



MESM GROUP PROJECT PROPOSAL 2019-2020

Whales, Vessels, and Fish: Economic Valuation of Whale Watching and Marine Spatial Planning Surrounding Dominica



Proposers:

Laura Ingulsrud, MESM 2020 | (347) 573-7544 | lauraingulsrud@bren.ucsb.edu
Callie Steffen, MESM 2020 | (701) 309-0177 | calliesteffen@bren.ucsb.edu

Client:

Shane Gero | Founder and Principal Investigator at The Dominica Sperm Whale Project |
(613) 552-8085 | shane@thespermwhaleproject.org

Objectives

To reduce mortality risk of eastern Caribbean sperm whales, research is needed to support economic valuation of the whales to incentivize their protection and improved marine spatial planning of shipping lanes and fish-aggregating devices (FADs). Achievement of these objectives will concurrently provide support to the tourism and subsistence fishing sectors.

To address this need, we will identify potential areas of risk for interactions between vessels, sperm whales, and FADs off the west coast of Dominica. This research will provide the government with tools to set up marine spatial planning with regard to shipping lanes and FAD locations, with the goal of reducing sperm whale mortality risk and sustainably managing the fishing and tourism industries in Dominica. Our specific objectives are as follows:

1. Perform an economic valuation of the monetary contribution of Dominica's whale tourism to Dominica's economy to incentivize their conservation.
2. Develop dynamic marine spatial planning for the coast waters of Dominica including:
 - a. Quantification and classification of vessel traffic in Dominican waters.
 - b. Documentation of whale collision risk probabilities.
 - c. Identifying FAD deployment and exclusion areas.
 - d. Mapping revised shipping lanes that take into account a-c above.

Significance

Building sustainable marine economies relies on an understanding of how our behavior impacts ecosystems. The economies of small islands rely to a greater degree on their natural resources. As a result, their long term resilience depends on the conservation of their natural heritage.

Sperm whales are a large tourism draw for the island of Dominica, nicknamed the "Whale Watching Capital of the Caribbean."¹ Travel and tourism contributed approximately \$60 million to Dominica's GDP in 2016, which is 34.7% of Dominica's total GDP. This amount is forecasted to rise to \$260 million, or 38.6% of Dominica's projected GDP, by 2027.⁹

However, there has been a recent decline in a subpopulation of eastern Caribbean sperm whales. Sperm whale populations in general are already fragile; even with optimal environmental conditions, the potential rate of increase of a population is small. In the case of eastern Caribbean sperm whales, current adult mortality is too high to support a sustainable population.⁶ Recent studies on the eastern Caribbean sperm whales have identified the subpopulation is under threat; at current reproduction rates and mortality, the Dominican population could reach a dangerously small size by 2030.¹ The reason for this decline is suspected to be partially due to a combination of collision with ships and entanglement in fishing gear.¹

This small subpopulation of sperm whales which use the waters off Dominica is largely isolated and behaviorally unique in terms of vocal repertoire; it cannot be replaced if extirpated.¹ The studies call for an assessment of likely causes for its decline, and for mitigation measures to be put in place to prevent the loss of this subpopulation. In order to support a key stakeholder in Dominica's eco-tourism-based economy, there is an urgent need to implement measures to protect this population. The results of this project will directly contribute to the Climate Resilient Execution Agency for Dominica's goal of building a national marine spatial plan and ocean policy for a new blue economy.

Background

The project is located in the waters along the Lesser Antillean chain, which includes the island of Dominica. The island relies on cruise ships to bring tourists to Dominica, which are substantial contributors to ship traffic in the area. Lethal ship strikes are a serious factor in mortality rates in whale populations and could be responsible for the increasing mortality of the eastern Caribbean sperm whale subpopulation.^{1,4} High-speed ferries, which are increasing their trips between islands in the Lesser Antilles archipelago, have proven to be a significant source of sperm whale mortality off the Canary Islands, a similar deep-water archipelago.⁸ Dominica's economy is heavily dependent on ship traffic for the import and export of goods as well as tourism. Cargo vessels, cruise ships, and high-speed ferries comprise a majority of the shipping traffic in these waters, and are important to these islands' economies. Ship traffic in the Caribbean is expected to increase due to the recent completion of the Panama Canal expansion, and worldwide shipping traffic is estimated to be increasing by 3% per year.^{2,3,6}

