

DEVELOPMENT OF A MARINE POLLUTION MANAGEMENT STRATEGY AND ACTION PLAN IN BARBADOS

to promote the preservation of marine habitats, marine ecosystem services, healthy ocean space and sustainable marine-based livelihoods

Deliverable 2 – Situational Analysis

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Consultancy Services for the Development of a Marine Pollution Management Strategy and Action Plan in Barbados to promote the preservation of marine habitats, marine ecosystem services, healthy ocean space and sustainable marine-based livelihoods

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Acronyms

ASD - Analytical Services Department, 146
BBD - Barbadian Dollars, 7
BSTP - Bridgetown Sewage Treatment Plant, 11
CR - Critically Endangered, 6
CSO: Combine Sewer Overflow, 109
CZMU: Coastal Zone Management Unit, 16, 117
DPSIR – Driver-Pressure-State-Impact-Response, 72
EA - Environmental Assessment, 142
EN - Endangered, 6
EPD: Environment Protection Department, 14
GI: Gastrointestinal system, 103
LBS – Land Based Sources, 30, 55, 71, 73
MAM - Ministério da Agricultura e do Mar, 65
MEA - Multi-lateral environmental agreements, 44, 45
MOSAP - Marine Oil Spill Action Plan, 59
MPA - Marine Protected Area, 68
MPo: Monitoring Program, 85
MS: Member State, 95
NCC: National Conservation Commission, 16
NOSCP - National Oil Spill Contingency Plan, 59
NPA - National Programme of Action, 56
OECS - Organisation of Eastern Caribbean States, 1
OPL - Offshore Petroleum Legislation, 142
PMe: Program of Measures, 85
SDR – Special Drawing Rights, 39
SIDS: Small Island Developing State, 3
SRA - Secretaria Regional do Ambiente e dos Recursos Naturais, 65
SRMCT - Secretaria Regional do Mar, Ciência e Tecnologia, 65
TCDPO - Town and Country Development Planning Office, 44
TSG-ML: Technical Subgroup on Marine Litter, 96
UNEP - United Nations Environmental Programme, 92
WCR – Wider Caribbean Region, 30, 72, 73
WFD - Water Framework Directive, 67

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1. Introduction

The present document is Deliverable 2 – Situational Analysis of the *Development of a Marine Pollution Management Strategy and Action Plan in Barbados to promote the preservation of marine habitats, marine ecosystem services, healthy ocean space and sustainable marine-based livelihoods*, to be conducted by NEMUS – Gestão e Requalificação Ambiental, Lda., for the Organisation of Eastern Caribbean States (OECS).

The overall objective of the project is to promote the preservation of marine habitats, marine ecosystem services, a healthy ocean space and sustainable marine-based livelihoods in Barbados, through the development of a **Marine Pollution Management Strategy and Action Plan**.

This strategy and plan will be designed upon the particulars of Barbados' governance structures for decision making related to development initiatives and will provide targeted recommendations and interventions.

Within the scope of the required services, the objectives of Deliverable 2, the Situational Analysis Report, are as follows:

- To understand the scope, powers, and tools available within Barbados' legislative and regulatory context, to stakeholders involved in marine pollution management;
- To understand the process through which these stakeholders prepare and implement plans and policies; and
- To understand the process through which they monitor and evaluate results of the plans and policies, and their implementation.

For this, the present report presents the results of the following tasks:

- Analysis of the legislative and regulatory context for marine pollution management in Barbados;
- Analysis of the governance context for marine pollution management in Barbados;
- Analysis of the plan-making and plan implementation processes for marine pollution management in Barbados; and analysis of current plans, namely, the current workflows and practices for situational analysis,

visioning, scenario-planning, preparation and evaluation of options, decision-making, policy-writing, and implementation;

- Analysis of monitoring and evaluation criteria applied in selected good-practice case studies for marine pollution management;
- Stakeholder engagement interviews.

