Areas*	The Nature Conservancy (developed from WDPA and information from local partners and governments)
Reviews	TripAdvisor
Species-specific information	BirdsCaribbean's Birds of the West Indies Checklist[1]

Available for viewing at **maps.oceanwealth.org/oecs but not available for download*

Whale and dolphin watching

Data Layer	Source
Participatory-mapped points	Survey and in-person mapping conducted by TNC staff in February 2020
Observations	iNaturalist & Diveboard via GBIF
Operators, Photos, and Reviews	TripAdvisor
Photos	Flickr

Unless otherwise noted, all data sources were accessed in 2019.

1 Gerbracht, J., and A. Levesque. 2019. The complete checklist of the birds of the West Indies: v1.1. BirdsCaribbean Checklist Committee.

Definitions

Birder Footfall – Captures simple birdwatching effort, based on eBird observation data. To avoid double counting, only one record per observer per day was allowed in any single location. These values can be summarized and mapped by grid cells, protected areas, or country boundaries, or other mapping units. In the data available for download, values are summarized by 500m x 500m grid cell.

Key Species – are intended to characterize birds that would be of particular interest to bird- watchers, and are defined as birds that are rare, endemic, endangered, or otherwise charismatic (as identified by stakeholders). A list of every bird in the region and its score for each of these metrics can be found in the technical report.

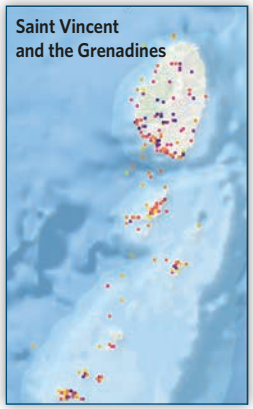
Species Importance – is a sum of each of the four key species metrics applied to each species. When this score is multiplied by the number of observations of each species per person per day, and these totals are summed, these values can be summarized and mapped by grid cells, protected areas, country boundaries, or other mapping units to provide a species importance score. In the data available for download, values are summarized by 500m x 500m grid cell.

Onshore Operator Locations – This term refers to the departure point of the whale and dolphin watching trips. These locations were defined through attraction location data from TripAdvisor, supplemented through additional desktop research.

