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Review of threats and implementation of the Regional Action Plan for the Conservation of Marine Mammals in the Wider Caribbean Region

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Abstract

The Action Plan for the Conservation of Marine Mammals in the Wider Caribbean Region (MMAP) was adopted in 2008 by Contracting Parties under the Protocol concerning Specially Protected Areas and Wildlife (SPAW) of the Cartagena Convention, administered by the United Nations Environment Programme (UN Environment). After more than a decade of MMAP-related programmatic work under SPAW, this paper presents a synthesis of major threats to marine mammals in the Region and an assessment of progress achieved by the 17 Contracting Parties to the SPAW Protocol toward achieving implementation of the MMAP and based upon a scientific and technical analysis conducted in 2020. The country assessment focused on 11 threat categories (indicators), along with two additional indicators relating to country legislation and national action plans. As part of this scientific and technical analysis, surveys were sent to SPAW Contracting Party focal points and individual interviews were conducted with key regional organizations and experts. For every SPAW Contracting Party, each indicator was assigned a relative level of its current intensity (Low, Moderate, High, or Unknown). A similar scheme was utilized to represent each country's response to that threat. The results highlighted those threats that were of concern for several countries and hence may be considered a management priority at the regional scale. In terms of threat mitigation, these priorities are: interaction between marine mammals and fisheries, pollution, and acoustic disturbance. Regarding needs, the development of national marine mammal action plans, as well as the implementation of research and monitoring programmes dedicated to marine mammals, should be considered a priority. Finally, two threats were found to be of high priority for knowledge enhancement: acoustic disturbance and vessel strikes. It is important to note that this review was not intended to single out insufficient country effort, but rather assist Wider Caribbean countries to identify threats and/or issue areas which would benefit from attention.

Keywords:
acoustic disturbance, bycatch, pollution, strandings, vessel strikes, SPAW Protocol

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Introduction

The Wider Caribbean Region (WCR) hosts a highly diversified community of marine mammals, serving as primary habitat for critical activities such as feeding, mating, and calving. At least 35 species of marine mammals occur in the WCR (SPAW-RAC, 2020): seven species of baleen whales (Mysticeti), 26 species of toothed whales (Odontoceti), and two sirenians (the West Indian manatee, *Trichechus manatus*; and the Amazonian manatee, *Trichechus inunguis*). At least seven of these species are Red -Listed by the International Union for Conservation of Nature (IUCN) as critically endangered, endangered or vulnerable, and at least eight are data deficient (IUCN, 2022).

The Convention on the Protection and Development of the Marine Environment of the Wider Caribbean Region was adopted in March 1983 at Cartagena de Indias, Colombia (thereafter known

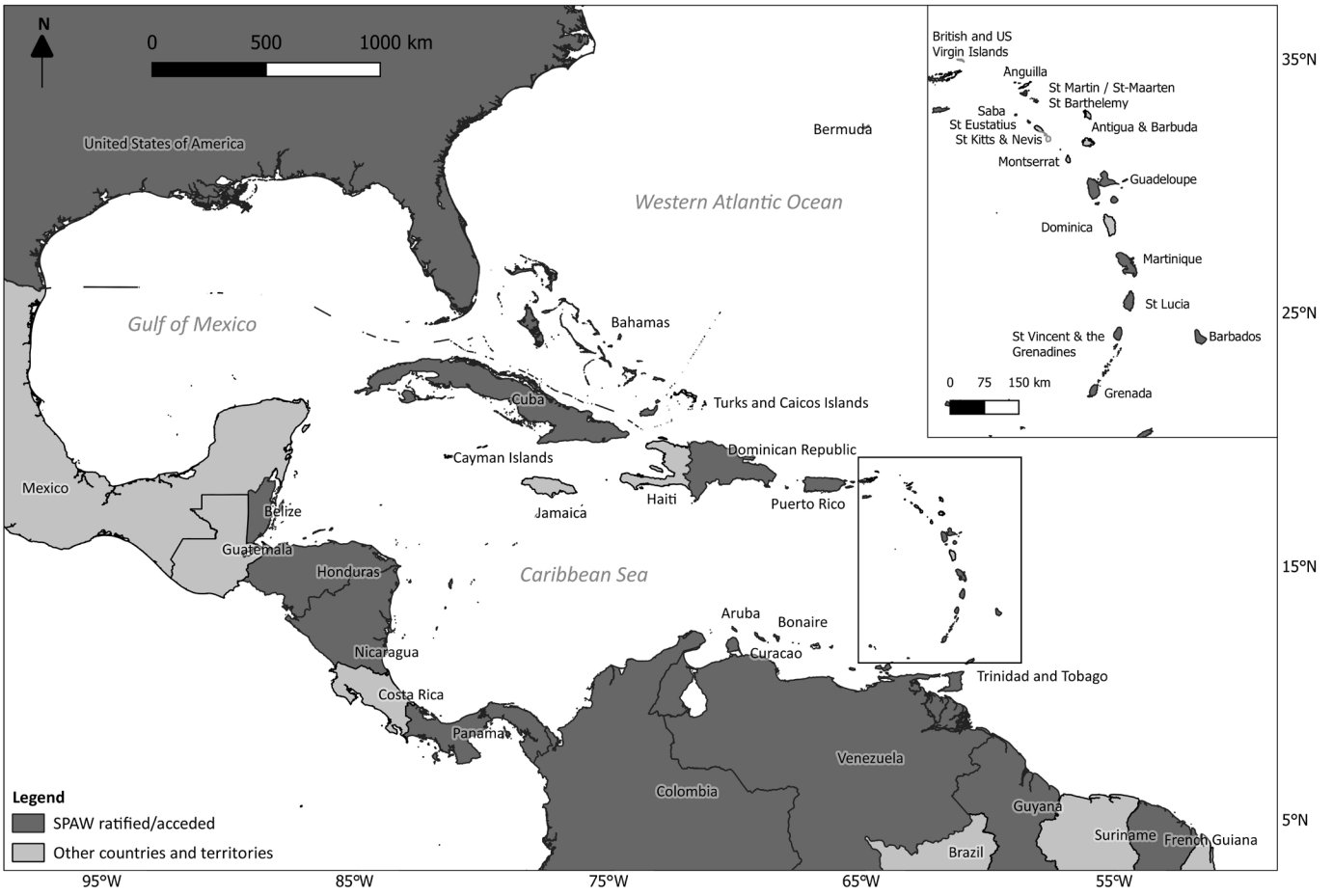

Figure 1. Map of the Wider Caribbean Region.

as the Cartagena Convention). To date, it has been ratified by 18 countries (Table 1), and it is administered by the United Nations Environment Programme acting as Secretariat through the Caribbean Environment Programme (CEP) in Kingston, Jamaica. As defined in its article 2, the Convention area means the marine environment of the Gulf of Mexico, the Caribbean Sea, the Guiana Shield up to French Guiana, and the areas of the Atlantic Ocean adjacent thereto, and within 200 nautical miles of the Atlantic coasts of signatory States (Fig. 1). Under the Convention, the Protocol Concerning Specially Protected Areas and Wildlife (SPAW Protocol) was adopted on 18 January 1990 and entered into force on 18 June 2000 as the only regional marine biodiversity legally-binding instrument in the WCR.

All cetacean and sirenian species are protected under the SPAW Protocol and are currently listed on its Annex II, which calls on Contracting Parties to ensure total protection and recovery for such listed species (Table 2). In addition, two otter species (giant, *Pteronura brasiliensis* and Neotropical, *Lontra longicaudis*) listed on Annexes II and III, respectively were included in the review because the MMAP (Action Plan for the Conservation of Marine Mammals in the Wider Caribbean Region) is not strictly limited to marine species, but also includes those that inhabit estuarine waters and beyond, to the limits of freshwater and ecologically-connected watersheds. Within the SPAW Protocol, "Wider Caribbean Region" has the meaning given to the term "the Convention are" in Article 2 (1) of the Convention, and also includes waters on the landward side of the baseline from which the breadth of the territorial sea is measured and extending, in the case of water courses, up to the freshwater limit, and such related terrestrial areas (including watersheds) as may be designated by the party having sovereignty and jurisdiction over such areas.

The MMAP was adopted by the Fifth Conference of the Parties of the SPAW Protocol in September 2008 (UNEP, 2008).

Table 1. Status of ratification of the SPAW Protocol. Current to August, 2022.