Fishing in urban areas off Dominica's coast is another human activity that impacts the sperm whale population. While most of the fishing activities in the eastern Caribbean use small-scale light gear such as FADs, entanglements in this fishing gear have previously caused sperm whale deaths, and there were two reported entanglements in 2015.^{1,7} A FAD is a device made from a variety of materials and is used to lure fish, as the fish are attracted to the shelter this floating structure provides. FADs in this area can be comprised of a tangle of floating ropes, nets, plastic containers, and pieces of wood, all of which pose an entanglement risk. However, Dominica's pelagic fishery is also essential to the local population for subsistence, as none of the catches are exported. In addition, the increasing use of FADs has eased fishing effort and pressure on reef fish by allowing fishermen to fish further offshore, but has in the process created conflict between fishermen and ships through the accidental destruction of FAD gear.⁵ Ships have been known to dislodge and cut up FADs, which can increase entanglement risk for sperm whales. While FADs increase mortality risk for the vulnerable eastern Caribbean sperm whale subpopulation, the pelagic fishery in Dominica is reliant on FADs to provide the economy with locally sourced fish.⁵

The waters off the islands of the Lesser Antilles, especially off islands constituting the more urban areas of sperm whale habitat such as Dominica, are heavily used by humans. This subpopulation of sperm whales is one of the main tourism draws to Dominica, but the island also relies on cruise ships and subsistence fishing using FADs to support its economy. All of these issues of sperm whale mortality, vessel traffic, tourism, and fishing are interconnected and require a multi-faceted approach to effectively manage this shared area off the coast of Dominica and preserve the eastern Caribbean sperm whales.

Available Data

1. The Dominica Sperm Whale Project (DSWP) has been collecting and providing data on the presence and abundance of sperm whales off Dominica's coast from 2005 through 2015 with photo-identification and located sightings. Opportunistic sightings have also been recorded from 1984-2003.
2. The DSWP will provide island-specific maritime traffic AIS data, which was obtained from terrestrial automatic identification system (AIS) station 1249 in Dominica between 2012 and 2015 with a gap post-Hurricane Maria up until January 2019.
3. The DSWP will provide recordings of opportunistically sighted FAD locations.

4. The World Bank, Caribbean Tourism Organization, World Tourism Organization, and the World Travel & Tourism Council are publicly available sources for tourism data.
5. General data on whale watching and swim with whale tours, their prices, itineraries, and capacities are publically available. Further research to contact individual operators within the industry may be needed to collect precise data on number of tours, amount of people per tour, and paid value to tour operator.

Possible Approaches

1. **Economic valuation of the whale watching industry.** This task will involve compiling data on the number of tours, number of people buying tickets, and financial reports from whale watching companies in Dominica, as well as data on indirect costs such as the cost of flights or cruises, hotels, meals, and other costs the whale watchers produce while on Dominica. This task will also involve calculating the value of whale tourism using the market price approach. This information will allow us to assign an economic value to the whale tourism industry as well as to each sperm whale.
2. **Quantification and classification of vessel traffic in Dominican waters.** This task will involve accessing available AIS tracking data from all vessels in the vicinity of Dominica, and compiling the data into a comprehensive report of vessel traffic.
3. **Documentation of whale collision risk probabilities.** This task will involve combining AIS vessel tracking data in the vicinity of Dominica with sperm whale population estimates and sightings data to analyze high-risk whale collision zones.
4. **Outlining a legal framework and costing of potential marine spatial plans.** This task will require close communication with the Dominican government, with the goal of cooperatively creating a feasibility and financial analysis of dynamic marine spatial planning around shipping lanes, whale sighting hot spots, and FAD deployment areas. Shipping lane planning will take into account the requirements for international shipping lanes under the International Maritime Organization.

Deliverables

1. Economic cost valuation of the sperm whale subpopulation in Dominica.
2. A map of shipping lanes in the vicinity of Dominica that would avoid high-risk whale collision areas and FAD deployment areas.
3. A final report, brief, and website detailing the research and findings.

Internships

The DSWP will provide an unpaid internship on location in Dominica (specific dates to be determined) with a focus of delivering and implementing the students' results within local government and building experience in the field for data collection with the research group. Funding for travel, accommodation, and expenses to be covered by the DSWP is currently pending under grant applications to third parties.

