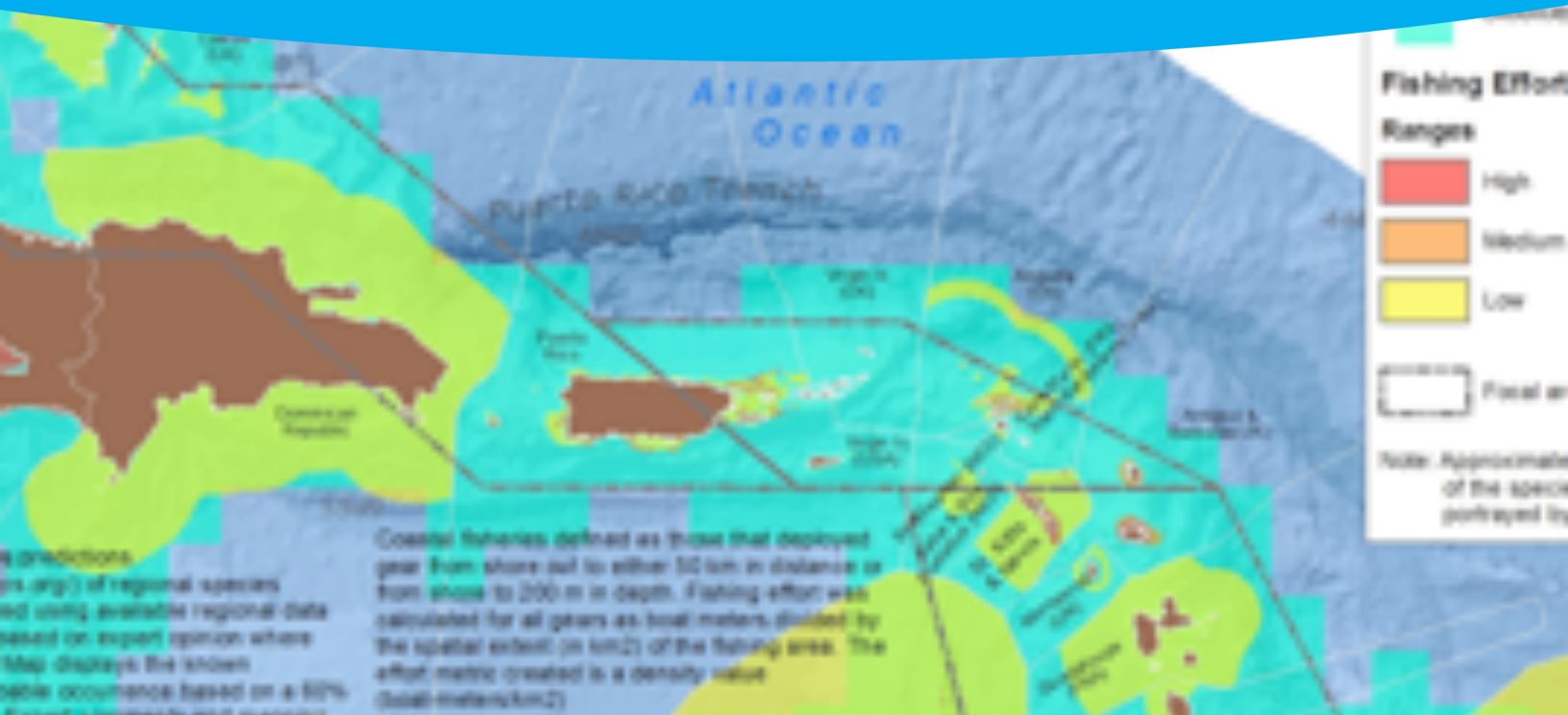




LifeWeb-Spain UNEP-CEP Meeting on Scenarios for Transboundary Marine Mammal Management in the Wider Caribbean” to be held 23th - 24th of April 2014 in San Juan, Puerto Rico

Marine Spatial Planning and Transboundary Management of Marine Mammals in the Wider Caribbean.



Background and Introduction

Launched in 2010 with financial support from the Government of Spain, the UNEP/Spain LifeWeb Project: "Broad-scale Marine Spatial Planning of Mammal Corridors and Protected Areas in Wider Caribbean and Southeast & Northeast Pacific" was conceived with the goal to assist implementation of the Convention on Biological Diversity Programme of Work on Protected Areas. The project also directly supports implementation of Marine Mammal Action Plans of the Regional Conventions of UNEP's Regional Seas Programmes for the Wider Caribbean (Cartagena Convention) and the Southeast Pacific (Lima Convention).

Five components are included in the Project:

- Data integration and mapping: in order to visualize critical habitats, human activities, and marine mammal distribution and migrations in the Wider Caribbean and Eastern Tropical Pacific regions;
- Training, exchanges and networking on integrated marine spatial planning (MSP), management and governance;
- Communication strategy and awareness raising on marine spatial planning and its value as a process;
- Strengthening regional policies underpinning transboundary governance; and
- Demonstration projects on marine mammal management planning.

A major milestone of the project was the "Inter-regional Workshop on Broad-scale marine spatial planning and transboundary marine mammal management" (21-14 May 2012, Panama City) (see the report on: http://www.pnuma.org/documento/taller%20mamiferos%20marinos/Lifeweb%20Report%20Workshop_PTY%20May%202012.pdf), where Government designated experts identified priorities and provided inputs for Project development.

The last phase of the LifeWeb project consists in the development of scenarios on marine mammal transboundary management for the Wider Caribbean, under the component on "Demonstration Projects". Two priority areas were selected to that purpose: one from Venezuela to French Guiana and the second one from the Dominican Republic down to Grenada and Barbados.

As a follow-up, a small expert group from the Wider Caribbean (acting in their personal capacity) was invited to participate on the development of the

scenarios, with technical inputs and recommendations, as follows: Paul Hoetjes (Dutch Caribbean), Asha Singh (Trinidad and Tobago), Pedro Sanchez (SMMDR, Dominican Republic), Oswaldo Vasquez (SMMDR, Dominican Republic), Romain Renoux (AGOA Sanctuary, St. Martin), Anne Reglain (IMO/RAC- REMPEITC, Curaçao), Nathalie Ward (NOAA-US), John Reynolds (Mote Laboratory, US).

In addition to the above expert group, the Lifeweb Project coordination team also provided technical assistance and Fundación MarViva was primarily responsible for the mapping development of scenarios based on the data already collected under the Lifeweb Project, as follows: H el ene Souan, Director SPWA-RAC; Alessandra Vanzella-Khoury, SPAW Programme Officer, CAR-RCU; Ole Vestergaard UNEP-DEPI and Jorge Jimenez, MarViva.

As a result, the present document outlines the process in the application of marine spatial planning and the work of the expert group of in developing scenarios for transboundary management of marine mammals in the region. This pilot scenario exercise builds upon data also generated by the LifeWeb Project under component “Data integration and Mapping”.

The Wider Caribbean waters harbor close to 34 different species of marine mammals (Hoyt, 2011), including—six species of baleen whales (Mysticeti), 24 species of toothed whales (Odontoceti), one sirenian, and three pinnipeds. Information on the biology, population status, migration and habitat requirements of those species is, however, scarce. Management measures for these species have been hindered by the lack of knowledge on many of the aspects related to their populations and factors that affect their conservation.

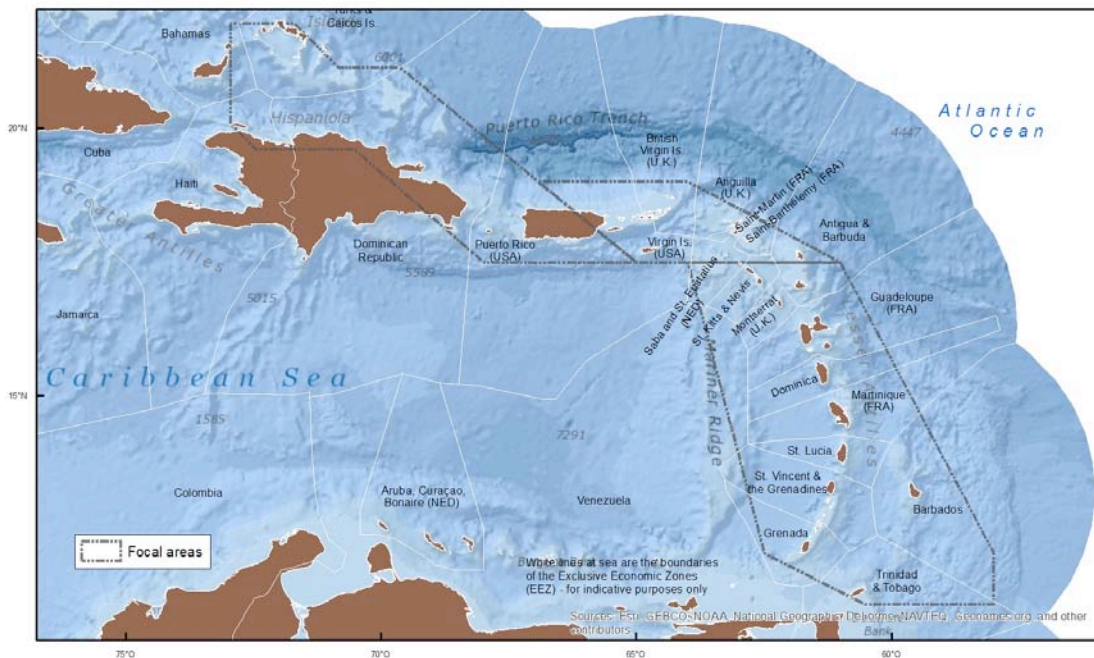
In the framework of the UNEP-LifeWeb Project, Fundaci n MarViva was asked to contribute with the development of Management Scenarios that would promote conservation of Marine Mammals (MM) in the Wider Caribbean by using a Marine Spatial Planning approach. Based on data and mapping previously generated by the project, and with the support of an Expert Group with wide experience in the region and subject, scenarios were developed to reduce the potential conflicts identified between key MM species and human uses practiced in Caribbean waters. This methodology maximizes the use of available information, providing map-based information to justify and define space-based conservation measures.

Geographical Scope of the Analysis

One of the main recommendations for the Wider Caribbean, emanating from the Inter-regional Workshop held in Panama, was that scenarios for transboundary management of marine mammals be developed using the work already done under the various components of the Lifeweb project. Participants at that workshop agreed on two priority geographic areas to focus on, namely an area extending from the Dominican Republic south to Grenada all along and including the Lesser Antilles, and a second one encompassing countries of Northern Latin America (Venezuela, Trinidad and Tobago, Guiana, Suriname, and French Guiana);

Subsequent mapping analysis of the first priority area extending from the Dominican Republic south to Grenada defined three focal areas located around: a-The MM Sanctuary of the Dominican Republic, b-The Virgin Island Region, and c- the Lesser Antilles Corridor. The limits of these three areas were further refined based on distribution maps previously generated for the species selected for the analysis (see below).

Countries and Overseas Territories



Project "LifeWeb (SPAW-RAC)" (2014)

The first selected focal area is what has been called the Dominican Republic-Puerto Rico Focal Area. It covers the north coast of the Dominican Republic, and includes most waters surrounding Puerto Rico, except the eastern coast. Turks and Caicos, in the northern fringe of the focal area, were also included here due to their relevance for the humpback whale. The second focal area is centered on the U.S. and U.K. Virgin Islands, including the eastern coast of Puerto Rico eastward to Antigua and Barbuda. The third focal Area includes the Lesser Antilles from Antigua and Barbuda southward to Trinidad and Tobago, including Barbados.

Focus Species

During the MSP analysis and following discussions at the Inter-regional workshop in Panama, MM species of high interest and that are representative of a group (by their use of habitat, behavior, migration pattern etc.) were selected: the Humpback Whale *Megaptera novaeangliae*, the Bottlenose Dolphin *Tursiops truncatus* and the Sperm whale *Physeter macrocephalus* and analysis was centered on their known distributions.

The Humpback whale is known to migrate from their feeding grounds in the north Atlantic to the Caribbean region during the winter, their reproduction season. High concentrations are reported north of the Dominican Republic at the Navidad and Silver Banks. They are also important concentrations at the Engaño Bank, the Mona Passage NW of Puerto Rico and the U.S. Virgin Island down to the Lesser Antilles. The Bottlenose Dolphin is a widely distributed species whose abundance in the Caribbean is still unknown. They are most frequently sighted at inshore waters throughout the Caribbean region. The sperm whale inhabits the continental slope and deeper waters throughout the region, and although its status is unknown, concentrations are known in the Eastern Caribbean.

During the MSP analysis, recommendations were made by the expert group to include two additional species, the manatee *Trichechus manatus* (a coastal species) and the short-finned pilot whale *Globicephala macrorhynchus* (widely distributed throughout the region).

The Pilot whale is typically found associated with high topographic relief. No systematic studies of home range or migration patterns are available. However, seasonal inshore/offshore movements have been reported, likely related to squid distribution. The manatee is clearly restricted to shallow waters where vegetation is available. The species shows a fragmented distribution, being more abundant in the Greater Antilles, eastward to Puerto Rico.

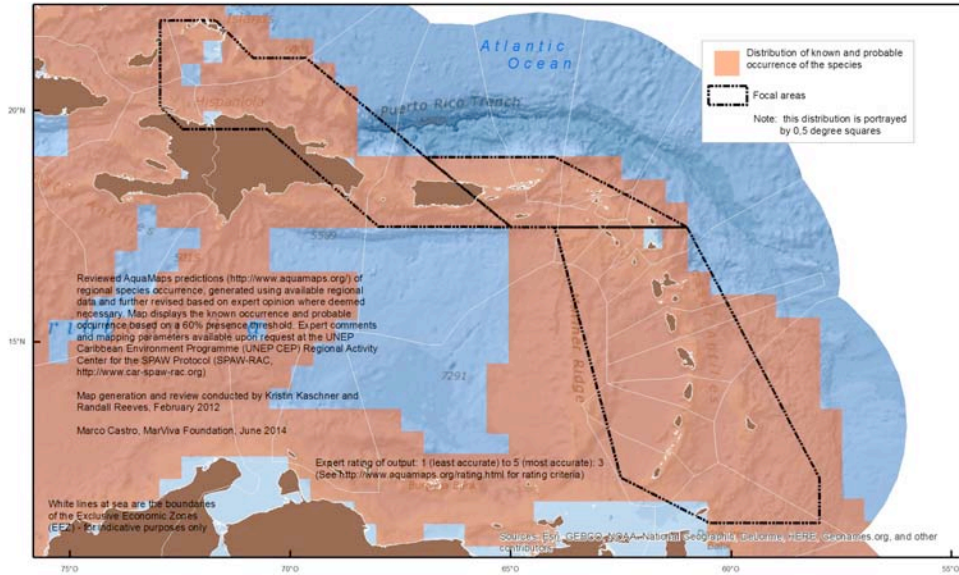
In total, five species were used in the analysis, out of the 34 species reported for the region. Criteria such as their relative importance in the tourism industry (Humpbacks and Bottlenose dolphins), their wide distribution (pilot and sperms whales) or their restricted coastal habitats (manatee), were used to select these species. While it was recognized that important MM populations are found in the continental shores of Central, South and North America, it was decided to focus this pilot exercise and the analysis on these five species within the three selected focus areas.

The limits of the focal areas selected above, were adjusted to the MM distribution limits provided by existing maps, previously generated by UNEP-CEP Regional Activity Center (SPAW-RAC). These maps describe the known occurrence and probable occurrence of the selected MM species based on a 60% presence threshold. Distributions were mapped out of 0.5-degree squares.