STATE	DATE OF RATIFICATION OR ACCESSION
The Bahamas	24 June 2010
Barbados	14 October 2002
Belize	04 January 2008
Colombia	05 January 1998
Cuba	04 August 1998
Dominican Republic	24 November 1998
France	05 April 2002
Grenada	05 March 2012
Guyana	14 July 2010
Honduras	13 October 2018
Netherlands	02 March 1992
Nicaragua	04 May 2021
Panama	27 September 1996
Saint Lucia	18 May 2000
Saint Vincent and the Grenadines	26 July 1991
Trinidad and Tobago	10 August 1999
United States of America	16 April 2003
Venezuela	28 January 1997

Table 2. Aquatic mammal taxa listed in Annexes II (strictly protected) and III (regulation of exploitation) of the SPAW Protocol.

Family	Scientific name	Common name	IUCN status[1] (2022)
Taxa listed in SPAW ANNEX II			
Order: CETACEA (All species)			
Balaenopteridae	*Balaenoptera musculus*	Blue whale	EN
	Balaenoptera physalus	Fin whale	VU
	Balaenoptera acutorostrata	Common minke whale	LC
	Balaenoptera edeni	Bryde's whale	LC
	Balaenoptera borealis	Sei whale	EN
	Megaptera novaeangliae	Humpback whale	LC
Balaenidae	*Eubalaena glacialis*	North Atlantic right whale	CR
Physeteridae	*Physeter macrocephalus*	Sperm whale, cachalot	VU
Kogiidae	*Kogia breviceps*	Pygmy sperm whale	DD
	Kogia sima	Dwarf sperm whale	DD
Ziphiidae	*Ziphius cavirostris*	Cuvier's beaked whale	LC
	Mesoplodon europaeus	Gervais' beaked whale	DD
	Mesoplodon densirostris	Blainville's beaked whale	DD
	Mesoplodon mirus	True's beaked whale	DD
	Mesoplodon bidens	Sowerby's beaked whale	DD
Delphinidae	*Orcinus orca*	Killer whale, orca	DD
	Globicephala macrorhynchus	Short-finned pilot whale	LC
	Pseudorca crassidens	False killer whale	NT
	Peponocephala electra	Melon-headed whale	LC
	Feresa attenuata	Pygmy killer whale	LC
	Steno bredanensis	Rough-toothed dolphin	LC
	Lagenodelphis hosei	Fraser's dolphin	LC
	Grampus griseus	Risso's dolphin	LC
	Tursiops truncatus	Common bottlenose dolphin	LC
	Stenella longirostris	Spinner dolphin	LC
	Stenella frontalis	Atlantic spotted dolphin	LC
	Stenella attenuata	Pantropical spotted dolphin	LC
	Stenella clymene	Clymene dolphin	LC
	Stenella coeruleoalba	Striped dolphin	LC
	Delphinus delphis	Common dolphin	LC
	Sotalia guianensis	Guiana dolphin	NT
	Sotalia fluviatilis	Tucuxi	EN
Iniidae	*Inia geoffrensis*	Amazon river dolphin, boto	EN
Order: SIRENIA (All species)			
Trichechidae	*Trichechus manatus*	West Indian manatee	VU
	Trichechus inunguis	Amazonian manatee	VU
Order: CARNIVORA			
Mustelidae	*Pteronura brasiliensis*	Giant otter	NE
Taxa listed in SPAW ANNEX III			
Order: CARNIVORA			
Mustelidae	*Lontra longicaudis*	Neotropical otter	NT

[1]EN = Endangered; VU = Vulnerable; LC = Least concern; CR = Critically endangered; DD = Data deficient; NT = Near threatened.

The MMAP is a non-binding instrument meant to guide and inspire national species recovery plans as well as regional cooperation to protect marine mammals and their habitats in the WCR. Hence, it does not replace other national, regional or global legal and regulatory instruments such as the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES), or the Convention on Migratory Species of Wild Animals (CMS), and similar multilateral agreements but rather serves as a regional framework to support the implementation of such agreements.

After more than a decade of MMAP-related programmatic work under SPAW, this paper presents a synthesis of the status of major threats to marine mammals in the WCR and an assessment of progress achieved by the 17 Contracting Parties to the SPAW Protocol toward achieving implementation of the MMAP.

This paper is based on marine mammal work coordinated by the Regional Activity Centre for the SPAW Protocol (SPAW-RAC) on behalf of SPAW Contracting Parties including a regional review of threats, country-by-country assessments (SPAW-RAC, 2020), and a summary of SPAW programme highlights to inform parties on regional marine mammal-focused initiatives and implementation of the Marine Mammal Action Plan (UNEP, 2021). At the time the study was conducted (2020), 17 countries had ratified the Protocol and were considered Contracting Parties. An additional country has become a Contracting Party since then (Table 1).

Regional Review of Threats

The WCR serves as primary habitat for marine mammal critical activities such as feeding, mating, and calving, although data

concerning the life history and distribution of these species are relatively lacking, despite some of these species being intensively studied elsewhere. However, focused regional and local research efforts and initiatives are being launched to address these data gaps. Results from the regional LifeWeb project (2010-2014) in the WCR (Regional Activity Centre for the Protocol Concerning Specially Protected Areas and Wildlife in the Wider Caribbean Region, n.d.) attemped to map and analyse essential marine mammal habitats for subsequent transboundary management and protection, and found that most of the existing data in the region focused on four marine mammal species: the humpback whale (*Megaptera novaeangliae*), sperm whale (*Physeter macrocephalus*), common bottlenose dolphin (*Tursiops truncatus*), and the West Indian manatee (UNEP-CEP, 2011). More recently, regional research efforts under the Caribbean-wide Orca Project (CWOP) are reviewing the status of the killer whale (*Orcinus orca*), minke whale (*Balaenoptera acutorostrata*), and false killer whale (*Pseudorca crassidens*) in the WCR (Bolaños-Jiménez et al., 2014b; 2021; Alvarado Hofmeister, 2021).

The scientific and technical analysis (SPAW-RAC, 2020) upon which this paper is based reviewed 11 threat categories as identified in the original SPAW Marine Mammal Action Plan. Highlights of the status review assessing these regional threats (indicators) is provided below.

Fisheries Interactions (Bycatch, entanglement, directed take)

In the WCR, most countries lack the resources, expertise, or technology to monitor or manage the bycatch of marine mammals (Bolaños-Jiménez & Rojas-Bracho, 2005; SPAW-RAC, 2020). At least 18 of the marine mammal species that occur in the WCR have been recorded as interacting with fishing gear, and at least 16 species of marine mammals have been documented as bycatch in artisanal and commercial fishing gear, including longlines, gillnets, trawls, beach seines, and traps (Bjorkland, 2011). Although most of the artisanal fisheries utilize hook-and-line, some marine mammal bycatch has been reported in or near fish-aggregating device technologies (FADs), including the entanglement of sperm whales near Guadeloupe and Dominica (Rinaldi & Rinaldi, 2016).

Gero & Whitehead (2016) suggested that 20 or more sperm whale entanglements may have occurred in the eastern Caribbean in 2015 alone. Sperm whale and humpback whale entanglements have also been noted in Aruba (Debrot et al., 2017), Martinique, and Guadeloupe (Rinaldi & Rinaldi, 2016). Major disfigurements have been observed in bottlenose dolphins, Atlantic spotted dolphins (*Stenella frontalis*), and false killer whales in Aruban waters and could be attributed to interactions with fishing gear (Luksenburg, 2014). The Regional Management Plan for the West Indian manatee notes that entanglement in fish and shrimp nets is a threat to the species (UNEP, 2010). Of the 16 species reportedly caught in fisheries in the Caribbean Large Marine Ecosystem (CLME), the most frequent interactions include short-finned pilot whales (*Globicephala macrorhynchus*), Risso's dolphins (*Grampus griseus*), Guiana dolphin (*Sotalia guianensis*), and beaked whales (*Ziphiidae* spp). (Bjorkland, 2011).

