Whale and Dolphin Watching Technical Summary

Overview

Under the Caribbean Regional Oceanscape Project (CROP) Subcomponent 2.1, the Organisation of Eastern Caribbean States Commission (OECSC) engaged The Nature Conservancy (TNC) to develop ecosystem service (ES) models for five countries in the Eastern Caribbean (Dominica, Grenada, Saint Lucia, Saint Kitts and Nevis, and Saint Vincent and the Grenadines) using methodologies developed under TNC's Mapping Ocean Wealth (MOW) initiative, and to develop training and resources to improve data access for decision-makers.

This document provides a technical overview of the Whale and Dolphin watching model created for this project. Click here to see the full technical report.

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. 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. 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.

In this study, we have created a data layer depicting the offshore footprint and intensity associated with whale and dolphin watching tours using a combination of image and text analysis applied to crowd-sourced data from Flickr and TripAdvisor, complemented by participatory mapping and survey data from charter vessel operators, as well as other stakeholder-provided information and guidance.

This dataset 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.

Data Sources

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

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

Modelling and Geoprocessing

The methods presented below in the conceptual overview (Figure 1) and the subsequent descriptions are novel methodologies informed by the needs and data availability in the region. Methodologies and interim results were reviewed by stakeholders at in-person and virtual workshops in 2019 and 2020.

AI/ML Methods

Microsoft Lobe, a free, desktop AI/ML tool was used to classify photos from Flickr and TripAdvisor and return a list of photos that best matched the criteria from the provided during model training (i.e. photos of whales and dolphins taken from vessels). Photos from Flickr were standardized to photo user days (PUDs) and plotted on a map. The PUD approach only allows the counting of one image per user per grid cell on any day (Wood et al. 2013).

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.
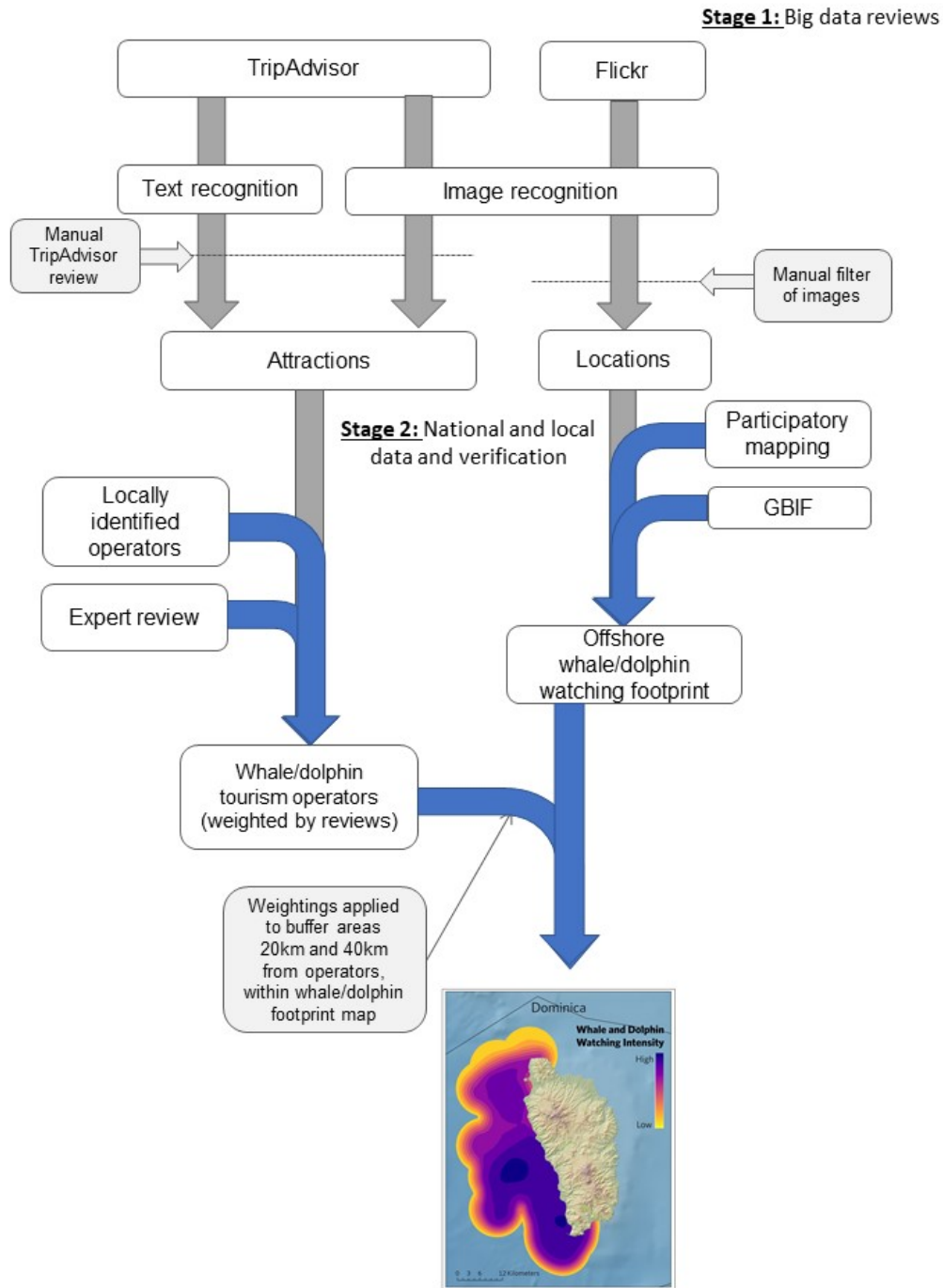
Conceptual Overview

Figure 1. Conceptual overview of the Whale and Dolphin Watching modelling process

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. Each attraction was weighted using a score based on the number of TripAdvisor reviews.

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 fishing.

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 Saint 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.

Limitations and Caveats

These are modelled data products based on a series of assumptions, including the motivations and activity patterns of tourists and charter operators. Model assumptions have been vetted by experts, stakeholders, and data where possible. The model is also based on

crowd-sourced data points, which may be subject to bias. As such, interpretation the model, especially for very small areas, should be treated with caution. Areas not represented on the map are not necessarily completely unused for whale and dolphin watching. Values associated with the spatial data are unitless and should not be used for quantitative analysis.

Suggested Citation

Spalding MD, McNulty VP, Longley-Wood K. 2020. Whale & Dolphin Watching in the Eastern Caribbean. Produced by The Nature Conservancy for the Organisation of Eastern Caribbean States under the Caribbean Regional Oceanscape Project

Data Access

Click here to download modelled data