Distribution of Selected Species

Consensus map of known occurrence and probable occurrence based on habitat suitability

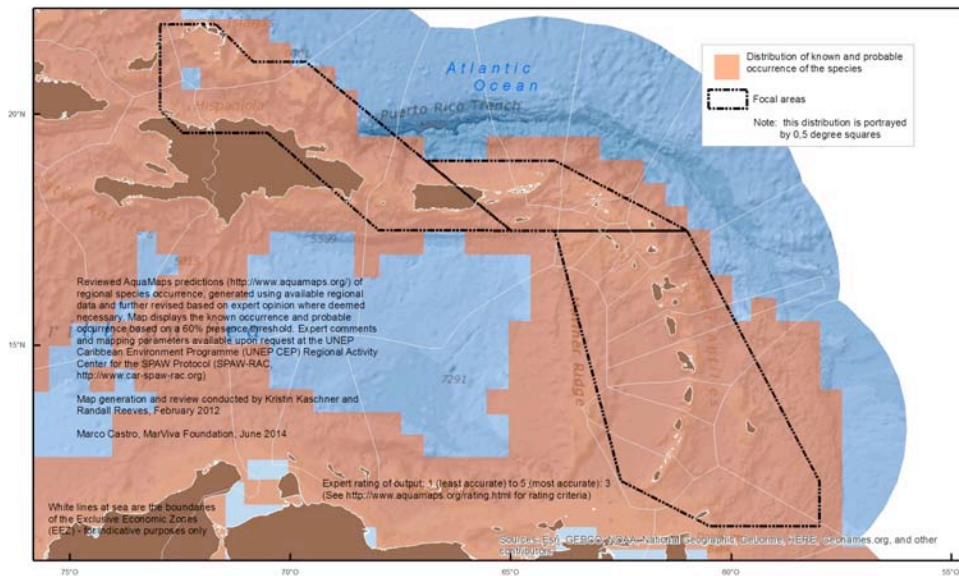
Sperm Whale
(*Physeter macrocephalus*)



Project "LifeWeb (SPAW-RAC)" (2014)

Consensus map of known occurrence and probable occurrence based on habitat suitability

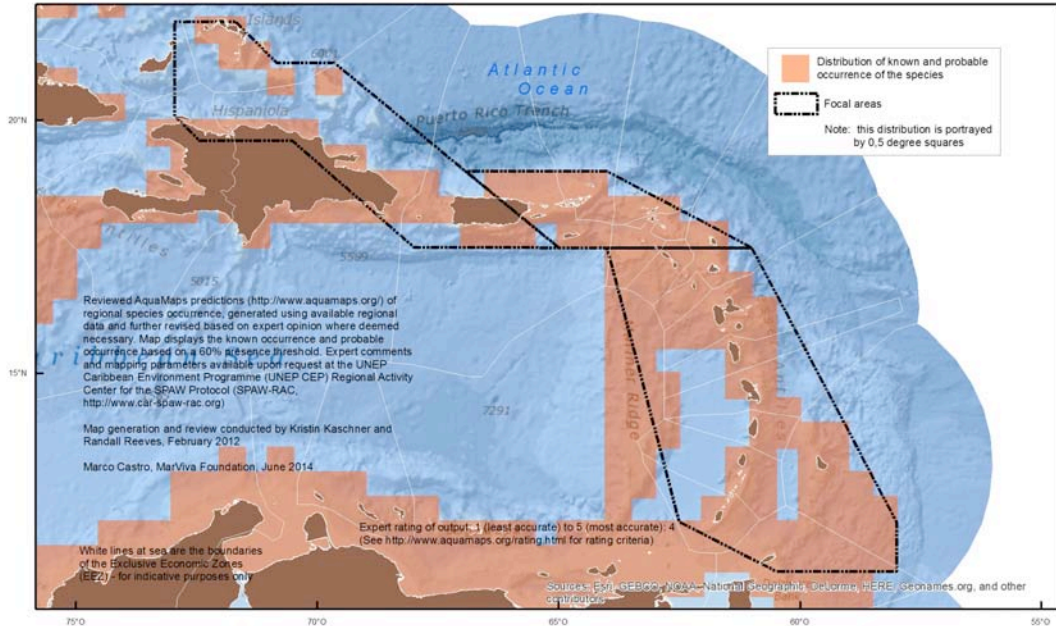
Short-finned Pilot Whale
(*Globicephala macrorhynchus*)



Project "LifeWeb (SPAW-RAC)" (2014)

Consensus map of known occurrence and probable occurrence based on habitat suitability

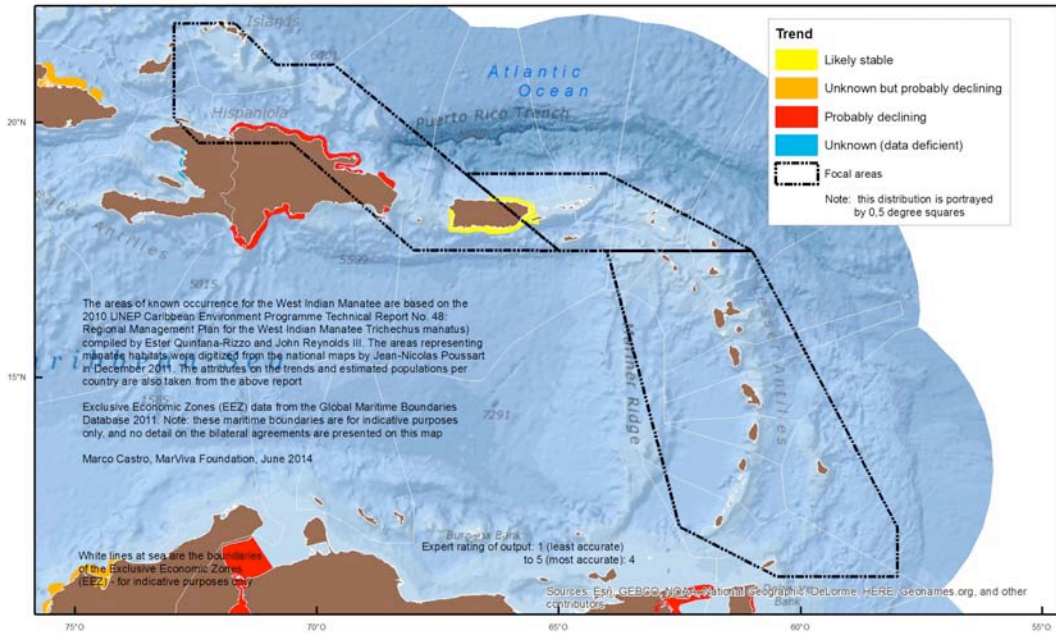
Common Bottlenose Dolphin
(*Tursiops truncatus*)



Project "LifeWeb (SPAW-RAC)" (2014)

Consensus map of known occurrence and trend of populations

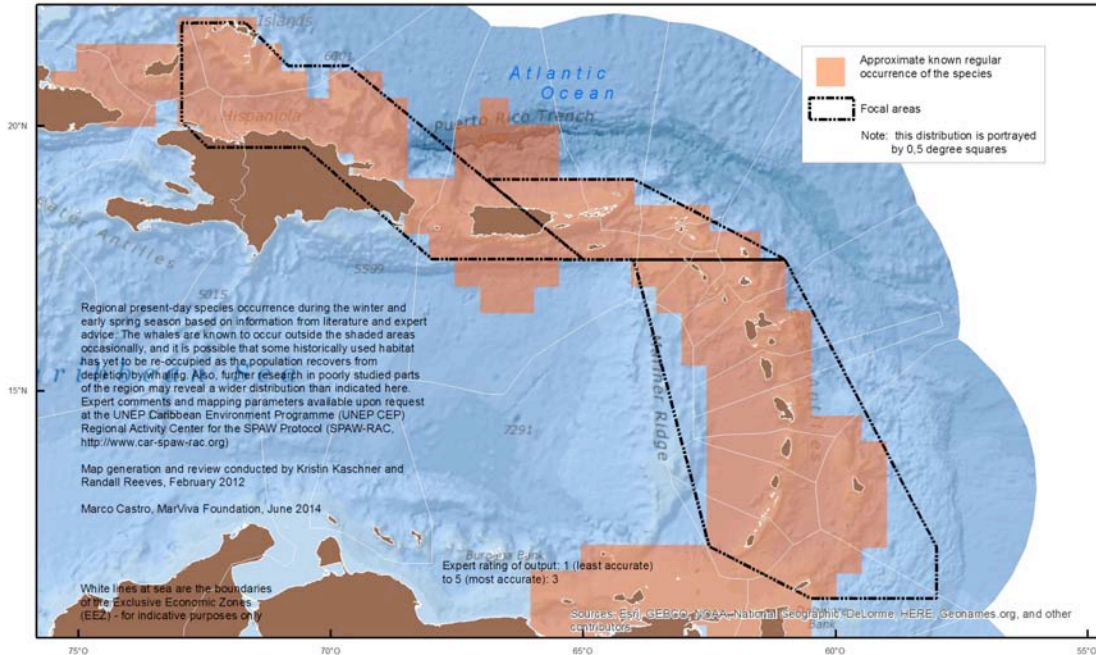
West Indian Manatee
(*Trichechus manatus*)



Project "LifeWeb (SPAW-RAC)" (2014)

Approximate known regular occurrence of humpback whales during winter breeding season

Humpback Whale (*Megaptera novaeangliae*)



Project "LifeWeb (SPAW-RAC)" (2014)

Data Set Availability and Usefulness

The MSP analysis was based on previously generated maps provided for this study. Most of these maps were produced through modeling efforts by different institutions and for different purposes. The analysis included maps on fishing effort, existing hotels on coastlines, marine managed area distribution, seismic research in the region, shipping routes, MM species richness, land based pollution and land based sediments.

The maps produced under phase 1 of the Project and the process of development can be found at <http://www.car-spaw-rac.org/?-Maps-and-reports->

One of the challenges in MSP is to set the limits of your analysis area big enough to include all ecosystemic processes but small enough to be able to implement the resulting actions. Issues such as political boundaries, migratory

processes and different jurisdictions might complicate the implementation of the resulting scenarios. Therefore, a delicate balance is always needed at the onset of the MSP process to ensure an implementable result.

Paucity in the species distribution data available and the reliance on sightings but not actual density, limited the quality of the species distribution analysis. The scale of most of the maps designed to encompass the whole Caribbean region, made the quality of the data suboptimal for MSP analysis at the country/regional level. Shipping routes, for example, lacked important components on local traffic routes and volumes, necessary again for site planning exercises. Species distribution lacked the detail needed to generate useful recommendations.

However, even with limited data, there was enough information to develop a general understanding of the distribution of the selected species and their interactions with main human uses at the broad level, allowing the identification of critical areas throughout the region, which in turn served as the basis for the generation of management scenarios. A list of information gaps required for a future detailed MSP analysis is provided further in this document.

Marine Mammal Protection in the Region

All marine mammal species are to be protected by SPAW Parties as per Article 11.1 of the SPAW Protocol. Additionally, the Caribbean Region has been very active in the designation and creation of Marine Managed Areas (MMA). The MM Sanctuaries in the French EEZ and the Dominican Republic are noteworthy due to their extension. In spite of having more than 74 MMAs throughout the Wider Caribbean, the region, however, lacks MMAs extensive enough to provide adequate habitat protection to most MM species, except those with restricted coastal distributions.

The coastal nature of most of the MMAs obviate the fact that MM habits require extensive territories and many of the species are not coastal. Therefore, it is clear that one of the gaps in the region is the development of MMAs, large enough to protect MM critical habitats. Creation of those MMAs (or extension of existing ones) should be considered in such a manner

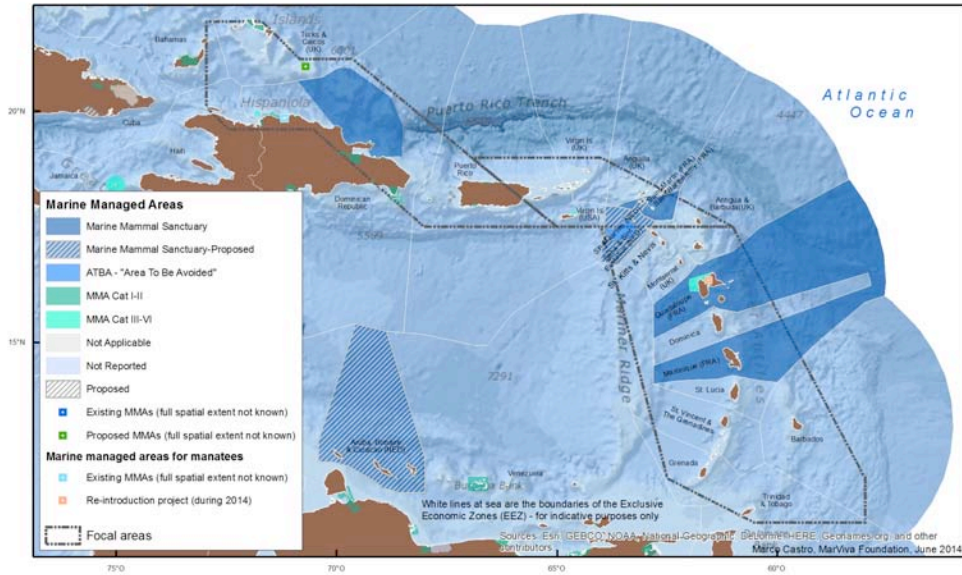
as to produce a network of MMAs that respond to the known migration patterns (such in the case of Humpbacks) of MM in the region.

Many of the established MMAs have unclear limits and their management is still incomplete. While creating new MMAs or extending some of the existing ones represent financial, enforcement and management challenges for many of the countries, it is clear that the role of these MMAs (particularly IUCN categories I-II) is fundamental for the conservation of many of the MM species in the region.

The continuation of the existing efforts to consolidate a regional network of MPAs should be maintained with a vision to establish a network of larger, interconnected MPAs that could accommodate habitat requirements.

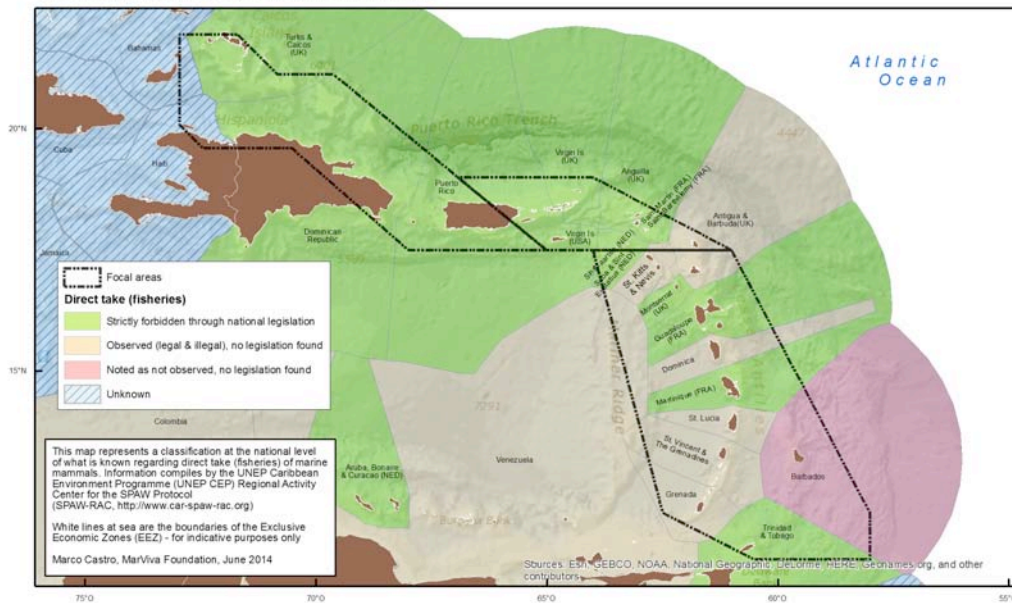
Besides, other tools exist that can be successfully used to better protect marine mammals in the region, in addition to MMAs and beyond their borders. The SPAW Action Plan for the Conservation of Marine Mammals in the Wider Caribbean Region explores such tools, including the prevention of pollutions in order to protect habitats and food resources, measures to avoid collisions with vessels, provisions to reduce by-catch, etc. All these tools, and the MMAs mentioned above, are to be considered in a MSP approach. The conclusions of the scenario development and the recommendation for mitigation measures should be implemented depending on the particular threats faced by marine mammals, and keeping in mind the need of consistency throughout the region given the extensive distribution, and large-scale movements, of the species considered.

Marine Managed Areas and Bathymetry



Project "LifeWeb (SPA-W-RAC)" (2014)

Marine Mammal Protection Direct take (fisheries) of marine mammals



Project "LifeWeb (SPA-W-RAC)" (2014)

Human Activities

Based on maps generated under the LifeWeb Project and by Halpern et al. (2008), we analyzed different human activities that directly or indirectly might be affecting MM within their known distribution ranges. Some of the available maps, such as seismic research, hotel distribution, etc., were discarded from the analysis due to limitations in their range, scale or lack of relationship with MM distribution.

For the human activities analysis, we used maps for fishing effort, commercial shipping and land-sourced non-point organic pollution. The commercial shipping activity was generated out of ship tracks per one Km² cell (Halpern et al. 2008). The fishing effort was defined for all gears as boat meters divided by the spatial extent (Km²) of the fishing area (boat meters/Km²), while the non-point organic pollution was generated out of the annual use of pesticides divided by the coverage area of urban agricultural landscapes (Halpern, 2008).

Overlap Analysis

We overlapped the MM species distribution with the selected uses coverage to identify areas where this overlap might be creating significant conflict (use-habitat conflicts). While overlap between a species distribution and a human use, does not necessarily represent a conflict and a negative impact of the use over the habitat, it does indicate that a deeper analysis is required in those areas where the interaction is more intense (for example, where traffic or fishing efforts are higher). A compatibility analysis is needed to reach that stage. Typically the compatibility analysis requires more information than the one provided by the existing maps. In the compatibility analysis, the balance between uses pressure and habitat resilience/tolerance is compared to decide whether the overlap is indeed a proof of use-habitat conflict. For this analysis, an expert group is required to discuss from a multi-disciplinary perspective the pressure-tolerance levels of the interaction and to develop a compatibility matrix.

In spite of these limitations, the overlap analysis calls attention to those areas where a more intense interaction is happening and allows advancing decisions of potential measures to be taken in those areas.