Marine mammal bycatch in gillnets (West Indian manatee and cetaceans) has been documented in the region, including Belize, Colombia, Mexico, Venezuela, and the United States (Bolaños-Jiménez & Rojas-Bracho, 2005; Bordin et al., 2022; Reeves et al., 2013). Tucuxi and Guiana dolphin have been documented in drift gillnets in Nicaragua and Venezuela, and presumed to be involved in western French Guiana (Van Waerebeek, 1990; Vidal et al., 1994; Chevalier, 2001; Bordin et al., 2022). Common bottlenose dolphins, manatees, and spotted dolphins have been documented in gillnet fisheries in Jamaica (Bjorkland et al., 2008). The Guiana dolphin and common bottlenose dolphins are also known to be incidentally captured by gillnets in Colombia and Venezuela, where estimates of 140-180 individuals/year, and 3-5 manatees per year are reported in Lake Maracaibo (Van Waerebeek, 1990; Vidal et al.,1994; Trujillo et al., 2013; Venezuela MMAP questionnaire response). In French Guiana, from 2014 to 2020, 26 Guiana dolphins were killed from entanglement in fishing gear, representing 60.5% of strandings (Bordin et al., 2022). The major cause of known mortality of manatees in Honduras from 1970 to 2007, based on 26 records, was entanglement in gillnets (González-Socoloske et al., 2011). Bottlenose dolphins and other cetaceans are incidentally caught in gillnet and crab trap fisheries in the southeastern United States and Gulf of Mexico adjacent to or part of the Caribbean region. Of the 49 commercial fisheries on the US east coast, 39 have documented bycatch, with the highest numbers occurring in fisheries in the Atlantic Caribbean, Gulf of Mexico large pelagic longline, and mid-Atlantic gillnet fisheries (Zollett, 2009; Reeves et al., 2013).

In the WCR, only one country (St. Vincent) currently conducts whaling with oversight by the International Whaling Commission (IWC), where cetaceans are killed for human consumption. Others use baleen whales for food opportunistically, such as when bycaught or stranded (Fielding, 2018). Small cetaceans, however, are subject to both opportunistic and organized takes (killing or live capture) by seven out of the 17 parties to the SPAW Protocol in their territorial waters (Bolaños-Jiménez et al., 2014a; AWI, 2019; Fielding & Kiszka, 2021). Small cetaceans have been hunted for their meat and blubber in St Vincent and the Grenadines since the early 20th century, exclusively out of the leeward village of Barrouallie. While short-finned pilot whales were originally the primary target, other dolphin species now represent the predominant take (Fielding & Kiszka, 2021). Catch data from 1949 to 2017 identifies the average annual take of 142.5 pilot whales and 210.6 "other dolphins" out of Barrouallie (Fielding, 2018; Fielding & Kiszka, 2021). In St Lucia, there are hunts for pilot whales and other whales and dolphins, including pygmy (*Feresa attenuata*) and false killer whales, bottlenose dolphins, Atlantic, and pantropical spotted dolphins (*Stenella attenuata*), striped dolphins (*S. coeruleoalba*), killer whales, Fraser's dolphins (*Lagenodelphis hosei*), and melon-headed whales (*Peponocephala electra*) (AWI, 2019). Other countries, including Trinidad and Tobago, continue to opportunistically hunt short-finned pilot whales, false killer whales, common bottlenose, spotted and spinner dolphins (*Stenella* sp.) (Robards & Reeves, 2011). The illegal hunting for meat and for use as bait has been identified as the major threat to freshwater aquatic mammals in Venezuela (Ferrer et al., 2017), with estimated but unconfirmed figures of small cetaceans hunted per year ranging from several hundred to 21,000 (Altherr & Hodges, 2018). Botos are illegally killed in Brazil and used as shark bait in longline or for the piracatinga (catfish) fishery, with commercial exports of piracatinga to

Colombia and for local consumption continuing to grow (IWC, 2018b; 2020). Manatees are killed for their meat by fishermen but are also subject to entanglement in fishing nets. Illegal hunting has been documented in range states such as Belize, Colombia, Panama, Costa Rica, Mexico, Haiti, Honduras, Dominican Republic, Guyana, and Venezuela (UNEP, 1995; González-Socoloske et al., 2011; Kiszka, 2014; Ferrer et al., 2017).

Habitat Degradation and Coastal Development

Caribbean marine and coastal habitats are characterized by coral reefs, mangrove forests, and seagrass meadows. Human activities such as infrastructure expansion, land-based and marine-based tourism, fishing and harvesting of living resources, mining, fossil fuel exploration, wastewater and solid waste disposal, shipping, and agriculture impact marine environments where marine mammals feed, socialize, travel, or rest. Mapping exercises under the LifeWeb Project indicate that for the north coast of the Dominican Republic, there are areas with intense commercial traffic overlapping well-known habitats for humpback whales, including the Marine Mammal Sanctuary of the Dominican Republic. This is a similar scenario for north of Puerto Rico and for Martinique, Guadeloupe, and St Kitts and Nevis, where critical areas for specific marine mammal species (except the West Indian manatee) overlap with high maritime traffic (SPAW-RAC, 2020). Within the past five years, the Kingdom of the Netherlands, St Lucia, St Kitts and Nevis, Jamaica, Dominica, Antigua and Barbuda, the US Virgin Islands, and the Bahamas have announced resort, marina, or port development projects that are located in, or adjacent to, sensitive ecosystems containing corals, mangroves, and seagrasses (UNEP-CEP, 2020). Since 2011, regular influxes of *Sargassum* into the Wider Caribbean region is a cause of increasing concern, being a type of brown alga or seaweed that forms large floating mats, often referred to as "golden tides". Satellite images have shown unusually high amounts of *Sargassum* spreading throughout the tropical Atlantic and Caribbean Sea in 2018 (UNEP, 2018). *Sargassum* negatively impacts fisheries, waterways, shorelines and tourism, but more research is required to determine the nature and scope of ecological impacts in the region, and on marine mammals (UNEP-CEP, 2021).

Pollution and Marine Mammal Health

The volume of maritime transport in the region constitutes an important source of pollution through the discharge of garbage and waste (marine debris). Sources of pollution from shipping include ballast water, sewage, grey water, solid waste, noise, oil discharges, and air emissions. Marine mammals may be affected by algal blooms through inhalation or the ingestion of food web transfer (Fire & Van Dolah, 2012). There have been no toxic tides reported in the insular Caribbean; however, small, restricted bays in the southern Caribbean may be vulnerable to this problem, although it is not reported on a regional level (Williams & Bunkley-Williams, 2000). Large mass mortalities of the West Indian manatee have been caused by toxic algal outbreaks in Florida over several decades and most recently in 2018. Similarly, over 180 bottlenose dolphins were likely killed by toxic algal blooms (*i.e.*, the red tide) in a declared Unusual Mortality Event (UME) from 2018 to 2019 along Florida's coastline (NOAA Fisheries, 2022).

As a result of the BP *Deepwater Horizon* oil spill in April 2010, oil exposure has caused reproductive and organ damage and has contributed to the largest and longest marine mammal UME ever recorded in the Gulf of Mexico, including a 50% decline in some bottlenose dolphin populations in the northern Gulf (NOAA, 2017). Oil exposure resulted in up to a 7% decline in the population of endangered sperm whales in the Gulf of Mexico and nearly half of the critically endangered Gulf of Mexico Bryde's whales were impacted by oil with a population decline of 22% (NOAA, 2020).

Oil and gas seismic exploration can impact the hearing and navigation of marine mammals, and shipping vessels can injure whales more directly through ship strikes. Belize has banned oil exploration, and Trinidad and Tobago is the most established and largest oil and gas producer in the region, with Guyana (Alleyne et al., 2018; A. Arjoons, pers. com., 17 March 2020), Aruba, Jamaica, Barbados, and the Bahamas in various stages of exploration. A 2015 review of seismic mitigation measures along northern South America indicates that Brazil and Colombia have adopted formal guidelines, whereas other countries in this area have applied general internationally accepted mitigation measures (MamaCocoSea Project, 2015).

Due to their position at the top of the food chain, toothed cetaceans tend to accumulate higher contaminant loads (Booth & Zeller, 2005). Mercury is discharged from artisanal mining operations in the Amazon Basin, including Colombia, Venezuela, Guyana, French Guiana, and Suriname, and flows into the Caribbean basin by the rivers from the region's major drainage basins (CLME+, 2013). Mosquera-Guerra et al. (2019) recorded total mercury in 46 river dolphins (*Inia* and *Sotalia*) including from Arauca, Amazon and Orinoco rivers (Colombia) evidencing the role of these species as bioindicators of the presence of mercury in natural aquatic environments. Information from St Vincent notes the high levels of mercury and selenium in pilot whales, killer whales, Risso's dolphins, and other small cetaceans that are caught and consumed on the island, and especially in Barrouallie (McCormack et al., 2020).