Considering the above listed tasks, the Situational Analysis Report has the following structure:

- Chapter 1 - Introduction;
- Chapter 2 - Country profile;
- Chapter 3 - Legal and regulatory framework;
- Chapter 4 - Institutional and governance framework;
- Chapter 5 - Planning and implementation processes;
- Chapter 6 - Review of good-practice cases;
- Chapter 7 - Stakeholder involvement;
- Chapter 8 - Conclusion and next steps;
- Chapter 9 - References.

2. Country profile

2.1. Introduction

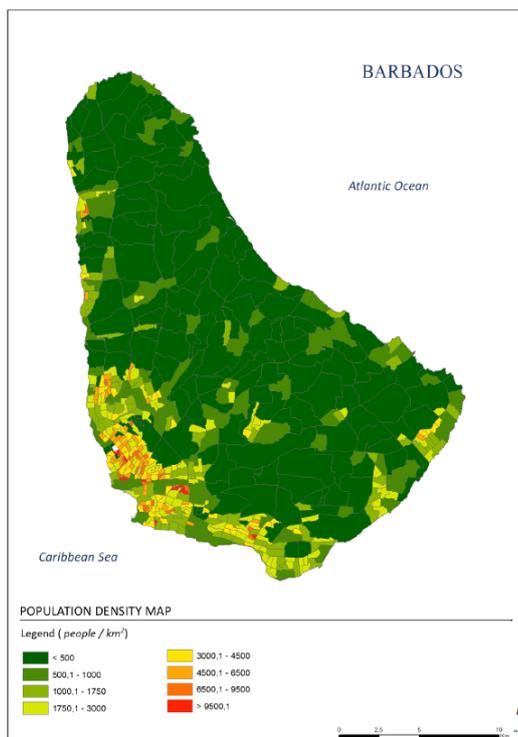
Barbados is a Small Island Developing State (SIDS) bound on the west coast by the Caribbean Sea and by the Atlantic Ocean on the east coast (Figure 1). Its territory covers over 432 square kilometers of land, with a coastline approximately 114 km in length. Barbados has jurisdiction over an exclusive economic area 430 times its land area, corresponding roughly to 185,000 square kilometers (Government of Barbados, 2021).



Figure 1 - Barbados Geographical Location

The country is inhabited by 287,025 people, 60% of which live within an urban corridor of three (3) coastal parishes, with 25% living less than two (2) km from the coastline (Environmental Planning Group Inc; HLA Consultants, 2014).

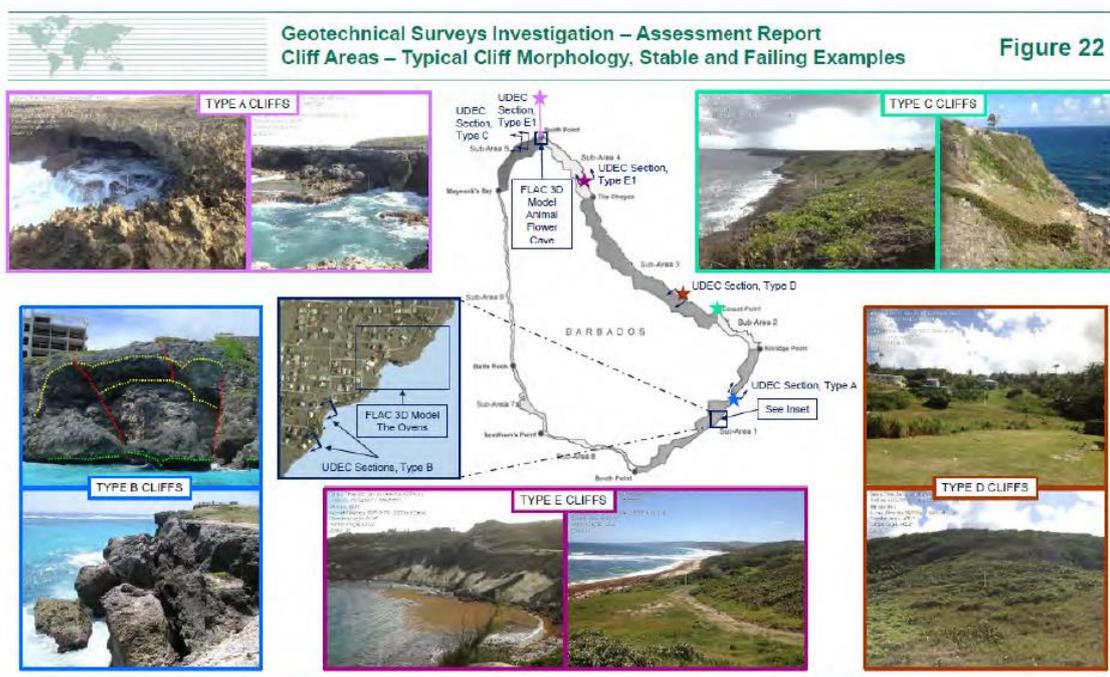
Barbados is one of the most densely populated countries in the world, especially in four (4) coastal communities, namely Speightstown (St. Peter parish), Holetown (St. James parish), Bridgetown (St. Michael parish), and Oistins (Christ Church parish) along the east and southeast coasts (Figure 2).