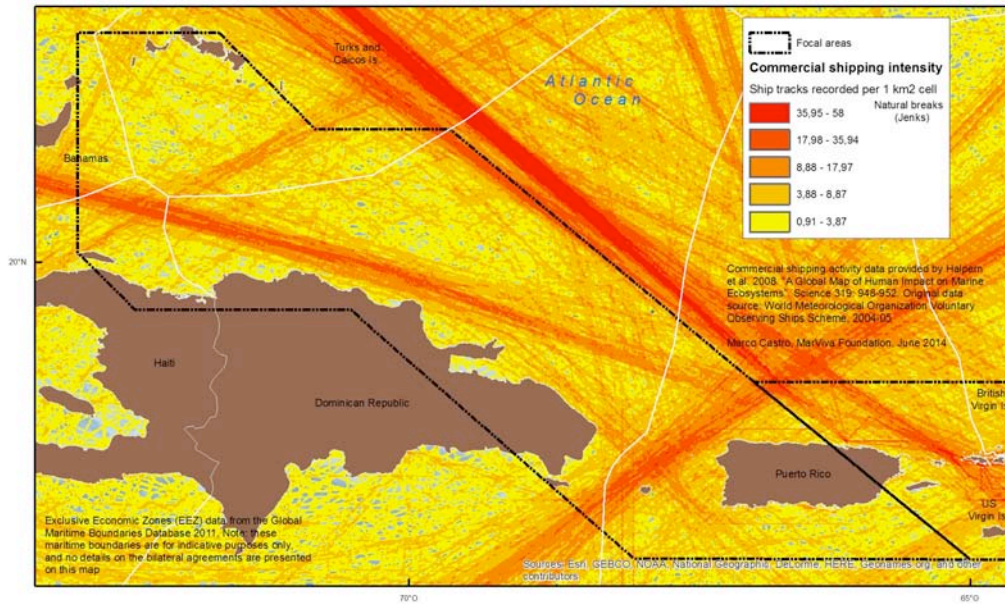
Shipping versus Species Distribution

For the three different focal areas, an overlap analysis was done between the shipping patterns found and the distribution of the five selected species. The overlap analysis was made at the level of focal areas, the use of smaller planning uses was not possible under the present scale and paucity of the available data.

Shipping routes depicted in the maps are mainly commercial shipping. Recreational craft, particularly at coastal areas, is not shown in these maps, even though we are aware that relevant interaction between maritime traffic and MM might occur in coastal areas. This interaction is not limited to collisions, but includes noise pollution and disturbance that impact MM distribution and behavior.

Shipping at the Focal Area # 1

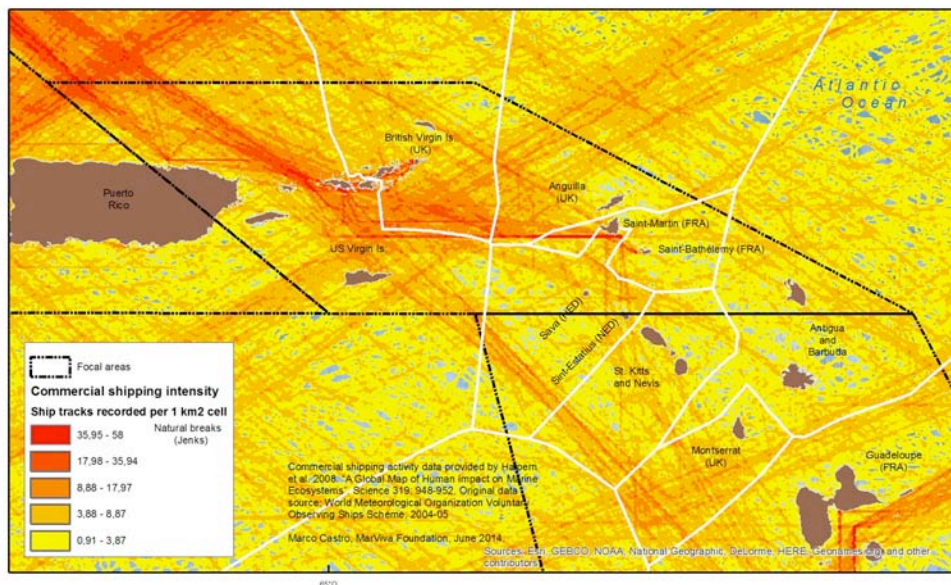
Dominican Republic - Puerto Rico focal area Shipping Routes



Project "LifeWeb (SPAW-RAC)" (2014)

Shipping Focal Area # 2

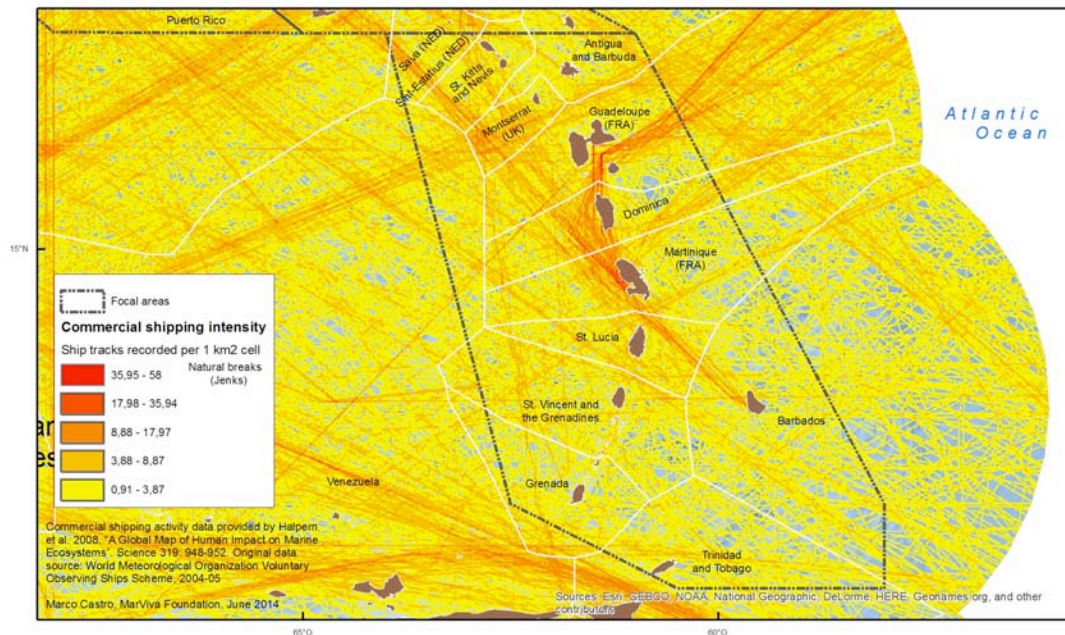
Virgin Islands - Barbuda focal area Shipping Routes



Project "LifeWeb (SPAW-RAC)" (2014)

Shipping Focal Area # 3

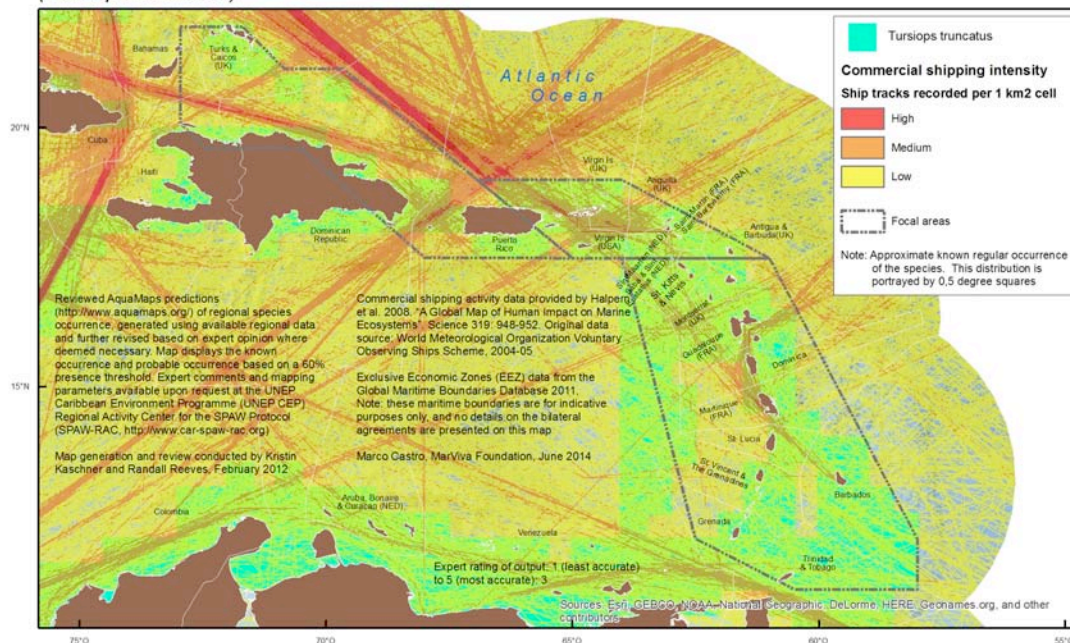
St. Maarten - Trinidad & Tobago Focal area Shipping Routes



Project "LifeWeb (SPAW-RAC)" (2014)

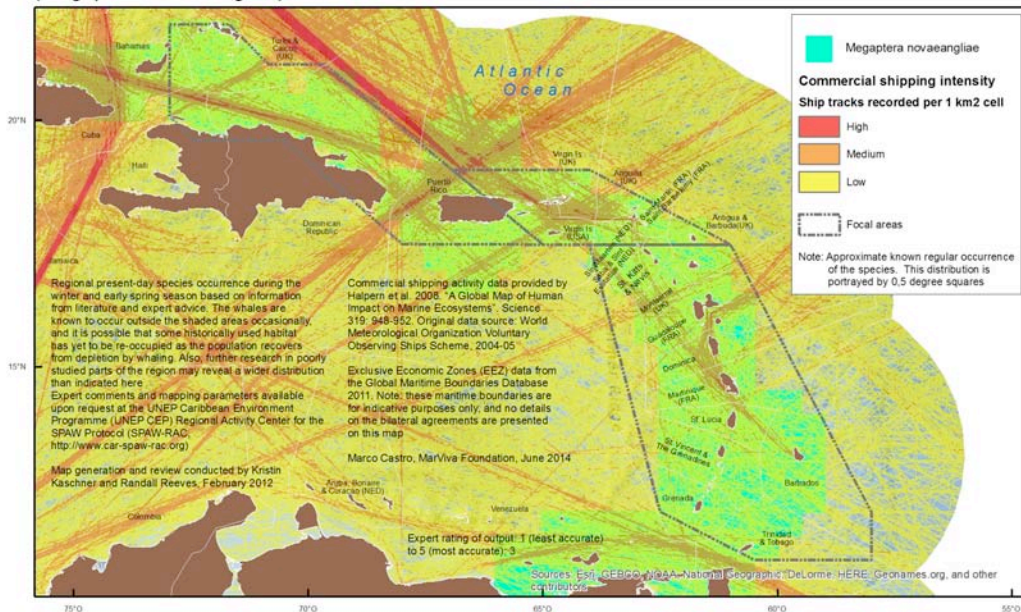
Due to the scale of the shipping routes, a detailed analysis of the overlap between MM distribution and shipping routes is not feasible at coastal areas neither at a detailed scale elsewhere. However, it is clear that within each of the three focal areas there are particularly critical areas at which, due to the high concentration of traffic, is likely that important interactions are happening between the maritime traffic and the MM species analyzed. The only exception in this case is the Manatee. Its restricted distribution to coastal waters, excludes it from the main traffic routes in the Caribbean. It is known that manatees do interact with local small traffic at coastal areas, but at the scale analyzed, this is the only species that did not show an interaction with commercial traffic routes.

Common Bottlenose Dolphin vs. Commercial Shipping Routes (*Tursiops truncatus*)



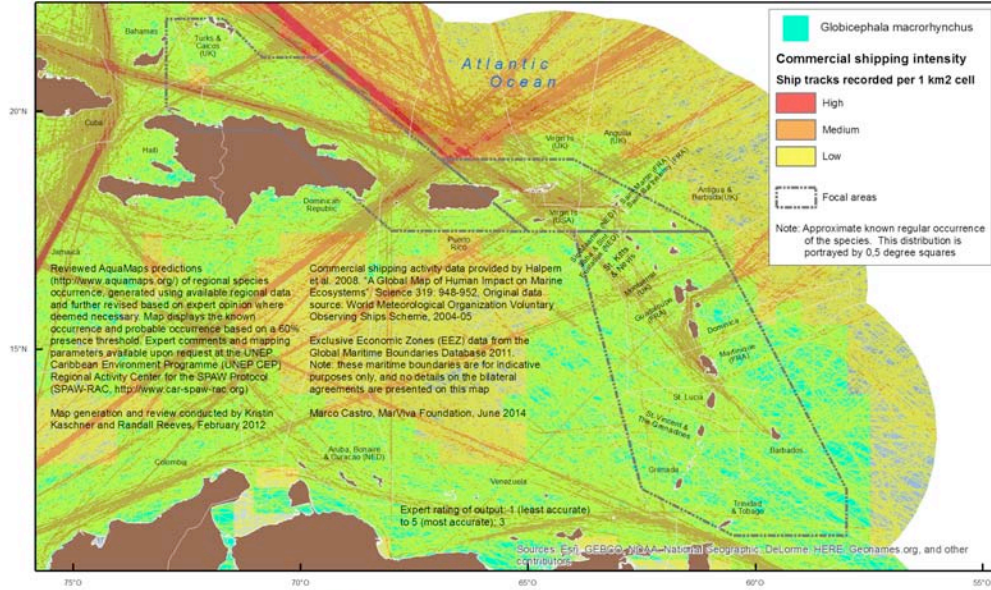
Project "LifeWeb (SPAW-RAC)" (2014)

Humpback Whale vs. Commercial Shipping Routes (*Megaptera novaeangliae*)



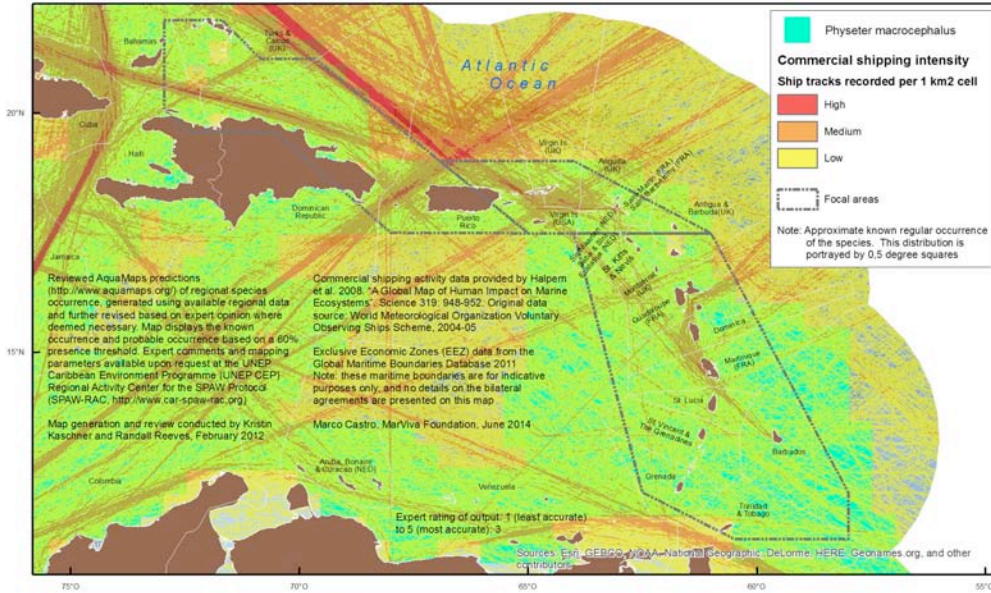
Project "LifeWeb (SPAW-RAC)" (2014)

Short-finned Pilot Whale vs. Commercial Shipping Routes (*Globicephala macrorhynchus*)



Project "LifeWeb (SPAW-RAC)" (2014)

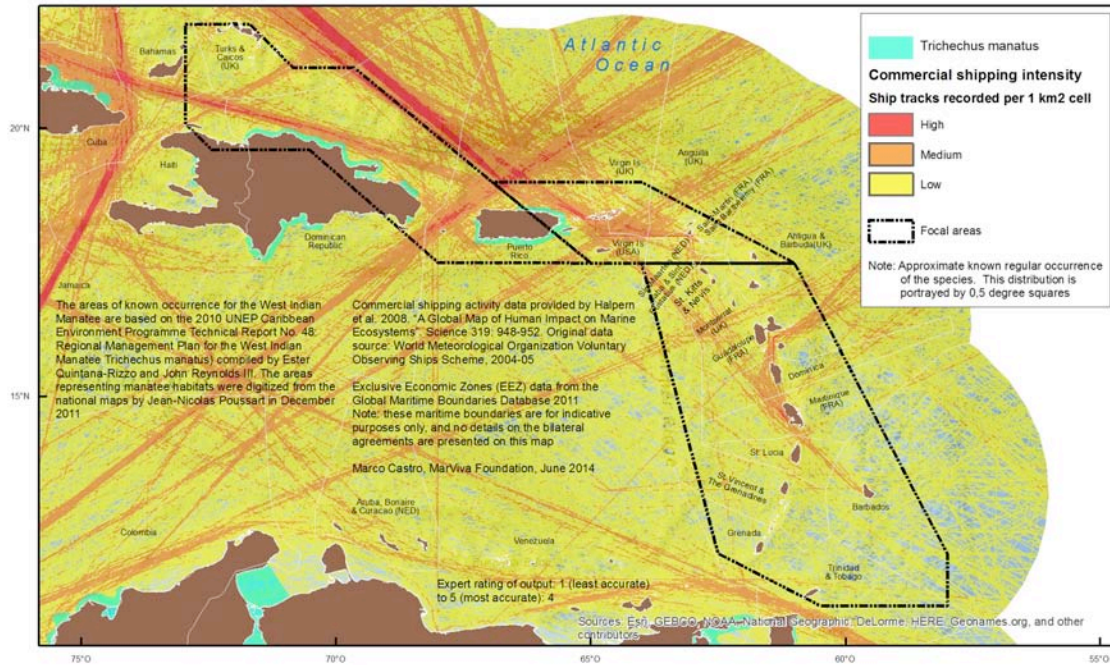
Sperm Whale vs. Commercial Shipping Routes (*Physeter macrocephalus*)