Marine litter is accumulating in the region, where up to 80% of the litter found in the Caribbean Sea is made of plastic (Diez et al., 2019). Most emanates from land-based sources, including shoreline and recreational activities that contribute upwards of 86% of the marine litter collected between 2006 and 2012 (UNEP-CEP, 2014). Currently, there are 14 Caribbean countries that have banned plastic bags and/or Styrofoam as part of efforts to combat marine pollution.

Little is known about the type, amount, and sources of abandoned, lost, or discarded fishing gear (ALDFG) in the Caribbean. A review of marine debris indicated that little information is available on contamination of the biota in the WCR (Ivar do Sul & Costa, 2007). Ingestion of anthropogenic debris has been documented in two stranded beaked-whale specimens for the Dutch Caribbean (Debrot et al., 2017) and a manatee died from the effects of ingesting a large sheet of plastic in Florida (Heneman, 1988).

Whale Watching and Associated Activities

Although detailed information for the WCR is incomplete, in 2008 there were at least 21 countries and territories that offer some form of marine mammal watching (Carlson, 2008). These include land-based, vessel-based sightings and listening tours,

as well as swim-with experiences, utilizing vessels ranging from small zodiacs to cruise ships. The countries with the highest whale watcher expenditures include The Bahamas, Dominica, and the Dominican Republic (Hoyt & Hvenegard, 2002). Whale tourism expenditures on Dominica generate approximately $3 million US dollars in annual net profit (Gerst et al., 2020). In Guadeloupe, Martinique and St Martin, the whale watch industry generated over two million Euros in 2015 (Mayol et al., 2015). Tourism activities focusing on cetaceans often involve invasive activities (such as swimming with the animals) that may cause disturbance, including vessel strikes, and other physical injuries (New et al., 2020).

Protected Areas and other Management Regimes

The designation of ecologically-sensitive or biologically-important areas, whether in the form of delineated marine protected areas under national designation or through the SPAW Protocol, may help to reverse the downward trend in general habitat degradation and loss of critical coastal ecosystems throughout the region. Protected areas can be used as control sites for scientific research and comparative analyses.

Research Programmes

Information on the distribution, abundance, and ecology of marine mammals in the Wider Caribbean Region is scarce (Lucke et al., 2014). Research efforts in the region have ranged from visual to acoustic surveys, satellite telemetry, and stranding response. Genetic studies have also increased, including with manatees (Vilaça et al., 2019), contributing some baseline knowledge about marine mammals in Puerto Rico, Cuba, Colombia, Bahamas, Mexico, and Honduras (Caballero et al., 2011). A variety of online data platforms (*e.g.*, Flukebook, Obsenmer, Observation.org) are currently being utilised in the region, facilitating the availability and sharing of data. The UNEP-Spain LifeWeb project (2010-2014) aimed to map marine mammal occurrence against some of the primary threats in the Region through the collection of GIS-generated data (SPAW-RAC – accessible via http://www.ancien-site.car-spaw-rac.org/?-SPAW-RAC-Mapping-Application-), recognizing that population-level assessments at the regional and local level are severely lacking. Project outputs included mapping of critical marine mammal habitats, regional-scale migration routes, and socio-economic information on human activities to underpin broad-scale spatial planning and management of human impacts on marine mammals in the Caribbean (and Southeast Pacific).

Strandings

Marine mammal strandings occur throughout the WCR. Stranding networks are important vehicles to provide data on many levels and across threats, informing issues such as bycatch, vessel strike, noise impact, contaminants assessment, improving basic knowledge on species (*e.g.*, reproduction, diet) and enhancing collaboration among WCR countries. Stranding networks have been developed in several SPAW countries. Capacity building and training workshops have been held in the past under the auspices of the SPAW MMAP, with the purpose of providing stranding response necropsy training, and disentanglement training by the IWC in partnership with UNEP-CEP SPAW Programme (Ward, 2007; 2010; Ward & Rinaldi, 2010). A compilation of protocols and techniques for responding to strandings was elaborated resulting from these workshops (Ward, 2007). The development of a stranding network was also identified as a priority during the 2013 MamaCocoSea workshop for countries in the northern South America (MamaCocoSea Project, 2013).

Captivity

Several species of marine mammals are maintained in captivity in the WCR (in both tanks and sea-pens) for the purpose of display to the public who pay to view them. Opportunities for direct physical contact with whales, dolphins, sea lions, and even manatees, including touching, feeding, and swimming with wild and captive animals, are increasing in range and intensity in the WCR. As of November 2020, there were 54 facilities in the insular Caribbean (not including US facilities), holding at least 565 individual cetaceans as per data compiled by Cetabase (www.cetabase.org). The authors were unable to verify the numbers of pinnipeds being held. Cetabase provides an updated list of captive cetaceans for the WCR (Available from https://docs.google.com/spreadsheets/d/1pWFqIwZ8msdQCwOip2D-RinCLEbT0y9fW71LL5GYP5c/edit?usp=sharing). There are very limited data on dolphin population assessments in the WCR, hence the impact of live captures and their potential harm to local wild populations remains unknown.The common bottlenose dolphin is the most commonly held species of cetacean in captivity in facilities in the WCR, although the Guiana dolphin has also been involved in shows performing alongside common bottlenose dolphins in Colombian facilities (Santos et al., 2010).

The Bahamas, British Virgin Islands (Tortola), US Virgin Islands, Cayman Islands, Colombia, Cuba, Curaçao, Dominican Republic, France, Honduras, Jamaica, Mexico, St Kitts and Nevis, Venezuela and the US offer different experiences with dolphin displays and dolphin interactive programmes.

Most cetacean capture methods are invasive, stressful, and can potentially be lethal. They can also fracture populations that are traumatized after the chase and handling of operators, and who may selectively take individuals from the population (St Aubin et al., 2011). At least 10 bottlenose dolphins were captured in Guyana in 2004 (up to 50 were authorized over the course of several years), and 15 dolphins were captured in 2005 near Roatan Island, Honduras (Rose & Parsons, 2019), as well as in Venezuela where 12 dolphins were illegally captured in May 2004 (Faría et al., in prep.). As reported in 2007, Cuba maintains a direct live capture fishery for bottlenose dolphins via annual quotas which are assigned to dolphinaria of various countries under CITES (Espinosa & Orta, 2007). Exports from Cuba include six dolphins sent in 2007 to the Dolphin Academy on Curaçao, and nine animals sent to Venezuela in 2011 and 2013 (Rose & Parsons, 2019). The level of ongoing or more recent exports is uncertain. The numbers of dolphins captured for domestic use is unknown, and there have been no studies to determine whether these removals are sustainable, considering the lack of sufficient data on the status of dolphin populations throughout the region.

Parties to CITES can export specimens if the exporting party issues a non-detriment finding (NDF), stating that removals will not harm wild populations. Bottlenose dolphins are listed on CITES Appendix II and as such require a non-detriment finding (NDF) for their export (Parsons et al., 2010).

Acoustic disturbance and underwater noise

There is increasing concern regarding the potential effects on marine mammals of underwater noise produced during geophysical seismic surveys, military (naval) training exercises, and vessel traffic. Cetacean mass stranding events have been associated with military operations across the globe (D'Amico et al., 2009). Vessel noise is also a known source of disturbance for cetaceans, including from whale watching vessels (Senigaglia et al., 2016).

Seismic surveys continue to occur around the Caribbean isles with increasing oil and gas exploration, with a recent survey conducted by the Texas University in November 2014 in the coastal waters around Bonaire (Debrot et al., 2017), and the Bahamas in 2020 (Palmer, 2021).

The US Navy's Atlantic Undersea Test and Evaluation Center (AUTEC) on Andros Island, within the Bahamas, is used for naval exercises involving the use of mid-frequency active sonars which have been associated with beaked whale mass stranding events in the Bahamas and elsewhere (Balcomb & Claridge, 2001; Moretti, 2017; Simonis et al., 2020).

In Panama, the intense bottlenose dolphin watching activities in Bocas del Toro, where a resident population is the main target, reveal that despite guidelines, engine and propeller noise are the principal causes of disturbances (May-Collado et al., 2018). Kassamali-Fox et al.(2020) report that in the presence of tour boats, activity budgets for foraging decreased and traveling increased.