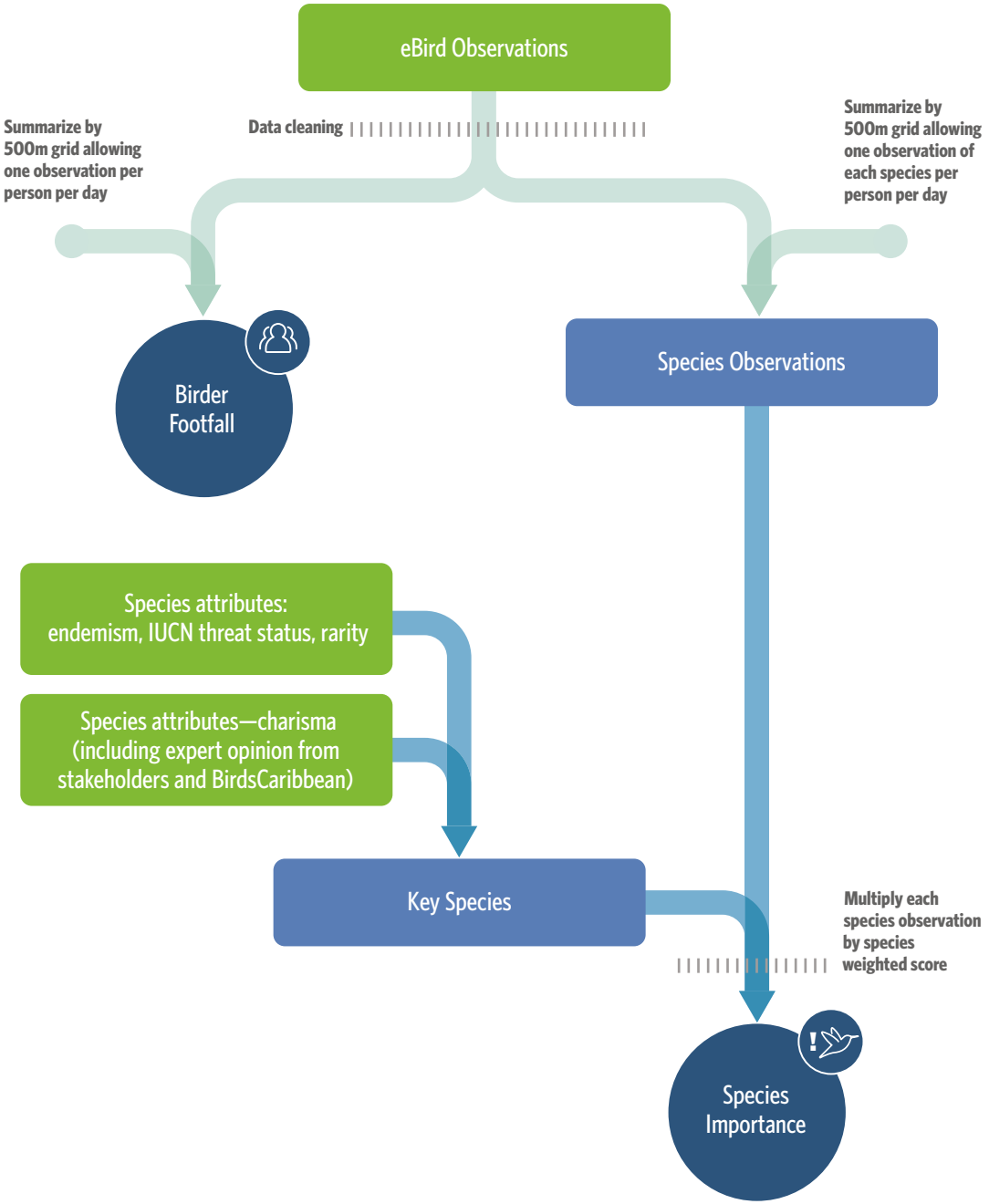
Participatory Mapping – A data gathering approach that invites experts in a particular subject matter, or participants in a specific activity to provide spatial data directly to researchers, based on their knowledge, through structured interviews and/or mapping exercises.

Expenditure – In this project, expenditure refers to the direct payments made from tourists to tourism operators for the cost of the trip. It does not include indirect spending such as travel, accommodation costs, or other any other spending related to the activity (e.g., food purchased in the area or equipment purchased for the trip).

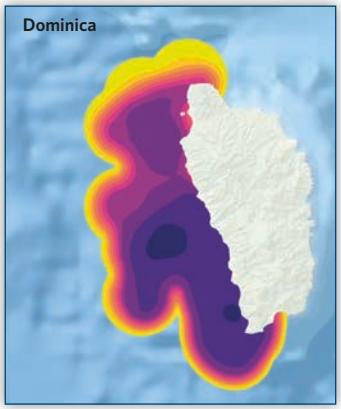
Bird Watching Modelling and Mapping Process