Project "LifeWeb (SPAW-RAC)" (2014)

West Indian Manatee vs. Commercial Shipping Routes

(*Trichechus manatus*)

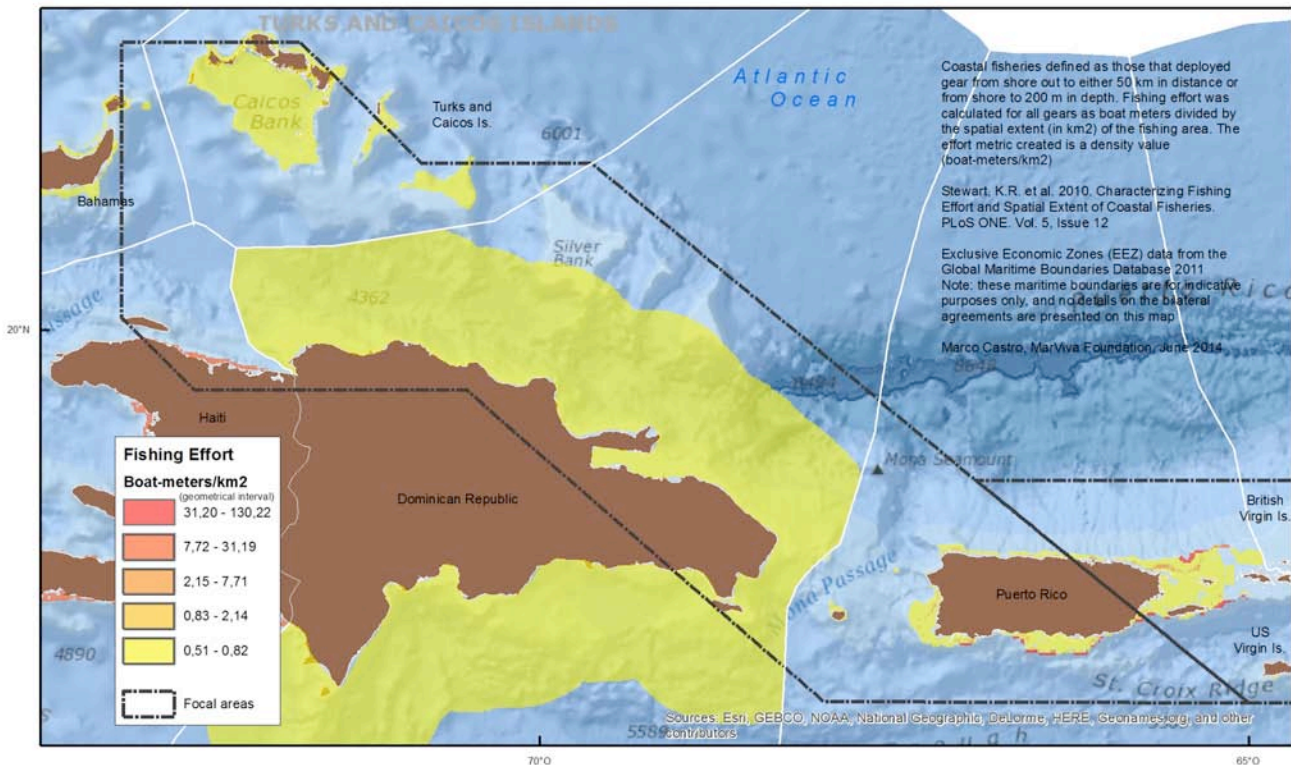


Project "LifeWeb (SPAW-RAC)" (2014)

Fishing effort

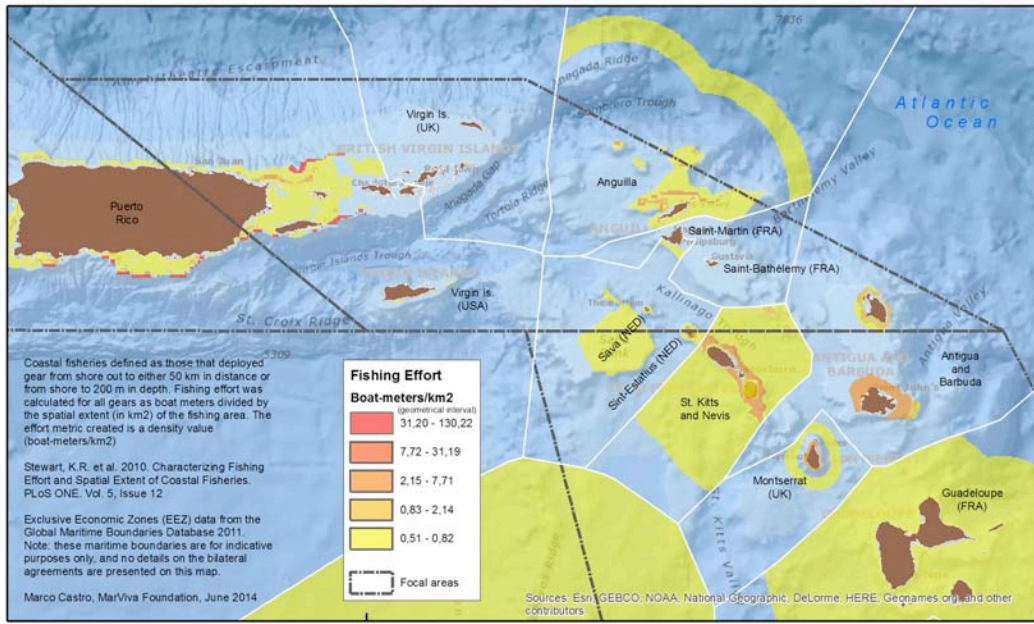
The other use analyzed was the fishing effort. Fishing effort at the three focal areas are depicted in the following maps:

Dominican Republic & Puerto Rico focal area Fishing Effort



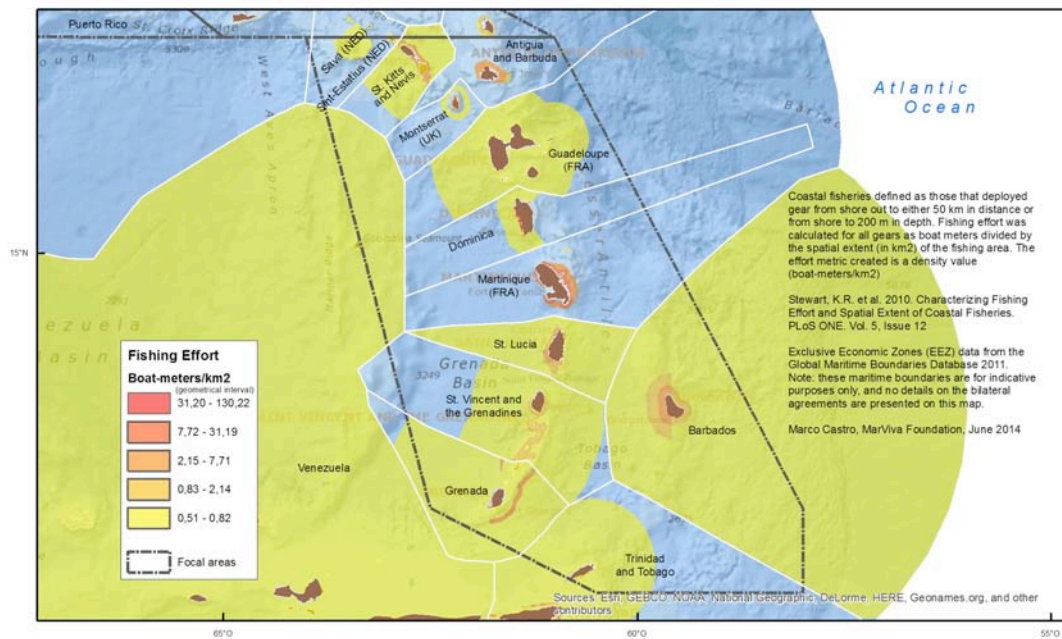
Project "LifeWeb (SPAW-RAC)" (2014)

Virgin Islands - Barbuda focal area Fishing Effort



Project "LifeWeb (SPA-W-RAC)" (2014)

St. Maarten - Trinidad & Tobago focal area Fishing Effort

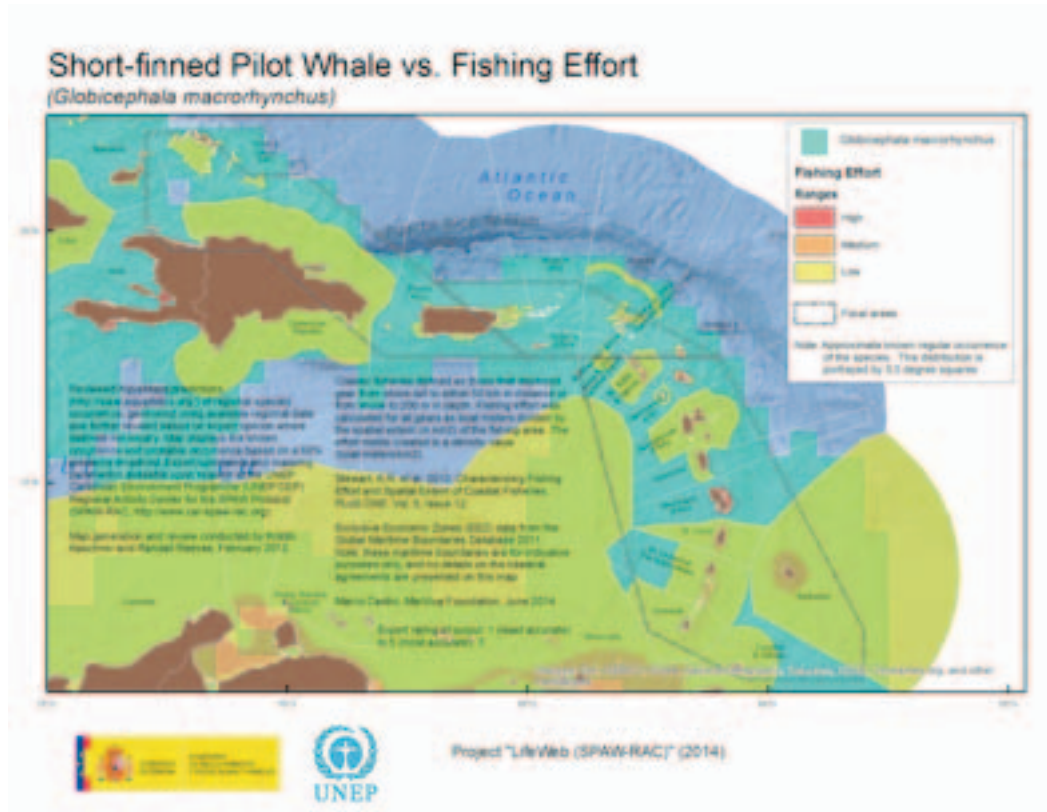


Project "LifeWeb (SPA-W-RAC)" (2014)

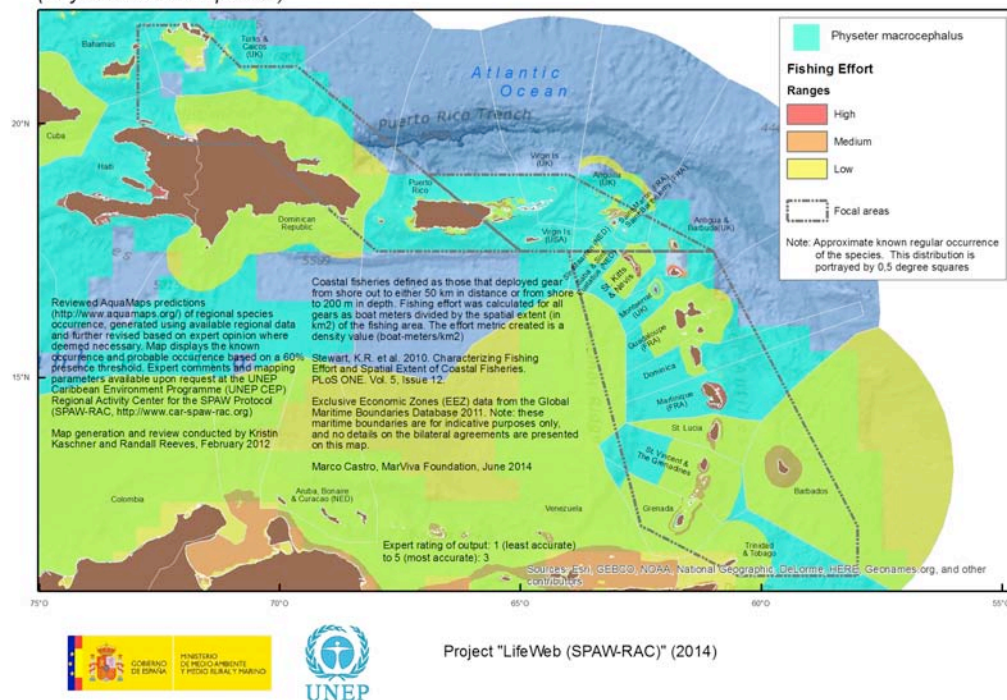
At the three focal areas fishing effort is largely coastal, widespread along the coasts of Dominican Republic, St. Kitts and Nevis, Grenada, Martinique and Barbados and concentrated at the south and southeast coasts of Puerto Rico. Fleets throughout the region are small-scale and largely artisanal. Gillnets and long-lines are fishing gears that interact with MM in the region. While the impact is likely small, interactions such as entanglement have been recognized for calves and adults of several MM species.

The overlap between the selected MM species and the fishing effort within the three focal areas is shown in the following maps. Light green areas represent the interaction between the species distribution (turquoise) and the fishing effort (mostly yellow). In many scattered areas around the Lesser Antilles (for example Barbados and Grenada) the brownish color indicates a more intense interaction.

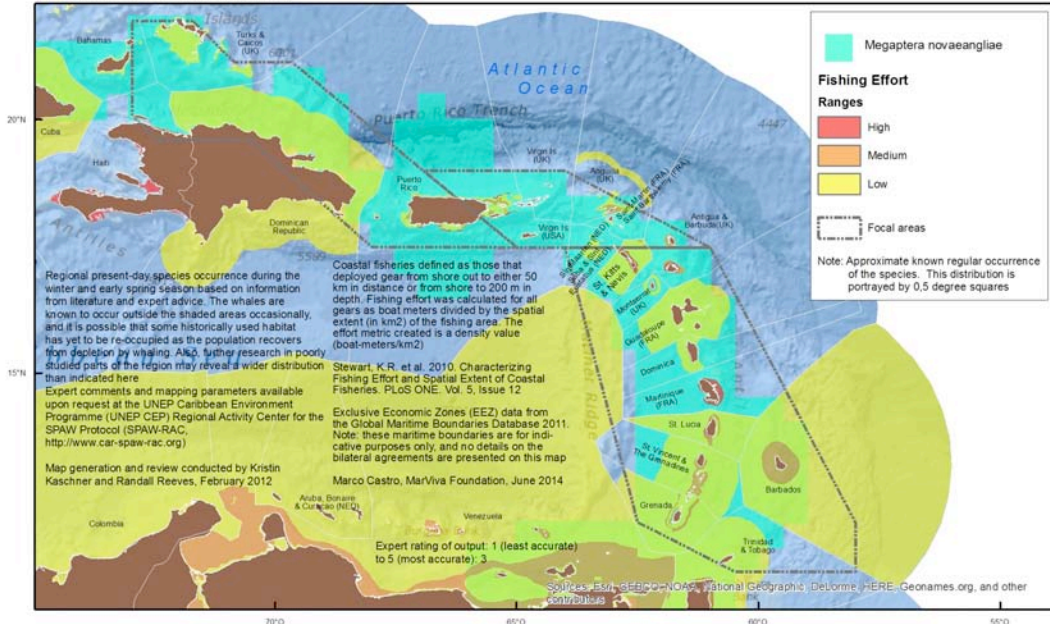
Fishing effort vs Species Distribution



Sperm Whale vs. Fishing Effort (*Physeter macrocephalus*)