Vessel strikes

Shipping in the WCR is one of the main identifiable anthropogenic impact drivers within the region, with high concentrations of shipping lanes throughout the Caribbean islands. Data from the Lifeweb Project, current to 2012, indicated that shipping intensity mainly consists of lanes utilized by industrial cargo liners and ferries with fixed cycles of repetition in a fixed lane, mainly between interisland shipping lanes. Commercial cruise vessel data is less available but is considered significant. Vessel traffic not only contributes to direct injury to marine mammals, but also serves as a significant source of underwater noise in the region (Heenehan et al., 2019). A joint IWC and SPAW Workshop to address collisions between marine mammals and with a focus on the WCR (IWC-SPAW, 2014) documented that there are around 10 reports of vessel strikes from the region listed in the IWC Ship Strikes Database from 1961 to present. This may reflect underreporting, rather than absence of occurrence. From 1991 to 2010 four ship strikes were recorded, including Omura's whale (*Balaenoptera omurai,* 1 Nov 2000, 100 km SW Bonaire Island), sperm whale (18 January 2001, 20 nm off Puerto Rico), Bryde's whale (*Balaenoptera edeni,* 11 January 2000, SW of Bonaire), and pygmy sperm whale (*Kogia breviceps,* 30 October 1991, St. Croix Island, Virgin Islands). Some additional reports exist from Guadeloupe (five strikes) and potentially two further reports from the Dominican Republic. The Workshop noted that small cetaceans are probably involved in collisions with smaller fishing boats too as many of the photographs of small cetaceans taken for photo-identification purposes within the region have propeller scars. It is likely that the occurrence of ship strikes in the Caribbean region is highly underreported (Debrot et al., 2017).

Luksenburg (2014) found high incidences of external injury in small coastal cetaceans in Aruban waters. In Venezuela, the probable cause of death for 19 of the 624 documented strandings that were analyzed was identified as resulting from collisions with vessels (Bolaños-Jiménez et al., 2014a). In the southeastern United States, collision with vessels is the primary threat to manatee populations. In 2018, manatee mortality rates were the highest in the previous five years, with the average number of deaths ranging between 371 to 538 deaths annually (Olsen & Krietz, 2020). Reports from Belize also indicate that vessel strikes are the primary threat to manatee populations (LaCommare et al., 2008), where collisions accounted for the highest number of strandings based on a dataset analysis from 1997 to 2019 (Galves et al., 2022).

Climate change

The threat and consequences posed by climate change for small island developing states and the Caribbean are forecasted to be significant. The key changes in climate expected for the Caribbean include increases in air and sea surface temperatures, an increase in sea level and ocean acidification, an increase in the frequency and intensity of storms and hurricanes, and greater overall unpredictability in weather (Nurse et al., 2014).

Climate change is also expected to exacerbate existing threats to marine mammals through habitat loss, disease, pollution, and interactions with human activities (Gulland et al., 2022). This is particularly true in the WCR, where the health and productivity of coral reef and mangrove ecosystems are highly correlated with sea surface temperature (Nurse et al., 2014). Possible marine mammal responses to climate changes include shift of distribution and preferred habitat utilization (Albouy et al., 2020). In addition, loss of supporting habitat for coastal/estuarine species will impact prey availability (Birchenough, 2017).

In the Caribbean, cetacean prey source supplies are to a large extent the result of wind-induced upwellings (Debrot et al., 2017). In tropical areas, marine mammals will likely have to deal with increased thermal stress, more frequent cases of toxic algal blooms, and reduced freshwater flows which will tend to concentrate environmental contaminants from land in coastal and estuarine areas (IWC, 2010). The species that may be affected include coastal tropical cetaceans (and the West Indian manatee) in regions where coral reef tourism may decline or be displaced due to the conditions of reef health. Those species occurring in the Economic Exclusive Zones (EEZ) of countries faced with drought and decreasing precipitation may also be affected, where consequent declines in food security may result in greater reliance on marine ecosystems and prey depletion for marine mammals (IWC, 2014).

Materials and methods

Data collection

To obtain data on marine mammal populations in the WCR, a variety of sources were used, not only pertaining to the 17 countries which are Contracting Parties to SPAW (Table 1), but also more broadly to the entire WCR, and included scientific, technical, and other published grey literature; websites of regional and

international organizations of relevance; and outputs from major initiatives on marine mammals in the WCR between 2009 and 2021. Reports and recommendations, including SPAW Programme meeting and other programmatic information documents (UNEP, 2009, 2019; UNEP-CEP, 2019) were also reviewed. While recognising that several countries have both Caribbean and Pacific coasts and may be parties to UN Environment Regional Seas Conventions in both regions, the country analyses focused on the Caribbean Sea.

Framework

Formal interviews were scheduled with SPAW government focal points, experts, and other collaborative organisations between February and May 2020. A questionnaire was drafted in English, French, and Spanish to guide these interviews to solicit information relating to country-specific measures, regulations, and programmes pertaining to marine mammal protection. The questionnaire was drafted to incorporate categorical elements (threats), including actions and indicators (*i.e.*, outputs) of progress noted in the 2008 prioritized MMAP, to provide a basis for comparative evaluation against original MMAP priorities and national effort. Interviews were conducted via teleconferencing tools and lasted on average between 30 minutes to 1.5 hours (12 SPAW focal point interviews were successfully conducted out of 17 Contracting Parties). Some contracting parties provided feedback on draft country assessments that were sent to them for review to ensure author accuracy.

Assessment

MMAP Evaluation Tool

To provide a visual tool to represent relative progress toward the implementation of the MMAP, a set of benchmarks was devised to establish a pool of criteria that could be used to qualitatively evaluate progress towards the primary goal of implementing MMAP objectives as presented in the original MMAP. Given the relative lack of consolidated or harmonized regional data, the challenges inherent to summarizing and evaluating trends and progress should be acknowledged and considered as a limitation of this study. Furthermore, assessment of the adequacy or effectiveness of measures, initiatives, or programmes reviewed was beyond the scope of this study. However, this review also aimed to identify gaps and general trends and highlight recommendations to further marine mammal protection in the WCR.

In addition to the 11 primary categories of threat indicators identified in the MMAP, an additional two categories were included to create a pool of 13 indicators or evaluative markers by which to assess progress toward implementation of MMAP objectives.

Indicators and definitions

These 13 indicators include:

1. The existence of national legislation relating to marine mammal conservation and/or welfare;
2. The existence of marine mammal species-specific recovery plans and/or a national marine mammal action plan (a primary objective of the SPAW MMAP) by a given country; and
3. The 11 categorical issues (threat categories) identified within the original SPAW MMA: fisheries interactions, habitat degradation and coastal development, pollution and marine mammal health, protected areas and other management regimes, research, whale watch and associated activities, strandings, captivity, acoustic disturbance and underwater noise, vessel strikes, and climate change.

Threat levels

To evaluate progress toward the implementation of the MMAP for the current 17 SPAW Parties, each threat indicator was assigned a categorical designation based on the relative level of intensity (Low, Moderate, High, Unknown). These designations were based upon state of knowledge about a regional threat since the adoption of the MMAP in 2008, whether it may be increasing, decreasing or unknown/unchanged, assessments available at a national level derived from all available data sources, and general scientific consensus for a more wide-spread or impending threat (*e.g.*, climate change).

Country response levels

A similar scheme was utilized to represent the countries' response to that threat (Low, Moderate, High, Unknown). Designations were based upon a country's state of knowledge and preparedness regarding a regional threat since the adoption of the MMAP in 2008, and a country's response at a national level derived from all available data sources relating to initiatives, plans, programmes, intentions, or actions designed to address that threat. Country responses were not judged based on whether a country should have measures in place based in the relative presence or absence of specific threats, but rather the degree to which the threat, if present, is being addressed. No assumptions were made regarding threat levels where data were scarce. However, in the absence of local data, some reasonable assumptions based in a precautionary approach (*e.g.,* where there is high vessel traffic, the threat of a ship strike is likely higher) were made, especially where regional data or scientific consensus around an issue supported an assumption of relative risk levels.

Similarly, where country response was low, the authors could not necessarily assume that the threat level was therefore higher (as a result of inaction). A country might not be expected to preemptively respond to an indicator that is not currently a local threat and would equally receive a low response designation (*e.g.*, if there are no captive marine mammal facilities or intention to pursue captive programmes, a country would not reasonably be expected to have captive marine mammal regulations as part of its legislation). These correlations between country response and intensity of a threat level would be dependent not only on the availability of data to support such a correlation but other factors, such as political will, and financial and institutional capacity and are therefore beyond the scope of this study.