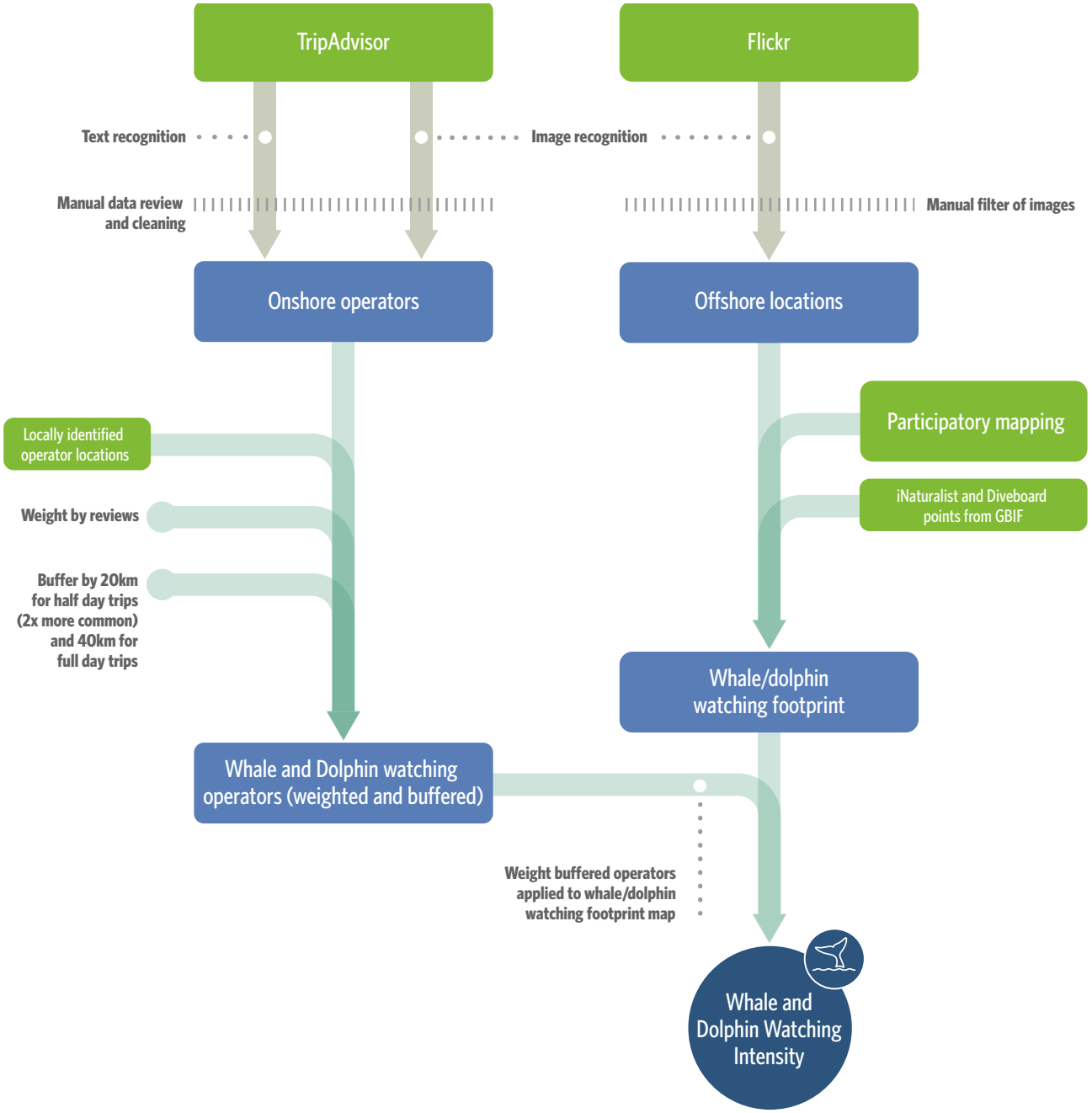
Mapped species importance in Saint Vincent and the Grenadines



Whale and Dolphin Watching Modelling and Mapping Process



Mapped whale and dolphin watching in Saint Vincent and the Grenadines



Data

- Input data source
- Intermediate data product
- Map product

Data Processing

- Geoprocessing Step
- AI/ML

Findings

The maps of birdwatching activity show a predominance of activities in coastal areas, with a likely correlation with accommodation density, but these maps still show observations recorded from offshore waters to wetlands and mountain areas. The patterns of species importance underline the particular value of these locations away from the tourist accommodation, notably mountainous and forest areas. Many of these important species depend heavily on the existence of a relatively large and intact ecosystem and for this reason, both the mapping tool and the associated technical report also show the protected areas and Important Bird Areas.

Both the maps and the expenditure estimates highlight the particular importance of whale and dolphin watching activities in Dominica and Saint Lucia, with St. Vincent and the Grenadines also having a nascent whale and dolphin watching industry. In all cases, activities extend out predominantly from the western shores, from coastal areas (where dolphins are more likely to be observed) out to deeper waters favoured by large whales.