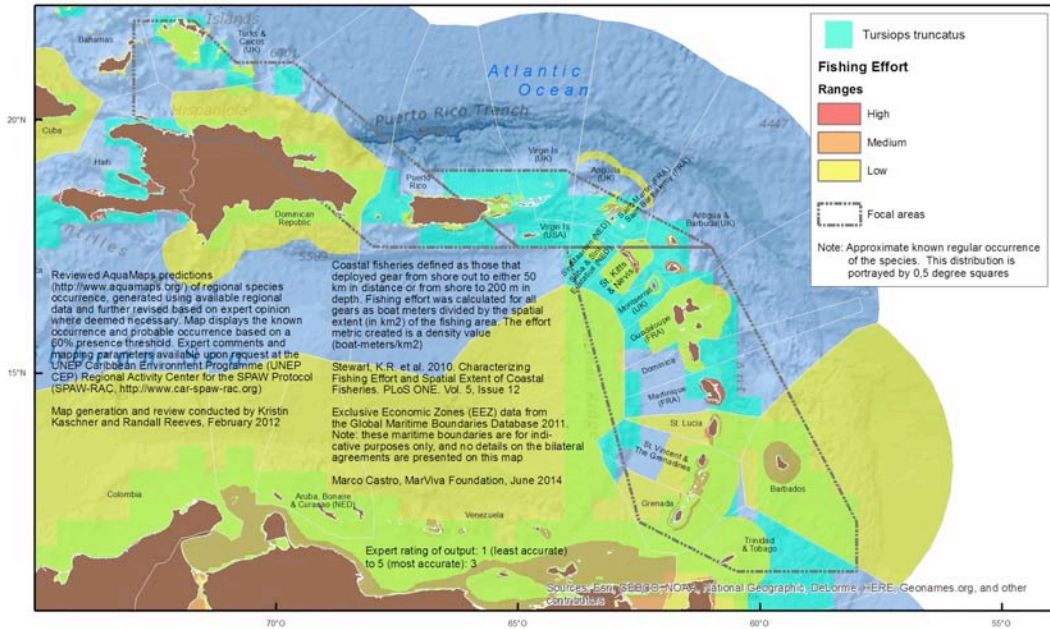


Humpback Whale vs. Fishing Effort (*Megaptera novaeangliae*)



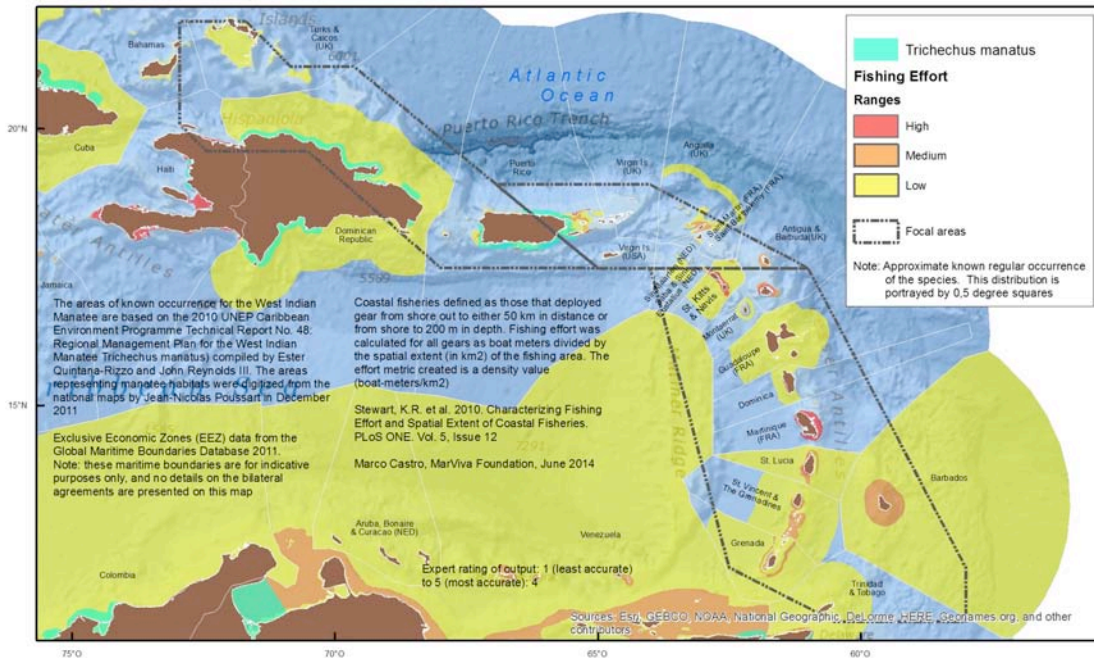
Project "LifeWeb (SPAW-RAC)" (2014)

Common Bottlenose Dolphin vs. Fishing Effort (*Tursiops truncatus*)



Project "LifeWeb (SPAW-RAC)" (2014)

West Indian Manatee vs. Fishing Effort (*Trichechus manatus*)



Project "LifeWeb (SPAW-RAC)" (2014)

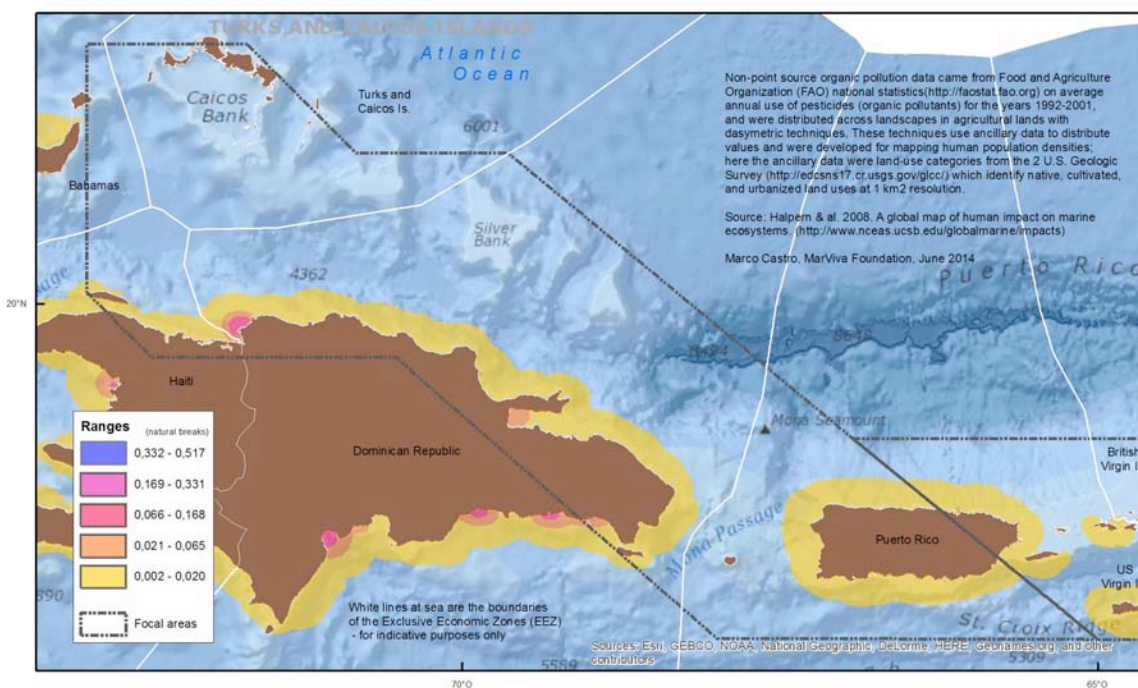
Non-Point Source Pollution

Pollution derived from agricultural activities is shown in maps developed by Halpern et al. (2008). Highly polluted areas in some coastal sectors are known for Dominican Republic, Guadeloupe, Dominica, Martinique and St. Lucia. Watershed-coastal waters interactions are evident in these maps and highlight the high importance of the land-sea interactions.

Presently over 70,000 different chemicals are used commonly in the industry and agriculture. For marine mammals, PCBs, DDT, chlordane dioxins and trace metals such as cadmium and mercury are of great concern. Coastal populations, in particular, are exposed to pulses of pesticides coming from agricultural lands. The impact of this pollution is little understood in most regions, the Caribbean not being an exception, but related impacts for MM populations, such as increase of diseases, premature pupping, cancer, etc. have been reported in some MM populations.

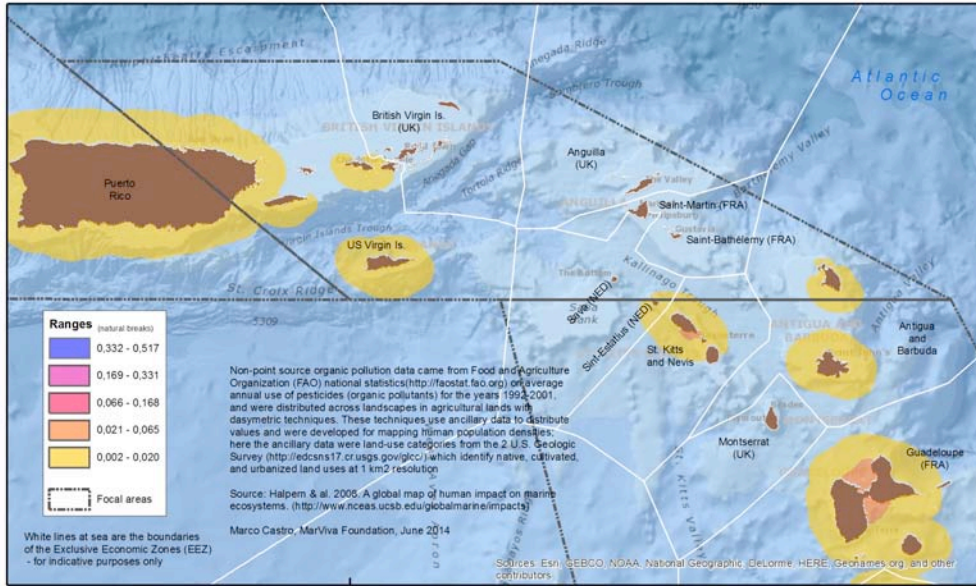
The occurrence of polluted areas within the focal areas is shown in the following maps:

Dominican Republic - Puerto Rico focal area Organic pollution (pesticides)



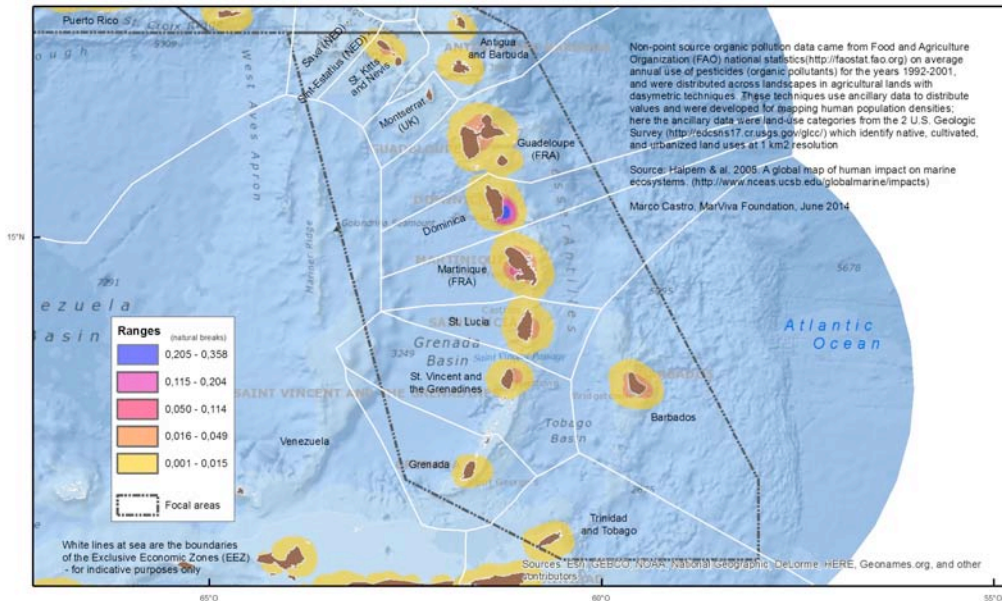
Project "LifeWeb (SPAW-RAC)" (2014)

Virgin Islands - Barbuda focal area Organic pollution (pesticides)



Project "LifeWeb (SPA-W-RAC)" (2014)

St.Maarten - Trinidad & Tobago focal area Organic pollution (pesticides)



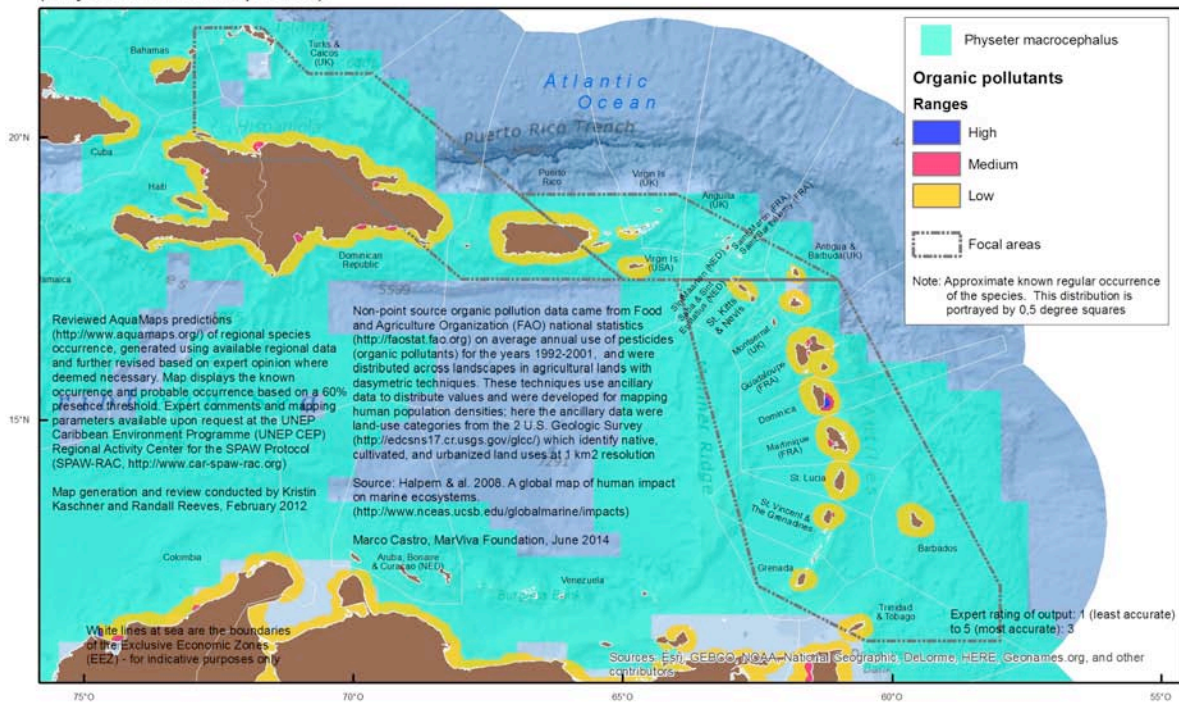
Project "LifeWeb (SPA-W-RAC)" (2014)

Highly polluted areas in some coastal regions of Dominican Republic, Dominica, Guadeloupe, Martinique, and St. Lucia are noteworthy, indicative of pollution from run-off from agricultural lands.

Pollution vs. Species Distribution

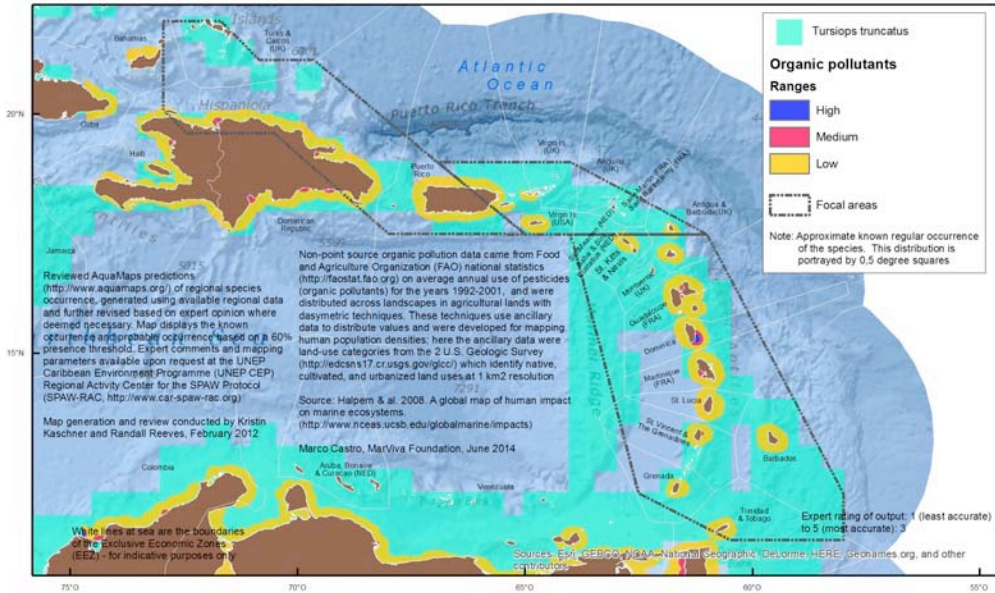
An overlap of the reported polluted areas with the distribution of the selected MM species is shown in the following maps. Of particular concern are the highly polluted areas on the coastal zones of the Greater Antilles where manatee populations, highly coastal, are concentrated.