A visual representation was devised and detailed in SPAW-RAC (2020) supporting country assessments, using both quantitative and qualitative data available through all modes of data collection identified above and utilizing benchmarks of action. The results from this analysis include a variety of color combinations along a spectrum of high to low response when mapped against various threat levels for each Contracting Party and based on a color scheme as follows:

Threat (Intensity)	Country response
Low	Low
Moderate	Moderate
High	High
Unknown	Unknown

This review was not intended to single out insufficient country effort or response, or effectiveness of legislation. Its purpose is to help to identify areas that could benefit from attention and focus, or a coordinated national response, consistent with the spirit and intent of the MMAP and the precautionary principle.

As a result, the utility of this analysis is primarily to prioritize action around those assessments that suggest high intensity threats and low country responses, and high intensity threats and unknown country responses.

Results and discussion

Given the nature of the visual tool to represent relative progress toward the implementation of the MMAP, differing amounts of information available for country assessments, and the varying levels of responses and reviews received from contracting parties regarding these assessments, the results of the present analysis may best serve as an evolving tool that can be used to update future country assessments and track progress.

Country assessments

The country-by-country assessments suggested that, although some of the major threats and needs have been addressed (Table 3, green color), for the vast majority of countries in the WCR several areas would benefit from attention (red color). In some cases, implemented measures have been insufficient to mitigate threats. For example, in several countries, although integrated coastal zone management plans and policies have been implemented, marine mammal habitat degradation remains a major threat. Results also highlighted the areas that were of concern for several countries and hence may be considered a management priority at the regional scale. In terms of threat mitigation, these are: interactions between marine mammals and fisheries, pollution, and acoustic disturbance. Regarding needs, the development of marine mammal national action plans as well as the implementation of research and monitoring programmes dedicated to marine mammals should be considered a priority. Finally, two areas were found to be of high priority for knowledge enhancement: acoustic disturbance and vessel strikes.

Threat (Intensity)	Country response
High	Low
High	Unknown

The assessment visually highlights areas of need. Countries may benefit from focusing attention on areas of little knowledge

Table 3. Progress toward the implementation of the MMAP for the 17 SPAW Parties. Summary of country threat indicators assessment and country responses (according to the colour code described in Materials and Methods).

Threat indicator	National legislation on marine mammal conservation		National marine mammal/ species specific action plan(s)		Fisheries interactions		Habitat degradation and coastal development		Pollution and marine mammal health		Whale watch and associated activities		Protected areas and other management regimes	
	In each column, Threat intensity/Country response are presented side by side													
The Bahamas	Yes		No											
Barbados	No		No											
Belize	Yes		Yes											
Colombia	No		Yes											
Cuba	Yes		No											
Dominican Republic	Yes		Yes											
France[1]	Yes		Yes											
Grenada	No		No											
Guyana	No		No											
Honduras	Yes		No											
Kingdom of the Netherlands[2]	No		No											
Caribbean Netherlands[3]	No		No											
Panama	Yes		No											
St Lucia	No		No											
St Vincent and the Grenadines	No		No											
Trinidad and Tobago	No		No											
United States	Yes		Yes											
Venezuela	No		No											

[1]French Guiana, Guadeloupe, Martinique, Saint Barthélemy, and Saint Martin (while recognizing the different environmental context of French Guiana, setting it apart from the other four insular French territories in the WCR, all territories are highlighted together in France's country assessment for the sake of consistency).
[2]Aruba, St Maarten and Curaçao
[3]Bonaire, St Eustatius and Saba

Table 3 (continued). Progress toward the implementation of the MMAP for the 17 SPAW Parties. Summary of country threat indicators assessment and country responses (according to the colour code described in Materials and Methods).

Threat indicator	Research		Strandings		Captivity		Acoustic disturbance		Vessel strikes		Climate change	
	In each column, Threat intensity/Country response are presented side by side											
The Bahamas												
Barbados												
Belize												
Colombia												
Cuba												
Dominican Republic												
France1												
Grenada												
Guyana												
Honduras												
Kingdom of the Netherlands[2]												
Caribbean Netherlands[3]												
Panama												
St Lucia												
St Vincent and the Grenadines												
Trinidad and Tobago												
United States												
Venezuela												

[1]French Guiana, Guadeloupe, Martinique, Saint Barthélemy, and Saint Martin (while recognizing the different environmental context of French Guiana, setting it apart from the other four insular French territories in the WCR, all territories are highlighted together in France's country assessment for the sake of consistency).
[2]Aruba, St Maarten and Curaçao
[3]Bonaire, St Eustatius and Saba

(gray), high threat intensity (red), and areas of low country response (red). Based on the visual tool, areas of critical need are represented below.

The country analyses required agreement upon benchmark measures for each threat by which the authors could evaluate awareness to, planning, or action toward mitigating or alleviating the threat. A review of regional threats provided the opportunity to evaluate the status of each threat indicator and measures that were being undertaken, or could be undertaken, to assess progress toward implementation.

Table 4 provides an overview of general benchmark measures implemented by countries in support of the MMAP. While not exhaustive, these measures do not represent all possible measures that could be adopted or implemented by a Contracting Party to address or mitigate a particular threat and may serve as milestones of action for each threat indicator or category.

Summary of Regional responses by threat category

For the purposes of this paper, the discussion below highlights and summarizes country responses to key threats. Although not comprehensive, a more detailed country-by-country assessment is available in the Scientific and Technical Analysis (SPAW-RAC, 2020) upon which this review is based.

Fisheries Interactions [Bycatch, entanglement, and directed take]

Artisanal and small-scale fisheries comprise the majority of fisheries in the WCR and country responses to fisheries interactions are varied. In the United States, bottlenose dolphin take reduction teams assess marine mammal bycatch in fisheries from New York to Florida, and the Gulf of Mexico, and respond to limits set by the US Marine Mammal Protection Act through a variety of measures, including mandated observer programs, regulatory restrictions on fisheries, area closures, gear modifications, and outreach programmes. The US also has a robust network of emergency responders to disentanglements of cetaceans. Through collaboration between the World Wide Fund for Nature-WWF and the Fishery Committee in French Guiana, the deployment of modified fishing gear to reduce bycatch has been implemented.

In response to the growing concern about marine mammal entanglements, in collaboration with the SPAW Programme, the IWC held a series of training workshops between 2012 and 2014 in the region (IWC, 2018a). Guidelines under UNEP-CMS on the safe and humane handling and release of small cetaceans accidentally bycaught in fishing gear, recognize that reducing stress and increasing the safe release of animals, and thus potential for survival, are an integral part of sustainable fisheries goals (Hamer & Minton, 2020). Campaigns for removal of gear and some training to fishermen is offered in the Dominican Republic and in Venezuela in conjunction with the Center for Shark Research for both cetaceans and elasmobranchs (SPAW-RAC, 2020).

The LifeWeb project mapping tool provides a bird's eye view of areas where marine mammal species overlap with high-intensity fishing activity. Bycatch is a more significant threat for those species that most frequently interact with fisheries, including bottlenose dolphins, pilot whales, Risso's dolphins, tucuxi, Guiana dolphin, and beaked whales. A comprehensive regional bycatch assessment and analysis would inform targeted bycatch reduction measures and marine spatial planning, and

Table 4. General measures adopted by SPAW Contracting Parties in support of MMAP implementation.

Contracting party	National legislation on marine mammal conservation	National action plan or species recovery, management plans	Bycatch reduction or marine mammal component to fisheries legislation	Integrated coastal zone management plans and policies	Oil spill contingency plan	Responsible viewing guidelines
The Bahamas	Yes	No	Yes	Yes	Yes	No
Barbados	No	No	No	Yes	Yes	No
Belize	Yes	Yes	Yes	Yes	Yes	No
Colombia	No	Yes	Yes	Yes	Yes	Yes
Cuba	Yes	No	No	Yes	Yes	No
Dominican Republic	Yes	Yes	No	Yes	Yes	Yes
France[1]	Yes	Yes	Yes	Yes	Yes	Yes
Grenada	No	No	No	Yes	Yes	No
Guyana	No	No	No	Yes	Yes	No
Honduras	Yes	No	No	Yes	Yes	No
Kingdom of the Netherlands[2]	No	No	Yes	Yes	Yes	No
Caribbean Netherlands[3]	No	No	Yes	Yes	Yes	No
Panama	Yes	No	Yes	Yes	Yes	Yes
St Lucia	No	No	No	Yes	Yes	No
St Vincent and the Grenadines	No	No	No	Yes	Yes	No
Trinidad and Tobago	No	No	No	Yes	Yes	No
United States	Yes	Yes	Yes	Yes	Yes	Yes
Venezuela	No	Yes	No	Yes	Yes	No

[1]French Guiana, Guadeloupe, Martinique, Saint Barthélemy, and Saint Martin (while recognizing the different environmental context of French Guiana, setting it apart from the other four insular French territories in the WCR, all territories are highlighted together in France's country assessment for the sake of consistency).
[2]Aruba, St Maarten and Curaçao
[3]Bonaire, St Eustatius and Saba

better understand spatial and temporal bycatch patterns. The level of engagement from fisheries organisations in the region in addressing marine mammal bycatch is low, despite increased and positive cooperation with the SPAW Programme over the last decade. Marine mammal references and data are missing from regional fisheries reports and action plans.