Exploring the data

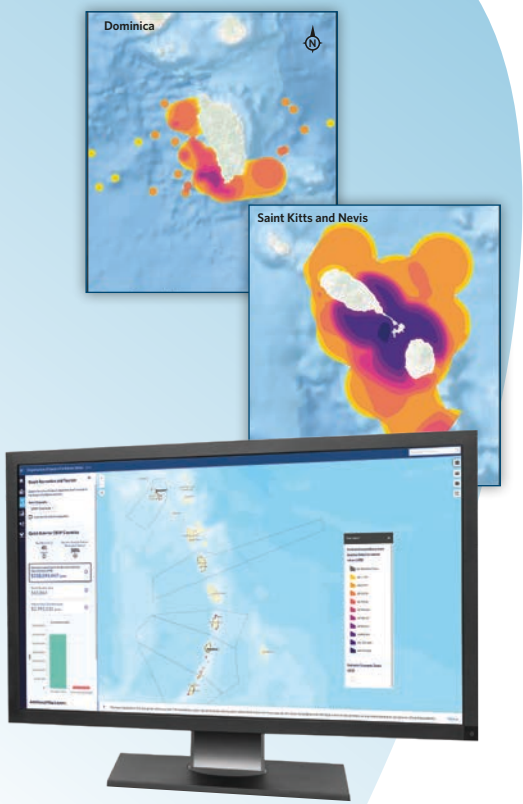
The birder footfall and species importance scores for the birdwatching dataset are unitless, but are helpful to compare values across a landscape or among protected areas or countries.

While the financial assessment for whale watching is drawn from a relatively small sample size, the results indicate **a direct expenditure of over $US 5.7 million per year**. On a per country basis, the estimated expenditures are as follows:

- Dominica $1,843,625
- Saint Lucia $3,808,476
- St. Vincent & the Grenadines $672,000

Although numbers are highest for Saint Lucia, it should be noted that, as a proportion of visitors and expenditure, it is likely that this industry represents a far more critical element of tourism expenditure in Dominica which has fewer visitors and lower expenditure overall.

The patterns of species importance underline the particular value of these locations away from the tourist accommodation, notably mountainous and forest areas.



Map viewer and output samples of the Mapping Ocean Wealth Platform

Data Access and Specifications

Outputs of this project included spatial datasets (File Geodatabase Raster Datasets depicting whale and dolphin watching and a Vector Polygon Feature Class depicting birdwatching) that can be imported, viewed, and analysed within Geographic Information Systems (GIS) such as Esri ArcMap, ArcPro, or QGIS. Data can be downloaded from the map viewer at maps.oceanwealth.org/oecs or at Oceanwealth.org/project-areas/Caribbean/crop/wildlife-viewing. The downloaded file contains a geodatabase and a metadata document. Raster data are broken out so that users can view data for all CROP countries or by individual countries. The vector layer allows user to sort by attribute values for country-specific information.

Applications

Maps and data such as these have an immediate and important role in drawing attention to a value that was perhaps already known by some, but which had never been clearly elucidated. Understanding the high value of nature-dependent tourism activities such as wildlife viewing highlights an opportunity to further develop this sector sustainably, and also points to the need for effective habitat management so that this sector can continue to thrive. Raising public awareness of such value can help to foster support for fish habitat conservation and management. Such knowledge needs to be factored in to planning and scenario-building.

By having a common currency, it is possible to place these values alongside others. In particular, high value areas can be seen as key economic drivers at the national scale, to be protected against risks that might arise from overfishing, boat traffic congestion, pollution, deforestation, and climate change. These values may become "opportunity costs" or the lost earnings that might be associated with otherwise apparently high value activities. They can also be viewed as indicative values that may be achieved from other locations through a combination of improved management and sustainable development.

Public interest

Public perception of the value of offshore areas can be low or vague and while it is not to be expected that individual public users will want or need direct access to the results of our work, the work itself can be used to generate information of high public interest. Whale and dolphin watching is a good example of where this has already been successful in diverting countries away from commercial whaling. In Dominica for example, a change in government in the year 2000 led to a change in the country's historically pro-whaling stance, and whaling is no longer permitted. Between 1998 and 2008, Dominica saw an 11% increase in the number of whale watchers visiting the country (O'Connor, 2009). In St. Vincent & the Grenadines, whaling is still practiced on a small scale and the indigenous community on the island of Bequia is allowed a take of several

humpbacks per year. This has been posed as a possible reason for the lack of expansion of whale and dolphin tourism in this country, despite a relatively high sighting success rate of whale and dolphin tours; however, there is currently an effort by local NGOs to further promote whale watching as an alternative to whaling, and these datasets may be of use to underscore this effort.