Sperm Whale vs. Organic pollutants (*Physeter macrocephalus*)



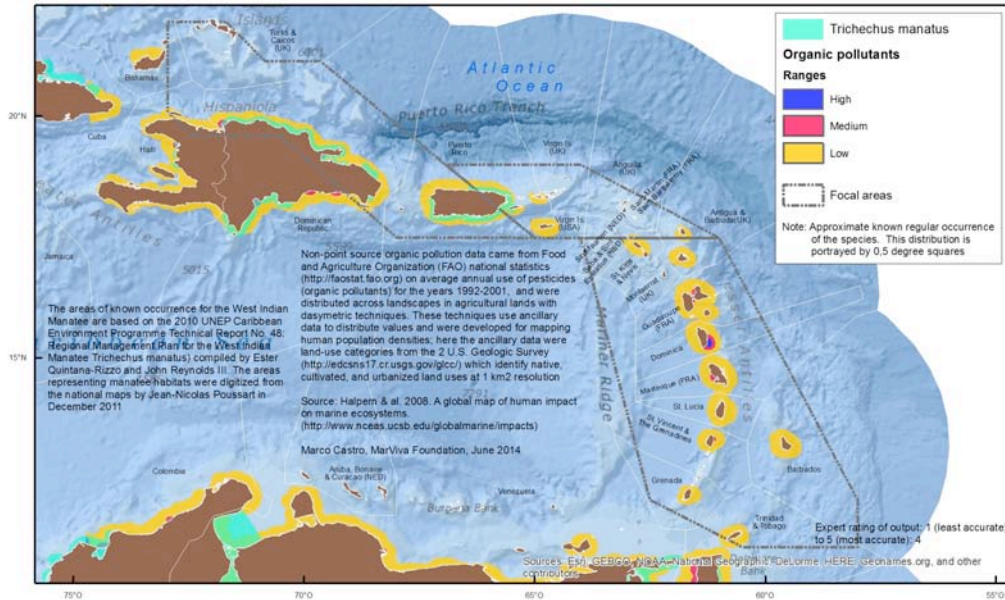
Project "LifeWeb (SPAW-RAC)" (2014)

Common Bottlenose Dolphin vs. Organic pollutants (*Tursiops truncatus*)



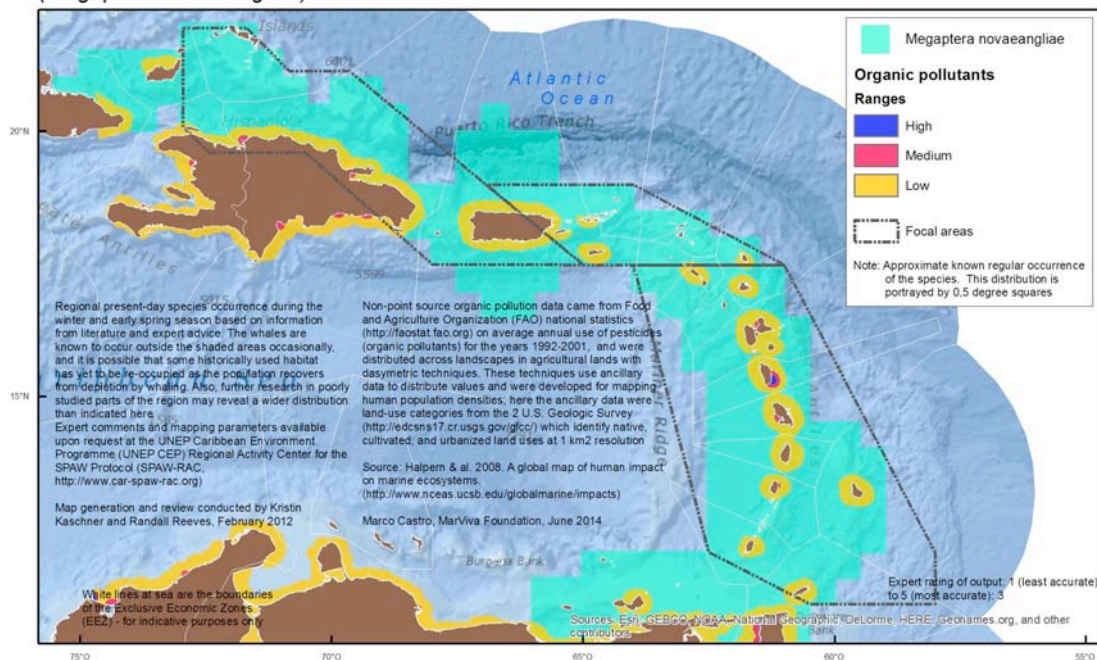
Project "LifeWeb (SPAW-RAC)" (2014)

West Indian Manatee vs. Organic Pollutants (*Trichechus manatus*)



Project "LifeWeb (SPAW-RAC)" (2014)

Humpback Whale vs. Organic pollutants (*Megaptera novaeangliae*)



Project "LifeWeb (SPAW-RAC)" (2014)

Critical Areas

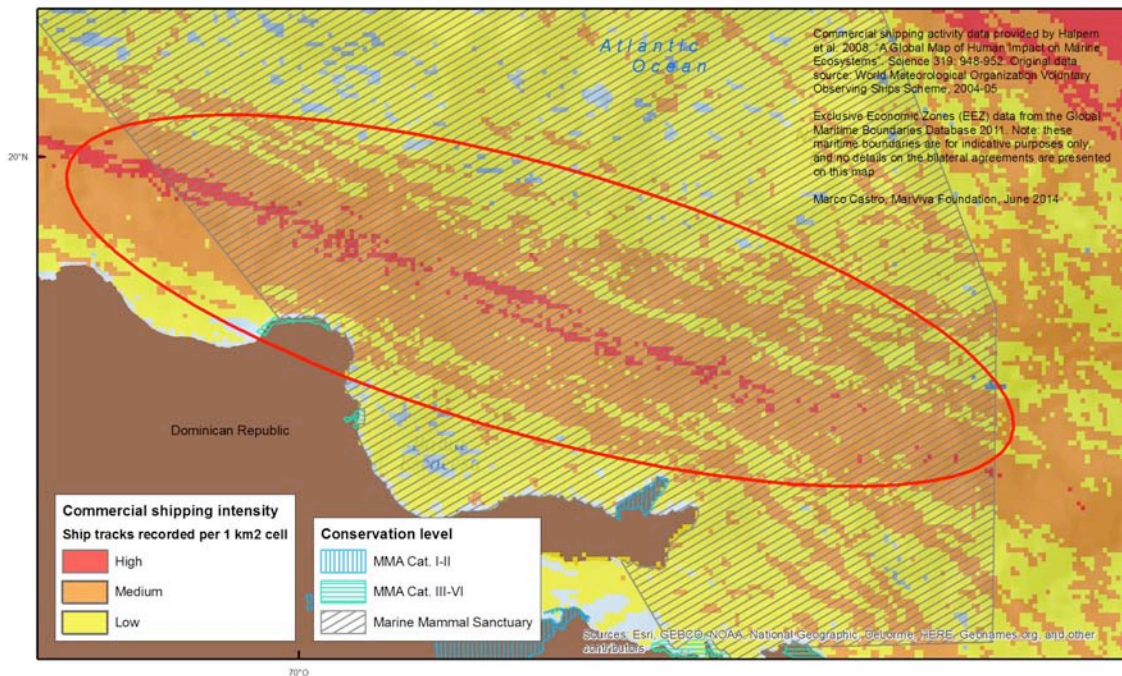
Out of the overlap analysis it was possible to identify several Critical Areas within each of the Focal Areas. As explained before the overlap analysis allows identification of areas where the interaction between a use and a species distribution is intense, although not necessarily conflictive. That is, a critical area is likely to harbor use-habitat conflicts, but a later compatibility analysis would be required to assess the conflict degree. In all the three focal areas, critical areas were identified and the three selected uses (maritime traffic, fishing and pollution) were involved in some of these critical areas. For the Focal Area # 1, the critical areas are shown in the following maps.

Focal Area 1

Two Critical Areas were identified in Focal Area 1. Areas with intense commercial traffic were overlapping well-known habitats for Humpback whales, including the MM Sanctuary on the north coast of Dominican Republic. Likewise north of Puerto Rico major maritime routes intersect on an area used by whales for their eastward migrations.

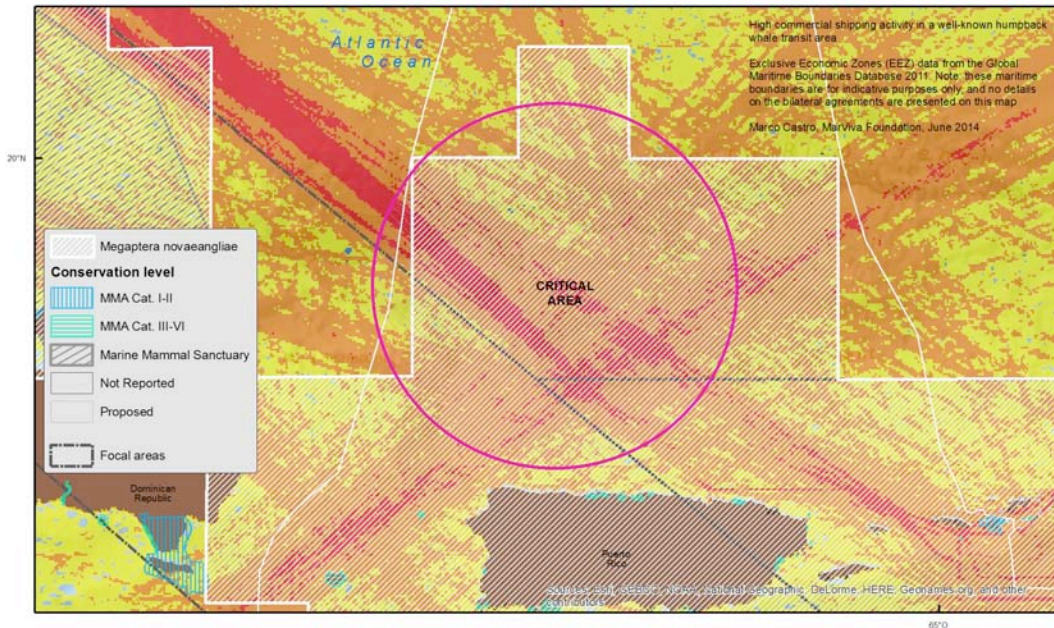
Fishing effort is the other use that heavily interacts with the species distribution patterns within this focal area. Of particular concern was the fishing activity in the southern and eastern sides of Puerto Rico.

Northern Dominican Republic critical area Humpback Whale Habitat vs. Commercial Shipping Routes



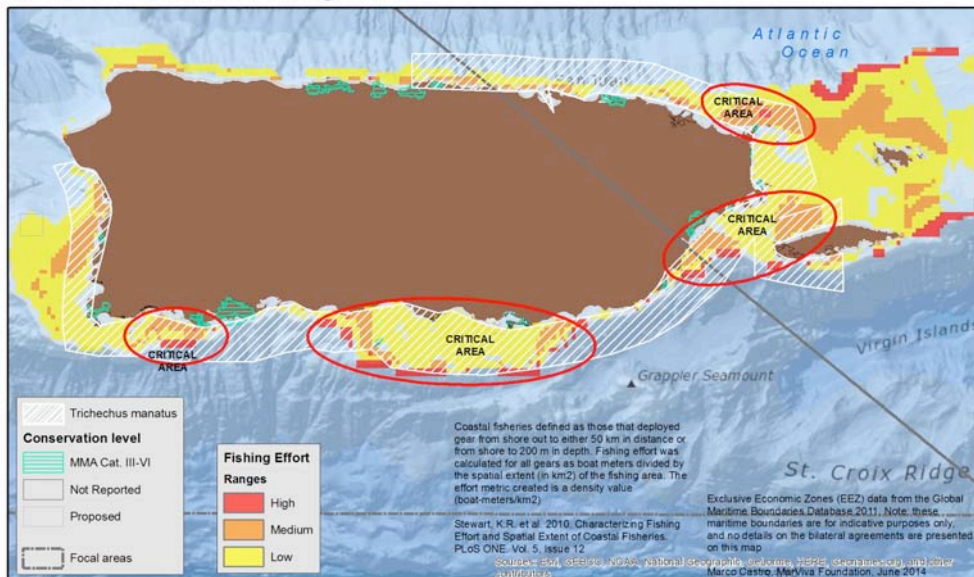
Project "LifeWeb (SPAW-RAC)" (2014)

Northern Puerto Rico critical area Humpback Whale Habitat vs. Commercial Shipping Routes



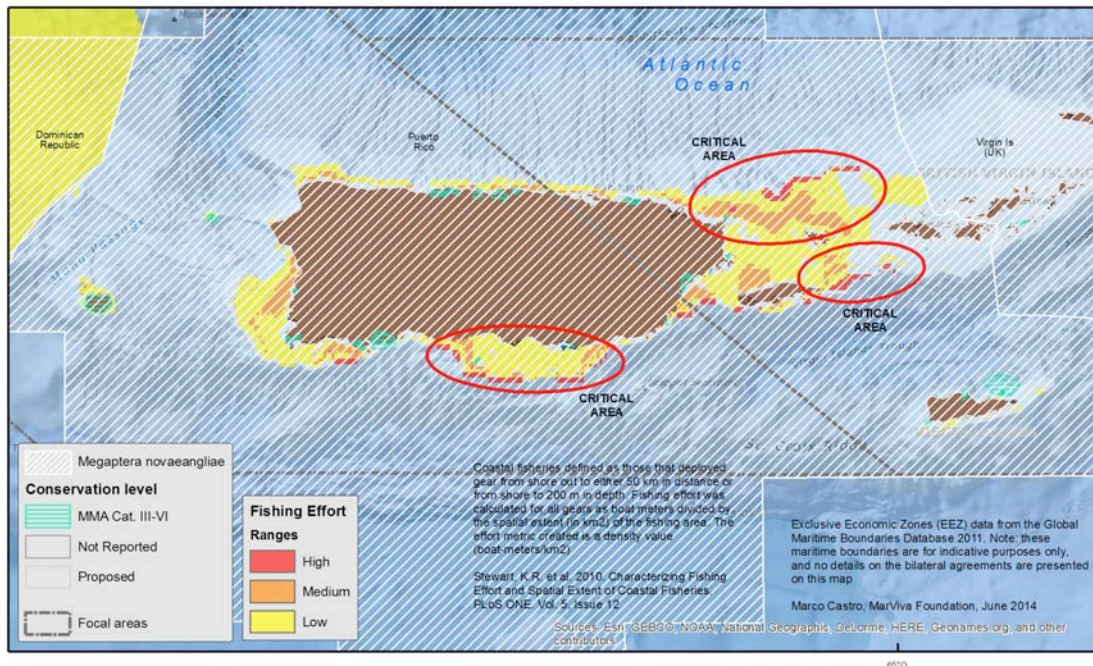
Project "LifeWeb (SPA-WRAC)" (2014)

Puerto Rico critical areas Manatee Habitat vs. Fishing Effort



Project "LifeWeb (SPA-WRAC)" (2014)

Puerto Rico critical areas Humpback Whale Habitat vs. Fishing Effort



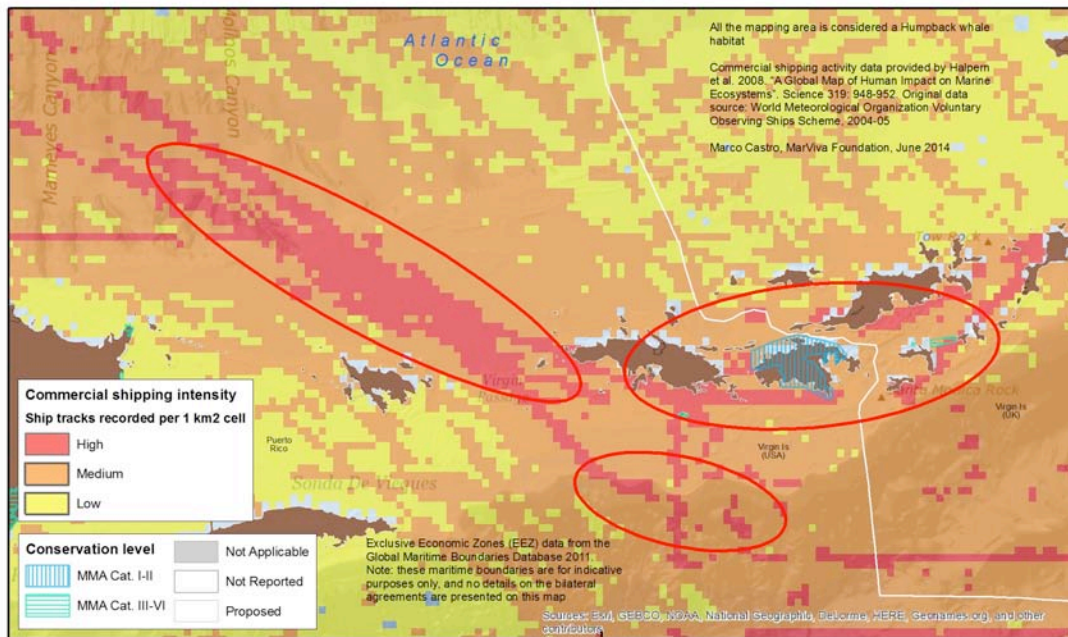
Project "LifeWeb (SPA-W-RAC)" (2014)

While fishing impacts on MM in Caribbean waters are generally unknown, some incidents of entanglement with gill nets and long-lines have been reported. Due to their coastal habits the manatee and the humpback whale (out of the selected species) are of particular concern, in the southern and eastern coast of Puerto Rico.