SPAW Parties and other countries in the WCR still legally and illegally take (hunt, capture, kill) marine mammals annually, and specifically cetaceans, in violation of their commitments to the SPAW Protocol (AWI, 2019). Some marine mammals are opportunistically and directly targeted for hunting as a food source and for use as bait in fisheries in the WCR.

At the 10th Meeting of SPAW Parties in 2019, Contracting Parties adopted a series of recommendations relating to cetacean protection, including the promulgation of national legislation prohibiting the take, capture, killing and harassment of marine mammals, including all cetacean species and the West Indian manatee (UNEP, 2019).

Currently, no Parties are reporting the directed takes (hunting) of marine mammals. These takes require an exemption under the SPAW Protocol. Unlike for Article 11(2) exemptions, guidance has not been articulated for Parties for actions that might be pertinent under Article 14. Those countries seeking an exemption for traditional marine mammal hunting activities under Article 14 would require population assessments to determine that such activities do not "cause either the extinction of, or a substantial risk to, or substantial reduction in the number of, individuals making up populations of species of fauna, particularly migratory species and threatened, endangered or endemic species." Because no baseline data is being collected on targeted populations, the impact of these hunts on local or regional marine mammal populations is unknown.

Habitat Degradation and Coastal Development

Most countries have adopted and are implementing tools and strategies for the conservation and maintenance of goods and services by coastal and marine habitats, such as integrated coastal management plans. However, coastal development and habitat destruction remain a significant challenge for many countries within the WCR as is basic wastewater disposal, including the disposal of raw sewage. Countries often do not include marine mammal protection when conducting environmental impact assessments as fundamental to all coastal and deep-water planning and development projects and permitting. SPAW Contracting Parties are currently not reporting or seeking review by the SPAW Scientific, Technical and Advisory Committee for all significant coastal development projects prior to approval for assessment of pertinence under the Exemptions provision of the SPAW Protocol (Article 11(2)) to enhance environmental review and assessments regarding marine mammal considerations. The influx of sargassum into the WCR since 2011 has become a significant management and potential health and safety issue that requires better understanding and expertise regarding disposal and prevention (UNEP-CEP, 2021).

Pollution and Marine Mammal Health

While there are considerable efforts in the region, regarding various land-based and marine-based pollutants, including action plans and initiatives to address such pollution under the Cartagena

Continues Table 4. General measures adopted by SPAW Contracting Parties in support of MMAP implementation.

Contracting party	Marine protected areas for marine mammals	Long-term research and monitoring programme	Stranding network and/or protocols	Captivity regulations	Seismic guidelines or mitigation measures	Vessel strike mitigation measures	Climate change strategy
The Bahamas	No	No	Yes	Yes	Yes	Yes	Yes
Barbados	No	No	Yes	No	Yes	No	Yes
Belize	Yes	Yes	Yes	No	Yes	Yes	Yes
Colombia	No	Yes	Yes	Yes	Yes	Yes	Yes
Cuba	No	No	No	No	No	No	Yes
Dominican Republic	Yes	Yes	No	Yes	No	No	Yes
France[1]	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Grenada	No	No	No	No	No	No	Yes
Guyana	No	No	Yes	No	No	Yes	Yes
Honduras	No	No	No	No	No	No	Yes
Kingdom of the Netherlands[2]	No	No	No	No	No	No	No
Caribbean Netherlands[3]	Yes	Yes	Yes	No	No	No	No
Panama	No	Yes	Yes	No	No	Yes	Yes
St Lucia	No	No	No	No	No	No	Yes
St Vincent and the Grenadines	No	No	No	No	No	No	Yes
Trinidad and Tobago	No	No	Yes	No	No	No	Yes
United States	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Venezuela	No	Yes	Yes	No	No	No	Yes

[1]French Guiana, Guadeloupe, Martinique, Saint Barthélemy, and Saint Martin (while recognizing the different environmental context of French Guiana, setting it apart from the other four insular French territories in the WCR, all territories are highlighted together in France's country assessment for the sake of consistency).
[2]Aruba, St Maarten and Curaçao
[3]Bonaire, St Eustatius and Saba

Convention and its Protocols on Oil Spills and on Land-based Sources of Marine Pollution, no continuous monitoring programme is in place to determine and mitigate impacts of pollution on marine mammal health and on their critical habitats and prey. Pollutants that are of importance include excessive nutrient loads, marine debris, wastewater, oil, mercury, and other heavy metals. Oil and gas exploration and exploitation is increasing in some parts of the WCR, posing a growing threat to the marine environment. Basic wastewater disposal, including the disposal of raw sewage, continues to challenge some Parties in the Region. Stranding networks are a viable and under-utilized resource to support the collection of information and samples to assess pollution impact on marine mammals.

Whale Watching and Associated Activities

Whale watching initiatives have been implemented in some areas, including the marine mammal sanctuary in the Dominican Republic and the Agoa Sanctuary (French EEZ). However, currently, marine mammal watching legislation or voluntary guidelines have been developed in less than half of the SPAW Protocol countries. A few Parties have developed and/or adopted their own marine mammal identification guides, however capacity building and monitoring of adherence to best practices in the field remain a challenge. Outreach surrounding the SPAW-adopted regional guidelines is lacking, although the IWC has included these guidelines in their online worldwide handbook (IWC, 2018b). There is a lack of research and monitoring of long-term impacts related to persistent and unregulated vessel traffic associated with marine mammal viewing within the WCR.

A recent survey of SPAW Contracting Parties UNEP (2021) on legislation, regulations, or guidelines specific to the management of marine mammal viewing indicate that the Dominican Republic, Colombia, Bahamas, USA, Panama, and France have legislation, regulations, or voluntary guidelines governing marine mammal watching. Of those countries with legislation or regulations, six require a permit to conduct marine mammal watching activities; seven prohibit the disruption of marine mammal behavior or feeding; six prohibit physical contact with marine mammals; seven specified responsible approach distance, vessel handling, speed, and viewing time limits. The primary species under observation is the humpback whale, followed by sperm whales, pantropical spotted dolphins, and the common bottlenose dolphin. In some countries, like Colombia, viewing operations also target the Guiana dolphin, tucuxi, and boto. Overarching Principles and Best Practice Guidelines for Marine Mammal Watching in the WCR under the SPAW Protocol were adopted in October 2012 (UNEP, 2012).

Protected Areas and other Management Regimes

The Sister Sanctuary Programme under the SPAW Programme has been put forward as a system to facilitate the effective management and conservation of species, such as the humpback whale, across jurisdictional boundaries and throughout its migratory range, as a foundation for a marine mammal protected areas network (UNEP, 2016). To date, five member-nations — Dominican Republic (Santuario de Mamiferos Marinos de la Republica Dominicana), Bermuda (Marine Mammal Sanctuary), the French Antilles (AGOA Sanctuary), the Caribbean Netherlands (Yarari Sanctuary), and the United States (Stellwagen Bank

National Marine sanctuaries - SBNMS) - support the initiative which has forged the foundations of a marine mammal protected areas network. The management plans for the sanctuaries in the Dominican Republic, French Antilles, and Caribbean Netherlands were established since the adoption of the MMAP in 2008, and in the case of Yarari, management priorities have been identified. Under the Caribbean Marine Mammals Preservation Network (CARI'MAM) Project, an analysis of existing management plans for marine protected areas using a "marine mammal tracking tool" indicates that most of the MPAs in the region are small and coastal, and do not include marine mammals in their management goals and objectives, or operational and financial planning of these areas.