Community groups and NGOs should feel empowered to use this work, in support of their own campaigns or outreach. They may, for example, wish to make the case for sustainable tourism development, expanding MPAs, or habitat restoration. Armed with maps and statistics their arguments will be both stronger and more balanced.

Business sector

CaribbeanBirdingTrail.org lists 15 birdwatching guides operating in all CROP countries except for St. Kitts & Nevis. Many of these guides are employed by tourism organizations that offer birdwatching as one of many tour options. Many regional attractions already promote the opportunity to see rare and exotic species as a unique selling point. Despite this, there is likely an opportunity to further develop this sector. In St. Kitts and Nevis for example, the country's easily-accessible salt ponds are home to many wading birds; however, there is not much promotion around the country's birdwatching opportunities. While there is value in recognizing the current value and distribution of tourist-based birdwatching (avitourism), there is also an opportunity to promote birdwatching as an activity that can be done as part of a larger itinerary of nature-dependent tourism.

The maps and statistics from this report are likely to be of interest to anyone working in the charter whale and dolphin watching sector, and indeed any business operating ocean-going charters that may wish to add wildlife viewing to the types of activities they offer. Many charter tour operators offer whale and dolphin watching tours as part of a suite of possible activities (sightseeing, sportfishing, water taxis), and may be interested in expanding that side of their business offerings based on this information. Adjacent industries such as hotels may also be interested in better understanding these patterns in order to better coordinate trips for their guests.

Building data into planning

The CROP countries have made a commitment to develop their Blue Economy. Within this framework they are proposing to develop their coastal resources in a manner that is sustainable and that enhances natural value and human benefits.

Marine Spatial Planning is a key component of developing the Blue Economy. Central to MSP is the integration of all relevant sectors; inclusivity, with the engagement of all stakeholders, including minority groups; and the utilisation of all available information to inform planning processes.

Understanding the high value of nature-dependent tourism activities such as wildlife viewing highlights an opportunity to further develop this sector sustainably, and also points to the need for effective habitat management so that this sector can continue to thrive.

In many settings, data on natural resource values for MSP is weak or lacking, however the current work provides a remarkable tool, available in only a very few countries. These data can be used alongside other data sources, ecosystem service values, and stakeholder opinions to guide decision-making and to inform equitable resolutions where there are differing interests. For example, these could be used during participatory mapping exercises, especially when used as a backdrop alongside other tourism activity values to structure conversations with stakeholders who bring their own knowledge regarding the values and impacts of wildlife viewing tourism activities to the table.

Management actions

In reviewing our maps related to birdwatching we would encourage several considerations. Firstly of course is the importance of birdwatching across multiple locations, including many that are beyond the regular path of many tourists. Such areas should be safeguarded, and could potentially promoted through the expansion of visitor facilities, trails and protected areas.

As with all nature dependent tourism, the sensitivity of nature must remain a paramount consideration in any efforts to secure sustainable benefits. Our maps do not capture the risks or impacts that tourism may be having on birds or marine mammals. Nor can they take into account wider issues of threat or declining conditions for these animals, which may be impacted by many other human impacts. Tourism can be a powerful force for conservation as governments and others come to realise their value, but sustainable management of these activities is critical. These maps may help to identify areas where tourism pressures are high and require management actions to promote sustainability.

These data can be used in conjunction with information on either current or planned protected areas. For the former, understanding how existing MPAs can add value to tourism activities may be additional justification for siting these locations in manners that can benefit existing nature-dependent tourism locations.

Scale and Use considerations

Unlike other Mapping Ocean Wealth data products, these data are not distributed across specific habitats. This was based on the fact that these activities take place places across a wide variety of habitats (both marine and terrestrial for birdwatching, and across benthic and pelagic habitats for whale/dolphin watching), rather than being tied to one specific habitat. Stakeholder consultations confirmed that this approach was appropriate. Therefore, the values are unitless intensity values that are most appropriate for visual comparisons among geographic locations, though calculation of birdwatching values may also be useful for quantitative comparisons across geographies.