Focal Area 2

At the Focal Area 2 maritime traffic and fishing efforts were identified at critical areas. The high intensity of maritime traffic between St. John and Culebra coupled with the reported concentration of humpback whales in this area highlights the need to establish management measures in this sector. Similarly, the high fishing pressure observed around St. Kitts and Nevis, Antigua and Anguilla, are indicative of potential conflicts with the selected MM species whose distribution includes those areas.

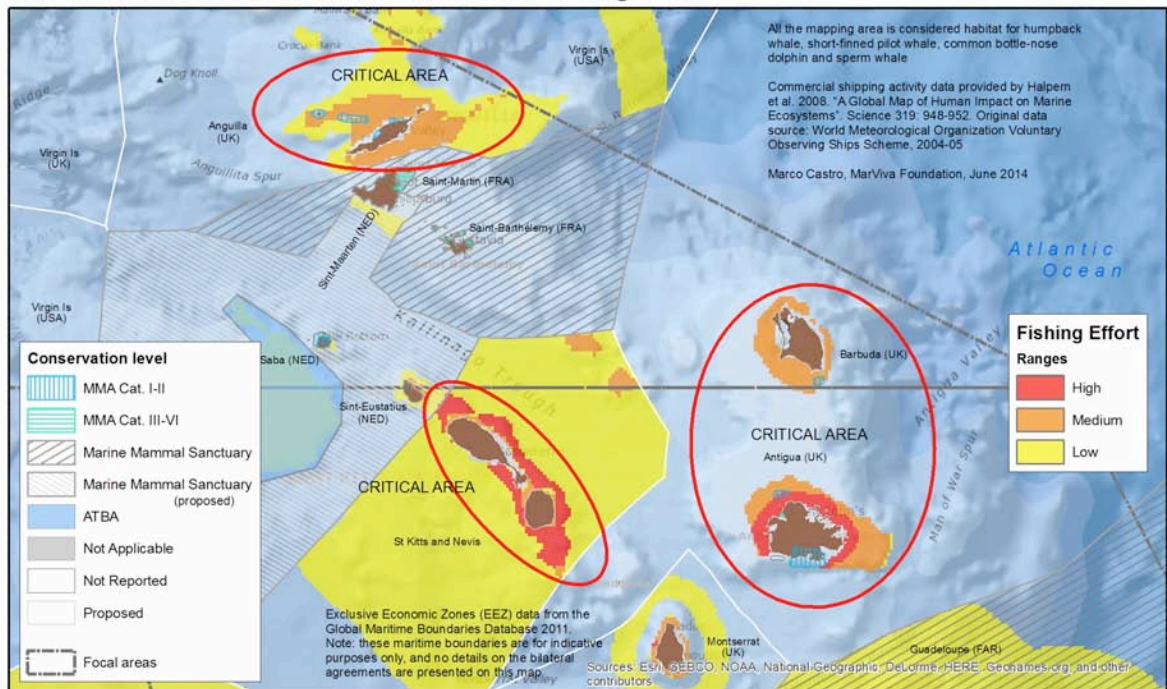
Virgin Islands critical areas Humpback Whale Habitat vs. Commercial Shipping Routes



Project "LifeWeb (SPAW-RAC)" (2014)

Northern Lesser Antilles critical areas

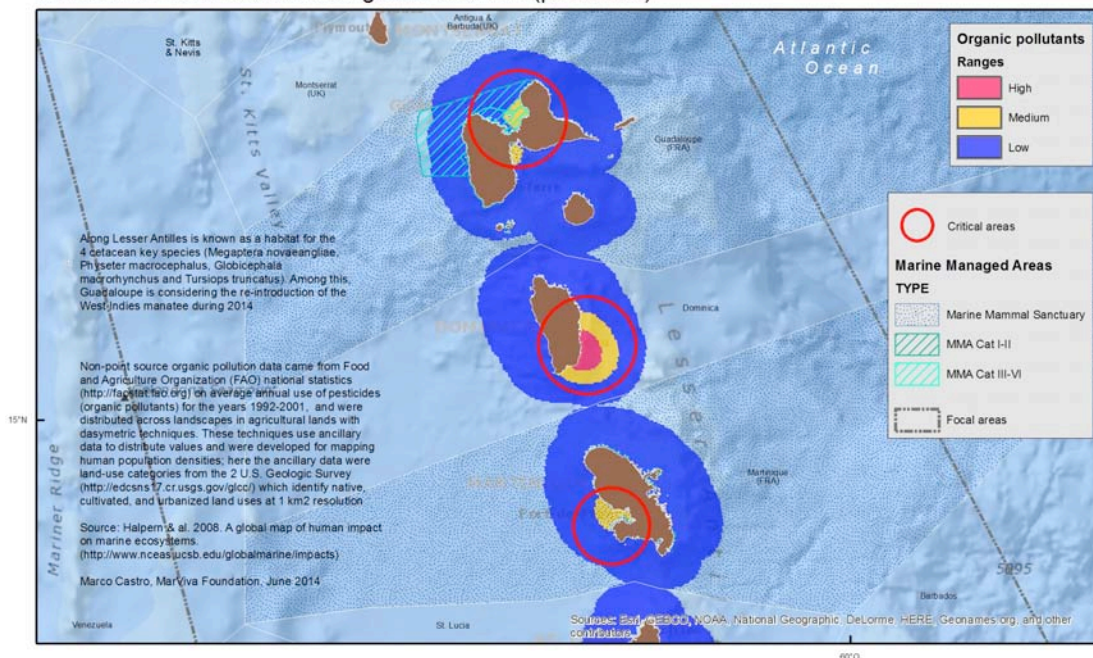
Coastal Marine Mammals Habitat vs. Fishing Effort



Project "LifeWeb (SPA-W-RAC)" (2014)

Guadeloupe-Martinique critical areas

Marine Mammals Habitat vs. Organic Pollutants (pesticides)



Project "LifeWeb (SPAW-RAC)" (2014)

Scenarios

Creating management scenarios, using large scale, non-detailed maps and missing compatibility analysis, only generates rough approximations for management decisions for those critical areas with high use intensity. Scenarios generated under these conditions need to be used as approximations to management approaches that might need a more detailed analysis if information is available.

The proposed scenarios resulting of this analysis are centered on the use of four management tools that seem appropriate for the type of overlap found. The first tool is related to the creation of **Particularly Sensitive Sea Areas** (PSSA) under the auspices of the International Maritime Organization (IMO). Under its established norms, IMO recognizes the PSSA as “an area that needs special protection because of its significance for recognized ecological, socio-

economic, or scientific attributes where such attributes may be vulnerable to damage by international shipping activities”.

The second recommended tool is the creation of **Regulated Fishing Areas**. This measure, usually under the management of a national Fisheries Agency, seeks to regulate fishing activities to minimize its impact on habitats or other populations. Different countries called them differently: Responsible Fishing Areas, Exclusive Zones for Artisanal Fishing, Regulated Fishing Areas, etc. The use of hook and line, regulations on gill net use and the exclusion of trawling and industrial fishing are characteristics of these areas.

The third tool is the creation of **Marine Managed Areas** (MMAs), categories I-II. This type of area is established to protect habitat conditions and key ecosystems. Due to their strict conservation objectives, most extractive activities are excluded from these areas, preserving the ecosystem and the populations relationships most times required for the maintenance of healthy MM populations.

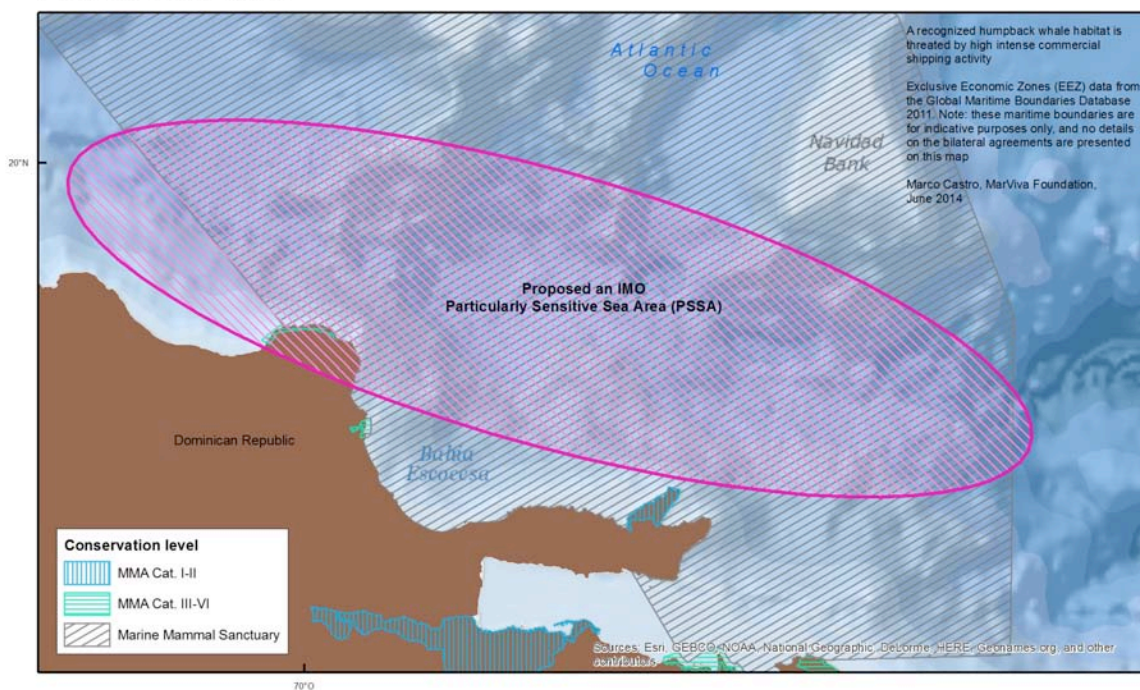
At the regional level, the creation of a **Network of Marine Managed Areas** (NMMA) is the fourth tool recommended. The migratory nature of some of the MM species analyzed and the seasonal movements (offshore/inshore) of some of the other species highlights the need for connectivity measures among the critical areas found in the three focal areas.

The lack of detailed information, prevent the provision of definitive geographic and spatial limits to the proposed scenarios, with only proposed approximations on their spatial distribution and coverage. Regional or National groups of experts would need to look into these recommendations and through a more detailed analysis, establish the actual limits of such proposed areas.

Focal Area 1: Proposed Scenarios

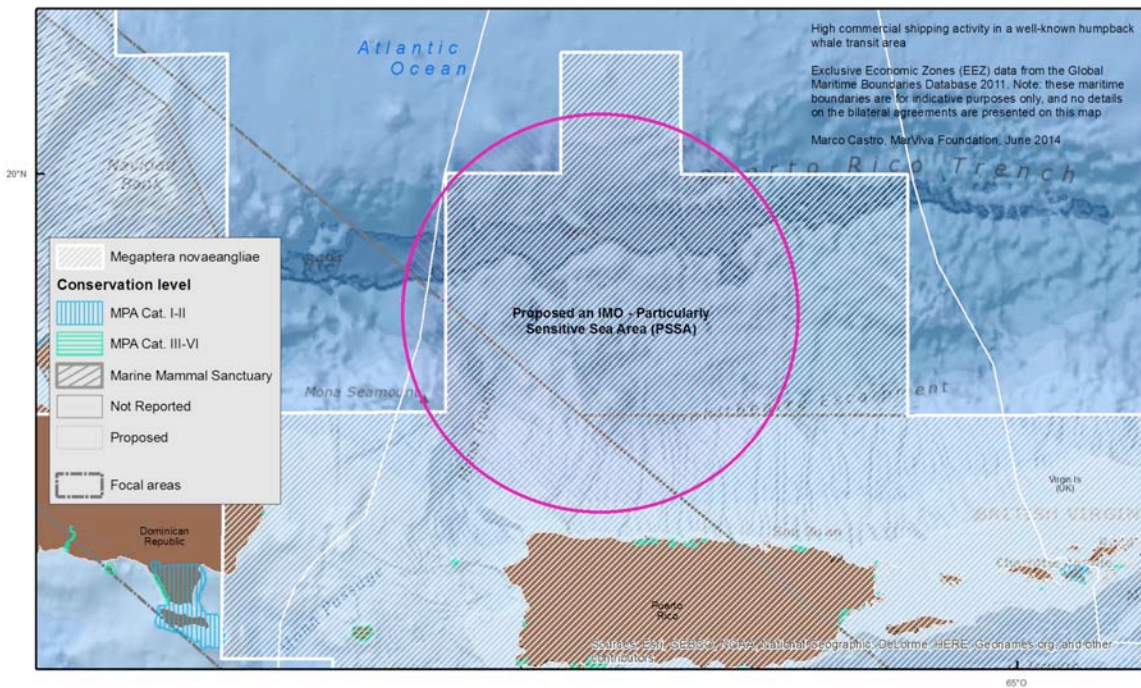
In the case of the areas with high-intensity traffic at northern Dominican Republic and Puerto Rico, we recommend the establishment of PSSA to minimize conflict, not only with humpbacks but likely with many of the other MM in the region. This implies the fulfillment of criteria and processes required by IMO. Re-routing is unlikely in both cases, but narrowing the traffic channel, reducing speed and noise and controlling waste disposal would benefit those areas that concentrate MM populations and are a route for the humpback migrations between the North Atlantic and the Caribbean.

Northern Dominican Republic critical area
Proposed Scenario



Project "LifeWeb (SPAW-RAC)" (2014)

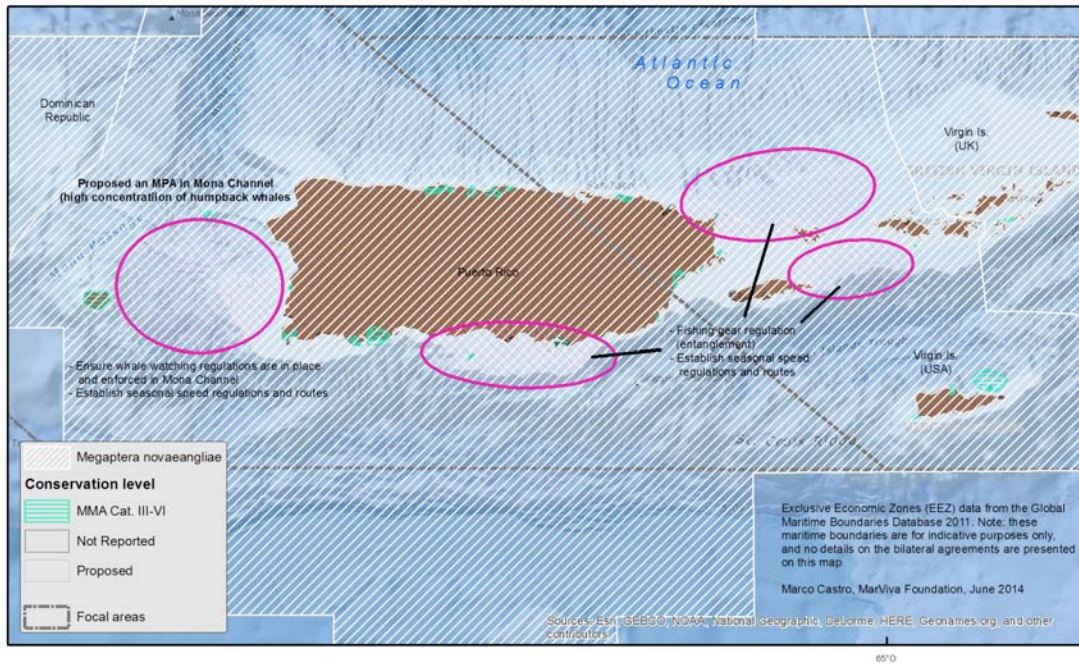
Northern Puerto Rico critical area Proposed Scenario



Project "LifeWeb (SPAW-RAC)" (2014)

In Puerto Rico, Marine Managed Areas covering significant areas of the marine realm are non-existing. The scale of the habitat requirements of most MM species surpasses the existing MMA sizes and designs in the Caribbean. Within this Focal Area the Mona Passage is a critical area where high seasonal abundance of humpbacks promotes an important whale-watching industry.

Puerto Rico critical area Proposed Scenarios



Project "LifeWeb (SPAW-RAC)" (2014)

We propose the establishment of a large MMA (category III-VI) in this area that will benefit not only the MM populations that seasonally concentrate there, but also more resident MM populations, including the manatee populations between Cabo Rojo and the Guanajibo River mouth in the west coast

At the same time, we recommend that fishing grounds in the south and east of Puerto Rico should be converted into Regulated Fishing Grounds. This will not only benefit the artisanal fishers by excluding more destructive gears (such as trawling) but will also reduce the chance of entanglement for MM species in this region including the manatee populations in Ceiba (east coast), Jobos Bay, and Guayama and Salinas (southeast coast).