However, tools are being developed in collaboration with international programmes that could serve to guide marine protected areas managers in the region such as the Self-Assessment tool developed to enhance the inclusion of marine mammals into marine protected areas management plans (Ocean Governance Project, 2022). In addition, despite SPAW projects and initiatives to promote network-type collaboration, such as the Sister Sanctuary initiative, the Caribbean Marine Protected Areas Management Network and Forum (CaMPAM), and the CARI'MAM, the ecological connectivity or common conservation/protection goals issues have not been fully addressed among listed protected areas under the SPAW Protocol.

Research Programmes

To date, the LifeWeb Project application and mapping tool remains the most comprehensive regional assessment of temporal and spatial scale of marine mammal occurrence and species distribution that may inform the designation of marine mammal critical areas for research focus and/or conservation. However, this project ended in 2014 and it was not designed to be updated with additional data. Networks of researchers are being established and strengthened in several areas of the WCR, notably in Central America, in the Gulf of Mexico, and in South America, but there is no coordinative body to support a network at the whole WCR scale. In addition, although a variety of online data platforms are currently being utilized, there is no facilitating mechanism for sharing of data and the development of collaboration. Much of the research in the region is often conducted without the participation of government or regulatory mechanisms. Improved data and scientific knowledge are required to serve as a foundation for improved policy, legislation, and education programmes for marine mammal conservation and protection in the WCR.

Strandings

Stranding incidents are sporadic and diverse across the region (Gómes-Hernández et al., 2020). Necropsy findings have correlated strandings with military sonar use, including Puerto Rico, Jamaica, US Virgin Islands, and the Bahamas (Filadelfo et al., 2009) and with encephalitis attributed to trematodes in Trinidad and Tobago (Phillips & Suepaul, 2017). Because of the low recovery rate of carcasses (both those that make it to shore, and those that never do) (Williams et al., 2011), undetected marine mammal mortality events are a further challenge. Effective stranding networks have been developed in several SPAW countries and capacity building and training workshops have been held in the region in the past with multi-stakeholder funding and collaboration. However, strandings remain unattended and unprocessed in many countries and regional collaboration is limited, as there is no centralised database, nor regional coordination and response, or a regional focal point or implementing agency. A Marine Mammal Stranding Guide was developed by the Eastern Caribbean Cetacean Network (ECCN) in collaboration with SPAW-RAC (UNEP-CEP SPAW-RAC, 2013) and while it is a key tool, it requires updating and being more effectively promoted. There is potential to expand upon existing social networks and citizen-based initiatives to disseminate real-time reporting and collaboration on strandings, a need recognised by the recent efforts by SPAW-RAC and the CARI'MAM Project.

Captivity

A significant number of marine mammals exist in captive facilities within the region and proposals for the establishment of new ones and operations involving dolphins in captivity continue to occur. Not all countries appear to possess regulations on the acquisition, care, and maintenance of marine mammals in captivity, and there is not an established tracking mechanism to follow the status of live captures and trade of animals once they are captured. A resolution was adopted in the Dominican Republic (Resolution No. 20/2018) which prohibits the capture, importation, exportation, and commerce of dolphin species in all national territory for five years. Captive mammal programmes are regulated by the Regulation on the Holding, Management and Exhibition of Marine Mammal Species in the Dominican Republic (Resolution No. 01/2008).

The development, adoption, and monitoring of the application of regulations and/or guidelines governing the acquisition, care, and maintenance of marine mammals in captivity, irrespective of the type of facility, is a challenge in the region. To date only one SPAW party (the Kingdom of the Netherlands) has presented an exemption to the Protocol with the Scientific and Technical Advisory Committee for captures, exports, or imports of marine mammals for education or research purposes.

Acoustic Disturbance and Underwater Noise

Stranding events and behavioral responses of cetaceans to anthropogenic sources of underwater noise, including seismic surveys, active sonar and vessel traffic, have been documented in the region (*e.g.*, Balcomb & Claridge, 2001; Luksenburg, 2014; Kassamali-Fox et al., 2020). However, anthropogenic underwater noise sources, including noise associated with sonars and maritime/coastal traffic, are not monitored in the region and long-term impacts on marine mammal populations are not assessed.

Although some mitigation initiatives have been developed for seismic operations along the coast of northern South America as reviewed in the Marine Mammal Conservation Corridors in Northern South America region (MamaCocoSea Project, 2015), no regional mitigation measures are being implemented. This review of the MamaCocoSea region, which ranges from north Brazil (west of the Amazon Estuary) to Colombia involving eight countries (Brazil, France (French Guiana), Suriname, Guyana, Venezuela, Colombia, Aruba, Curaçao, Trinidad and Tobago) indicated that, apart from Brazil and Colombia where local mitigation measures are currently adopted, and France where national guidelines for underwater noise were adopted in 2020, the remaining countries do not have mitigation guidelines in place. Nevertheless, some

countries and oil companies have voluntarily adopted mitigation measures during past surveys, such as soft starts (SS), *i.e.*, the gradual increase in the seismic source as stipulated from low power to the required working power (full volume) and the use of experienced and/or certified marine mammal observers (MamaCocoSea Project, 2015). However, information regarding the number of seismic surveys conducted, their noise levels, and set of mitigation measures is largely unavailable.

Vessel Strikes

Some countries are deploying technological tools to attempt to mitigate collisions between whales and vessels, including REPCET (Real time plotting of cetaceans) in the French West Indies (REPCET, 2022). In addition, a variety of marine platforms exists within the Caribbean that can serve as data collection points for vessel strike data (sailors, regattas, recreational, cruise, and whale watch operators). However, in most areas, data are lacking to quantitatively assess the impact of vessel strikes on marine mammals. Although there is substantial shipping traffic through the region, without cetacean distribution and strike data it is difficult to determine whether ship strikes are truly a regional problem beyond localized and species-specific data (*e.g.*, the West Indian manatee).The IWC-SPAW vessel strike workshop (IWC-SPAW, 2014) noted that the value of the LifeWeb Project GIS data is limited, as although it identifies where human threats occur, data is not sufficient to identify areas of highest risk. The workshop concluded that managers need better abundance and distribution data at local and national levels. There is a lack of central standardized and simple reporting format for inclusion of vessel strike data in the IWC Global Ship Strike database and other relevant instruments for the Caribbean region.

Climate Change

While many countries in the region are working to reduce their carbon footprints and have committed to comply with lower greenhouse gas emission targets, specific considerations for marine mammal protection are generally absent from planning strategies. In addition, long-term marine mammal data sets are lacking to support and contribute to on-going research on modelling and predictions for scenario development, mitigation, and adaptation measures in the WCR.

Conclusion

The present review and resulting assessments were not intended to single out insufficient country effort, nor to be punitive or meant to compare country responses or initiatives but rather assist WCR countries to identify threats and/or issue areas which would benefit from attention and collaboration.

To further this aim, recommendations offered below summarise the high-level recommendations of the regional report (SPAW-RAC, 2020) as a proposed prioritised roadmap to further implementation of MMAP measures at the national and regional levels:

- Development of a model national Marine Mammal Action Plan that can guide SPAW Contracting Parties toward developing their own national strategy and frameworks for marine mammal conservation;
- Integration of marine mammal data in joint programming among regional organisations for implementation of planning strategies to protect marine biodiversity and coastal ecosystems;
- Development of marine protected area management plans that include marine mammals;
- Integration of marine mammal considerations into national climate change action plans and strategies;
- Establishment of sampling programmes for emerging contaminants (heavy metals, micro and nanoplastics and associated chemical residues) in marine mammal resources that are harvested for human consumption;
- Enhancement of outreach and distribution of the SPAW regional marine mammal viewing guidelines and promotion of sustainable commercial whale watching activities;
- Development of regional guidelines for seismic surveys and others, oil and gas offshore exploration and exploitation operations;
- Creation of a centralized strandings database and reporting mechanism;
- Creation of national marine mammal inventories to track and manage the health and welfare of captive marine mammals;
- Identification and implementation of a centralized platform for reporting vessel strikes data;
- Enlistment of collaboration with the existing global bycatch mitigation initiatives, and enhancement of coordination with regional fisheries bodies to track and mitigate marine mammal bycatch;
- Promotion of the development of collaborative regional research efforts to enhance knowledge on marine mammal distribution and abundance in the WCR; and
- Support to citizen-based initiatives, including whale watching operators and recreational fishermen.

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