Birdwatching values are tabulated at a 500 m x 500 m resolution. Summarizing these datasets at lower resolutions (e.g., at the scale of countries, parishes, or protected areas) is appropriate. Whale and dolphin watching values have been smoothed, and the resulting raster is at a 50m resolution. We recommend that the maps be used at an assumed scale of no less than 1:25,000, and that any statistical reporting is limited to noting the extent of the activity within a specified area of larger than 5x5km.

Photo: ©Cherie Wagner/TNC

Stakeholders explore Mapping Ocean Wealth data at a 2019 workshop in Saint Lucia.

Time-frames

All of the data used and presented represent tourism up to end 2019. The influence of Covid-19 on tourism has been enormous and we cannot assume that eventual recovery will include a return to the pre-pandemic patterns. We recommend that users who are aware of such influences bear these in mind when examining our maps and make allowances for such change.

Other caveats and limitations

These are modelled data products based on a series of assumptions, including the motivations and activity patterns of tourists. Model assumptions have been vetted by experts, stakeholders, and data where possible. Bias or inaccuracy may have been introduced both through inaccuracies arising from the stakeholder mapping input and the locational inaccuracy sometimes inherent in the TripAdvisor or eBird locations that, in turn, drove the weighting of these activities. As such, interpretation of statistics, especially for very small areas, should be treated with caution. Estimates will be more robust when based on larger areas. Pixels with no values don't necessarily lack tourism values, as not all values will be captured in the modelling approach used.

Update and revise

A key advantage of our approach has been to build transparent models that are relatively simple to understand. Technical users are encouraged to explore the approaches we used – this may raise awareness of weakness or inspire questions which, at the simplest level, may enable those users to objectively comment on findings and suggest likely biases or even potential scenarios.

It is, of course, possible to re-run the models with different input layers or weightings. Detailed geoprocessing steps can be found in the technical report, and the project team can be contacted to share additional datasets and advise on how this might be done; however, it would of course require key technical and mapping skills to do this.

Post-Covid

The final outcome of the Covid pandemic remains hard to foresee. The grave social and economic impacts from the decline of tourism receipts will have had other consequences which remain poorly understood, but could include positive and negative environmental impacts (for example changes in fishing efforts, or agriculture, coastal development or pollution). The return of tourism may not follow pre-pandemic models. It seems likely that open-air, nature-centric tourism may recover faster than travel which places tourists in more crowded settings such as large-volume hotels and cruise ships.

There may be opportunities to use the pre-Covid models presented here to better understand the different components of tourism across the CROP countries and to begin to inform possible recovery scenarios.

Closing Words

These maps give detail to an already well-understood dimension to tourism in the Eastern Caribbean. The opportunity to view animals in the wild is a core component of tourism, and therefore of considerable importance to the economy of Eastern Caribbean. But these maps and numbers go way beyond simply re-iterating this. By providing hard numbers, and mapping these activities at a resolution that has never previously been achieved they give critical information for management and planning. Such knowledge is critical, enabling demands on coastal space to be properly assessed and enabling informed consideration of both conflicts and synergies with other demands.

We encourage users to explore the data online, but also to consider its validity and utility in different contexts. Deeper engagement with the data will enable wider uses, including in some cases the opportunity to project and predict outcomes beyond the maps themselves. We hope that future users may also be able update and improve the maps, using similar approaches, and informed by the details we have provided underpinning our methods and our findings.

FIND OUT MORE

For access to the high-quality maps and the full technical report, please visit the Mapping Ocean Wealth platform https://oceanwealth.org/project-areas/caribbean/crop/wildlife-viewing/

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As countries move towards more ordered and holistic planning in the coastal and marine space such knowledge is critical, enabling demands on coastal space to be properly assessed and enabling informed consideration of both conflicts and synergies with other demands.

Organisation of Eastern Caribbean States

gef

WORLD BANK GROUP

The Nature Conservancy

MAPPING OCEAN WEALTH

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