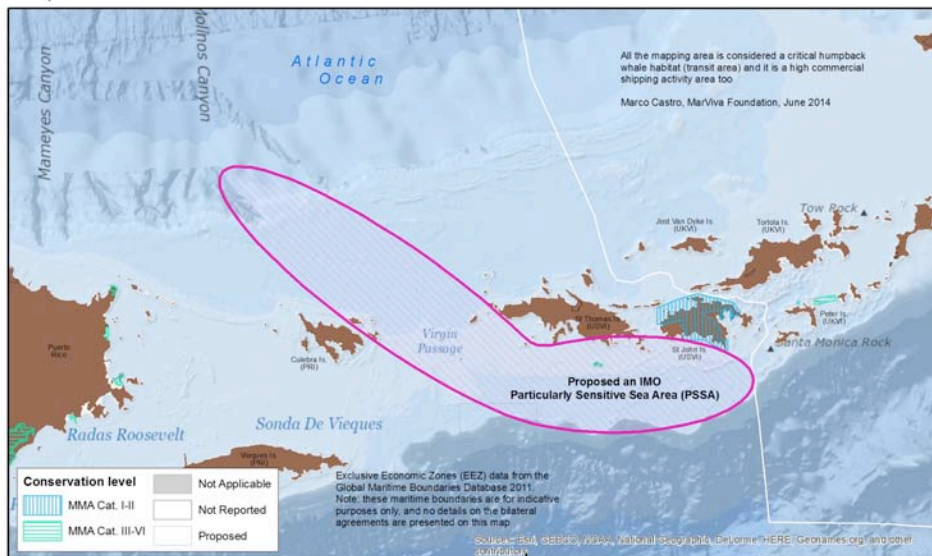
Focal Area 2- Proposed Scenarios

The FA 2 is an area where tourism and artisanal fisheries combine. The maritime traffic generated by the tourism sector is very intense around the Virgin Islands while fishing is intense around Antigua, Anguilla and St. Kitts and Nevis.

The critical areas found identify potential conflicts at the Virgin Passage between Culebra and St. John Islands due to the heavy maritime traffic, and at the coastal areas of most of the Lesser Antilles to the east of the Focal Area, due to the high fishing effort reported there.

The proposed scenarios include the establishment of a PSSA at the Virgin Passage designed to regulate the intense traffic in this area where necessarily MM movements also coincide. In the Eastern side of and Nevis we propose the establishment of a MMA (Category I) expanding the previous results coming from the USAID-TNC Marine Spatial Planning exercise done at these islands (Agostini, et al., 2010). An MPA established here, would also be relevant as a key link for a regional network of Protected Areas (see below).

Virgin Islands critical areas
Proposed Scenario



Project "LifeWeb (SPAW-RAC)" (2014)

Northern Lesser Antilles critical areas Proposed Scenario

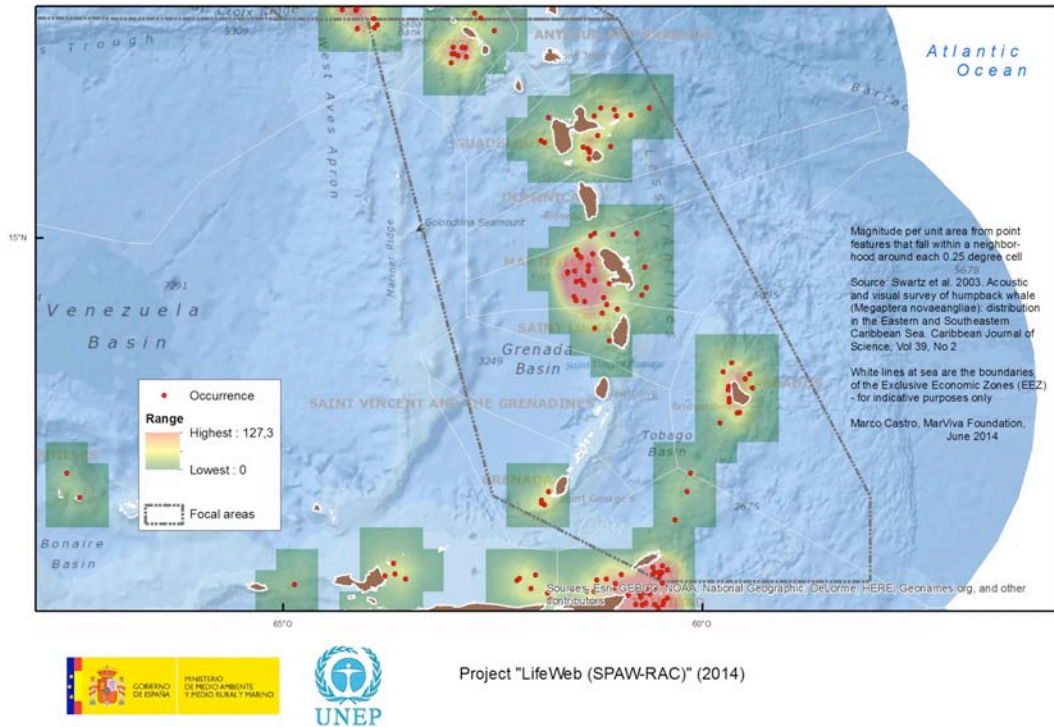


Project "LifeWeb (SPAW-RAC)" (2014)

Focal Area 3-Proposed Scenarios

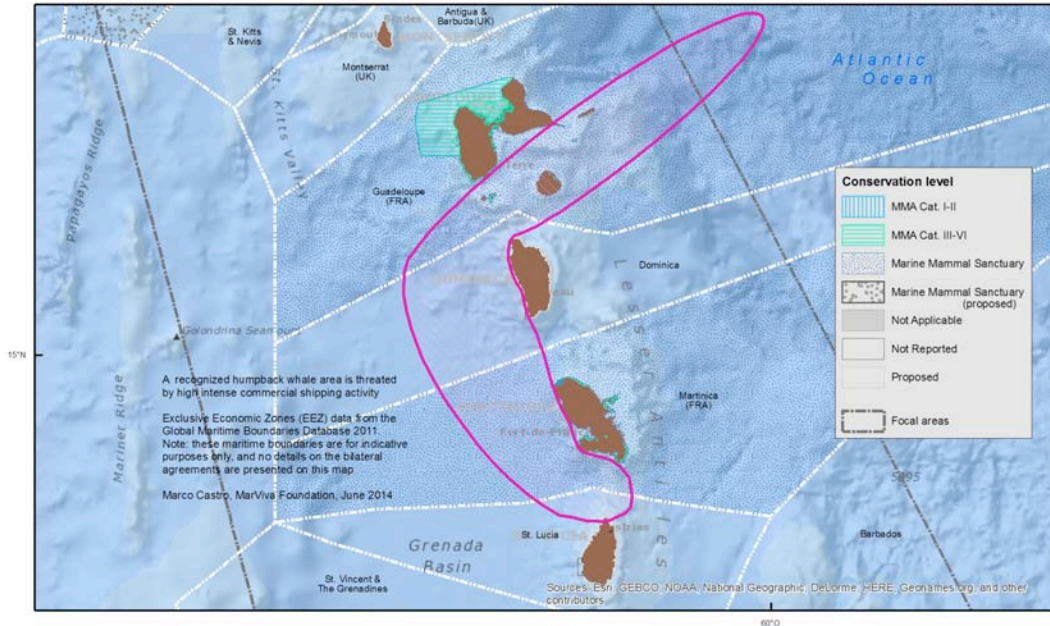
The easternmost of the Lesser Antilles have critical areas generated by the intense maritime traffic, high fishing pressure and coastal pollution. While data on the distribution and density of MM is generally scarce in this area, for the selected species, this area seems to hold smaller populations than those reported to the west. Nevertheless, at least for the humpback populations, some information (although scarce) is available on their distribution. Swartz et al. (2003), reported higher concentrations west of Martinique overlapping with high intensive traffic between Martinique and Guadeloupe islands.

Humpback Whales Density



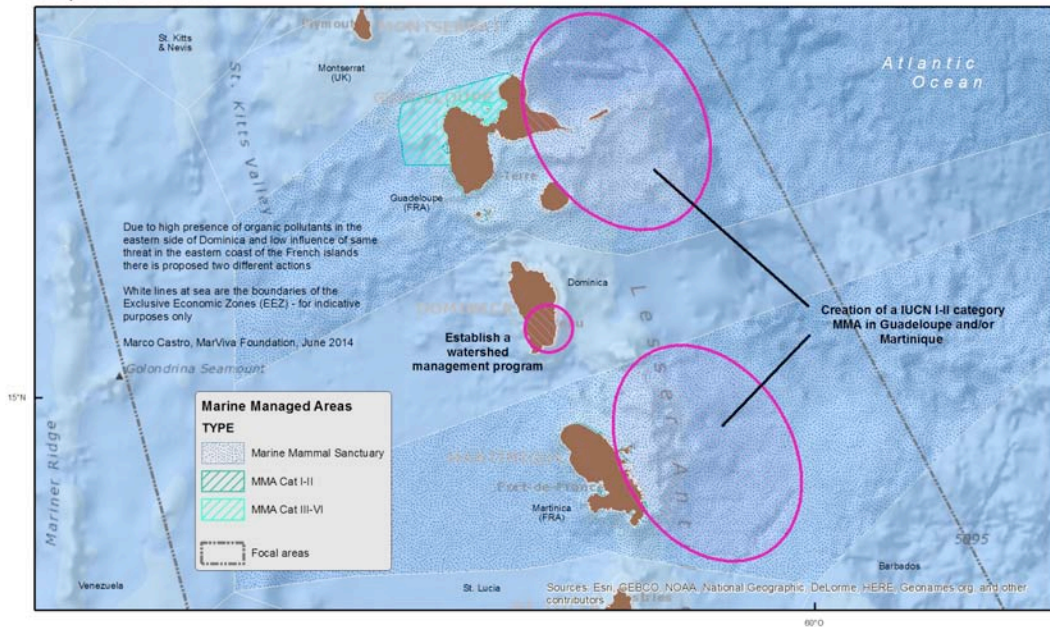
For this Focal Area, we recommend the establishment of another PSSA to be defined northwest of St. Lucia up to the eastern part of Guadeloupe. At the eastern coasts of Martinique and/or Guadeloupe a sizeable MPA (category I-II) should be established to secure habitat conditions to MM in the region and to ensure a link in the regional network of MPAs. Lastly, the southeastern coast of Dominica shows high levels of pollution associated with land use patterns in the associated watersheds. A watershed management plan should be developed there to reduce the negative land-sea interaction observed in the area.

Guadeloupe - Martinique critical area Proposed Scenario



Project "LifeWeb (SPA-W-RAC)" (2014)

Guadeloupe-Martinique critical areas Proposed scenario



Project "LifeWeb (SPA-W-RAC)" (2014)

Regional Scale Recommendations

From a regional perspective the obvious feature is the lack of correspondence between the habitat requirements (distribution) of the selected species and the level of habitat protection present in the Wider Caribbean region. While important areas have been declared as MM sanctuaries, stricter conservation categories (IUCN Categories I, II) are required to ensure habitat protection that would complement the existing protected area system.

While specific studies linking conservation goals with habitat requirements for key MM species are needed, we have ventured to indicate a broad distribution scheme of MMAs within the focal areas analyzed. This distribution is based on MMAs proposed by this analysis to address potential use-habitat conflicts, but also adding areas where high concentration of MM is known to occur in the region.

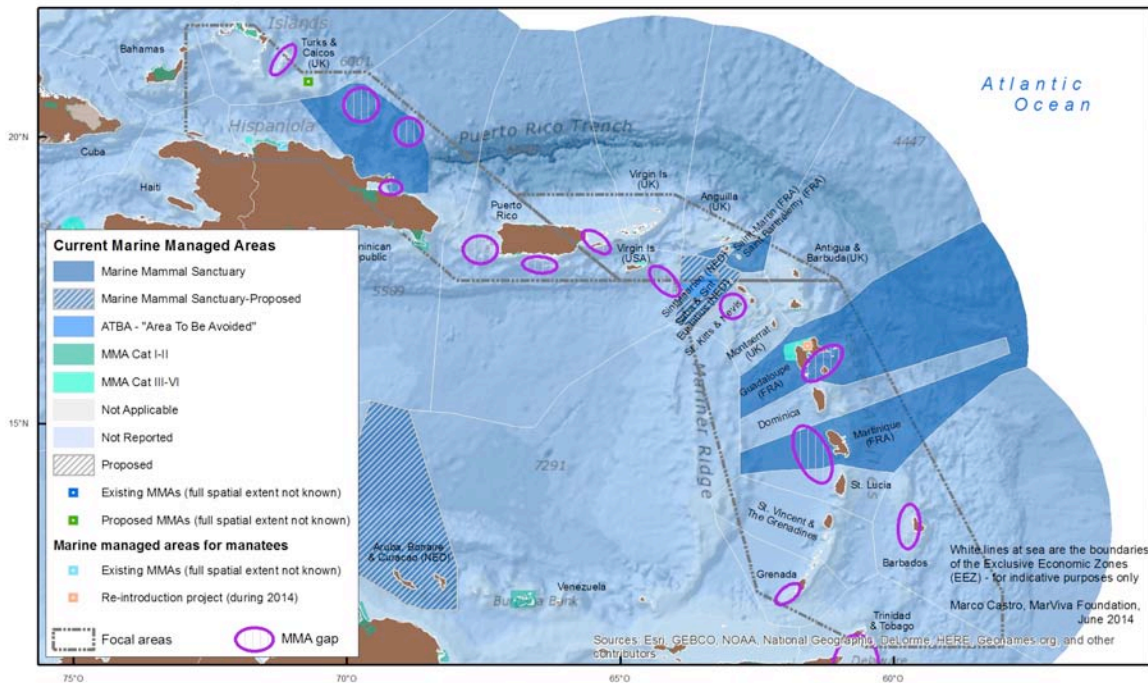
The establishment of a Regional Network of MMAs is considered of high relevance for many of the migratory or shorter ranging MM species. Regional efforts to ensure the establishment of this MMAs network and its effective implementation would clearly be a priority in the region.

The proposed sites, while still a broad recommendation, cover critical areas within the three focal areas. The specific limits, and regulations should be developed on a case-by-case basis, but coordination among the different Governments and partners in establishing and implementing these sites is fundamental to ensure that a truly effective regional network of MPAs is achieved.

While efforts are already in place under the SPAW Protocol and its associated programme on MPAs in the region, specific consideration to the needs of MM conservation should be given, whenever possible within existing management plans for such MPAs, in addition to the proposed expansion of such networks, proposed in this document for review and feedback by Governments.

The following map summarize our suggestions for approximate site locations that should be included in such a regional network:

Marine Mammals Managed Area Network A Realistic Proposal?



Project "LifeWeb (SPAW-RAC)" (2014)

Governance Recommendations

No MSP process will be successful without a proper governance structure. The successful implementation of the suggested scenarios will depend on the existence of an efficient representative governance structure. Local, National and Regional structures need to be established (if non existent) and coordinate their activities with the backing of a legal framework. It is through this governance structure that MSP processes and the implementation of the agreed scenarios should be conducted.

Efforts, in terms of time and funds, in the implementation of scenarios that do not come from the agreements reached by a multi-sectorial, participative, legally-backed structure are bound to disappear with time.

Information Gap Analysis

One of the challenges faced in this analysis have been the scale and type of information provided in the maps.

A recommendation for future analysis is to ensure that the different variables presented in the maps have been collected at a similar geographical scale and at the smallest feasible scale. Homologation/normalization of information gathered from different sources is a relevant step while building the maps.

The identification of critical areas requires the capacity in the maps of zooming in those areas. If data was gathered at a very large/regional scale, obvious limitations are imposed on the zooming. Relevant information is missing in the available information and therefore, more detailed data should be generated on:

Fisheries effort by gear type,

Fishing effort data coming from actual number of vessels and time spent in the activity,

Intensity of small craft and cruise-ships traffic (number of vessels, routes and timing),

Statistics on port location and usage to map movements of crafts among ports,

Species distribution based on actual densities and at a 1x1 Km resolution,

Habitat conditions and physical relevant parameters (temperature, chlorophyll concentration, etc.) at a small scale.

Literature Cited

Agostini, V.N., S.W. Margles, S. R. Schill, J. E. Knowles, and R. J. Blyther. 2010. Marine Zoning in Saint Kitts and Sustainable Management of Marine Resources. The Nature Conservancy. 38 pp.

Halpern, B. S., S. Walbridge, K. A. Selkoe, C. V. Kappel, F. Micheli, C. D'Agrosa, J. F. Bruno, K. S. Casey, C. Ebert, H.E. Fox, R. Fujita, D. Heinemann, H. S. Lenihan, Elizabeth M. P. Madin, Matthew T. Perry, Elizabeth R. Selig, Mark Spalding, Robert Steneck, Reg Watson. 2008. A Global Map of Human Impact on Marine Ecosystems. *Science*: 319 no. 5865 pp. 948-952

Hoyt, E., 2011. Marine Protected Areas: a World Handbook for Cetacean Habitat Conservation and Planning. Earthscan. 464 p.

Swartz, S.L., T.Cole, M.A.McDonald, J.A.Hildebrand, E.M.Oleson, A.Martinez. P. Cplaphan, J. Barlow & M.L. Jonez. 2003. Acoustic and Visual Survey of Humpback Whale (*Megaptera novaeangliae*) Distribution in the Eastern Caribbean *Journal of Science*. Vol 39 (2): 195-208.