Supporting Materials

Citations

1. Gero, S. & Whitehead, H. Critical Decline of the Eastern Caribbean Sperm Whale Population. *PLOS ONE* 11, e0162019 (2016).
<https://doi.org/10.1371/journal.pone.0162019>.
2. Miller, K. 2015. Needs for Professional Hydrography in the Caribbean Towards Risk Reduction in Maritime Navigation. *West Indian Journal of Engineering*. 38: 70-78.
https://sta.uwi.edu/eng/wije/vol3801_jul2015/documents/M08_v38n1p70-78KMiller-Jul2015.pdf.
3. Schwehr KD, McGillivray PA. 2007. Marine Ship Automatic Identification System (AIS) for Enhanced Coastal Security Capabilities: An Oil Spill Tracking Application. In: Proc. Mar. Technol. Soc. Conf., Oceans 2007. IEEE. p. 1–9.
<https://scholars.unh.edu/cgi/viewcontent.cgi?article=1387&context=ccom>.
4. Kraus SD, Brown MW, Caswell H, Clarke CW, Fujiwara M, Hamilton PK, Kenney RD, Knowlton AR, Landry S, Mayo CA, et al. 2005. North Atlantic right whales in crisis. *Science*. 309:561–562. <http://science.sciencemag.org/content/309/5734/561>.
5. Sidman C, Lorenzen K, Sebastien R, Magloire A, Cruickshank-Howard J, Hazell J, Masters J. (2014). Toward a Sustainable Caribbean FAD Fishery: An analysis of use, profitability and shared governance, Florida Sea Grant Report. TP-206. Retrieved from https://www.flseagrant.org/wp-content/uploads/TP_206_Toward_A_Sustainable_Caribbean_web.pdf.
6. Whitehead, H. & Gero, S. Conflicting rates of increase in the sperm whale population of the eastern Caribbean: Positive observed rates do not reflect a healthy population. *Endang Species Res* 27, 207–218 (2015).
7. Vidal, O., Van Waerebeek, K. & Findley, L. T. Cetaceans and Gillnet Fisheries in Mexico, Central America and the Wider Caribbean: A Preliminary Review. *Rep to Int Whal Comm Spec Issue* 15, 221–233 (1994).
8. Fais, A. *et al.* Abundance and Distribution of Sperm Whales in the Canary Islands: Can Sperm Whales in the Archipelago Sustain the Current Level of Ship-Strike Mortalities? *PLOS ONE* 11, e0150660 (2016).
9. World Travel & Tourism Council. Travel & Tourism Economic Impact 2017 Dominica. (2017). Available at: <https://www.wttc.org/-/media/files/reports/economic-impact-research/countries-2017/dominica2017.pdf>.

Budget and Justification

The allocated budget of \$1,300.00 will be sufficient for the project. Expected costs are anticipated to be limited to printing, presentation materials, and international calling to conduct interviews regarding the economic valuation.



January 14, 2019

Bren Group Project Review Committee
Bren School of Environmental Science and Management
2400 Bren Hall
University of California, Santa Barbara
Santa Barbara, California 93106-5131

For the consideration of the Bren Group Project Review Committee,

[The Dominica Sperm Whale Project](#) is an innovative and integrative study of the world's largest toothed whale. Through thousands of hours of observation of sperm whale families, the population of whales in the Caribbean has given us the unique opportunity to come to know them as individuals within families. Now 15 years into the program, we have followed many calves from birth through weaning and we now know that some families have been using the region for decades. No sperm whale population has been [this well characterized](#) and the detailed behavioural histories of these individuals are rare among mammals, particularly in the ocean.

I am excited to provide a supporting letter for the proposed group project, “Whales, Vessels, and Fish: Economic Valuation of Whale Watching and Marine Spatial Planning Surrounding Dominica.” This project will identify potential areas of risk for interactions between vessels and sperm whales; and quantify the economic value of the whale watching industry to the islands economy. These two much needed reports will contribute to provide government with evidence-based options to assist in marine spatial planning while reducing mortality risk of an economically important and cross-border species of concern; while also providing support and management of both the fishing and tourism sectors.

I formally commit to the following as the client for this project:

- 1) Providing existing data as listed in the proposal, with no stipulations or restrictions to publications derived from them
- 2) Support the students with technical support and be available for consultation and comment
- 3) I expect that the budget allocated by The Bren School should be sufficient to undertake the project
- 4) The DSWP can provide an unpaid internship on location in Dominica (specific dates to be determined) with a focus of delivering and implementing the students’ results within local government and experience in the field for data collection with the research group. Funding for travel, accommodation and expenses to be covered by The DSWP is currently pending under grant applications to third parties.
- 5) I agree that: (1) the DSWP logo may be used by the Bren School (e.g., its students, faculty and staff) solely in connection with the specific Group Project in which the client participates, and (2) any Group Project’s deliverables containing the client’s logo or other intellectual property may be made publicly available via the Bren School’s website and other formats.

I strongly urge you to consider this project. This project not only stands to greatly assist in the conservation of the declining sperm whale community in the Eastern Caribbean; but the results of this project will be actioned directly by the newly created [Climate Resilient Execution Agency for Dominica](#)

in one of its flagship projects of building a national marine spatial plan and ocean policy for a new blue economy.

Thank you for your consideration,

Shane Gero



Shane Gero
Founder | Principal Investigator
The Dominica Sperm Whale Project
www.thespermwhaleproject.org
shane@thespermwhaleproject.org
613-552-8085