Source: Integrated Coastal Zone Management: The Barbados ICZM Plan (2020 To 2030)

Figure 2 - Population Density Map

Barbados is mostly flat, and its geomorphological subdivision has nine physiographic units (Vernon & Carroll, 1965): St. Lucy plain; Below the First High Cliff; Below the Second-High Cliff; St. George's Valley; St. Philip Plain; Above the Second-High Cliff; Christ Church Ridge; Scotland District; Below Cliff Area. The coastline is characterized by its physiographic diversity with five main cliff types, as illustrated in Figure 3.

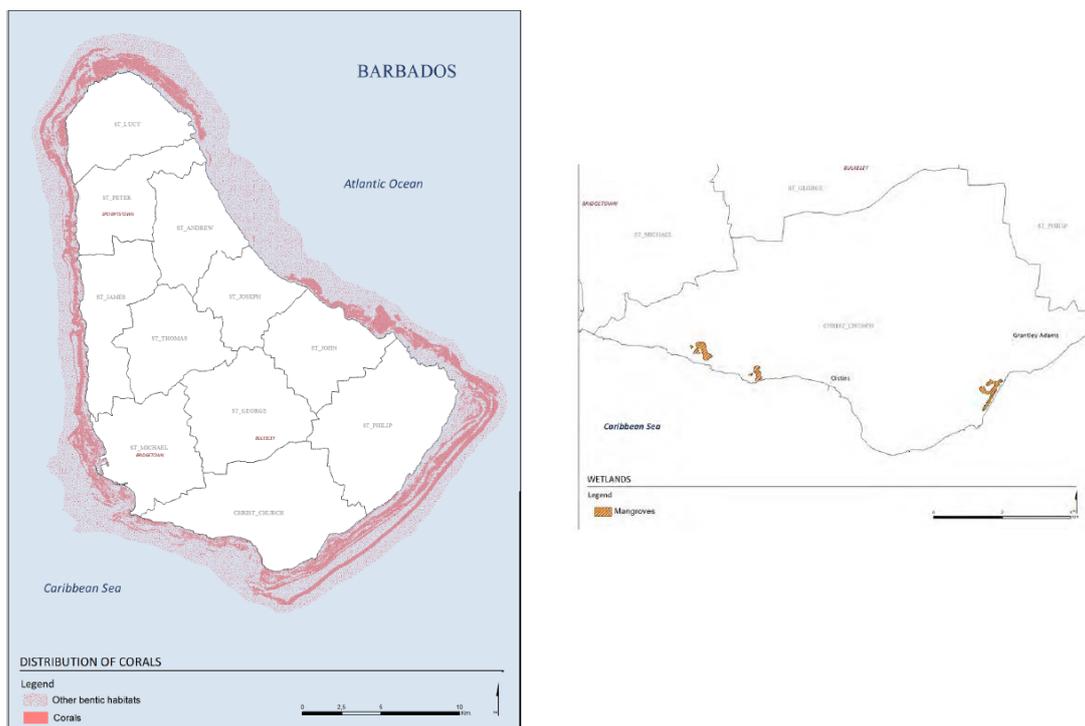


Source: Integrated Coastal Zone Management: The Barbados ICZM Plan (2020 To 2030)

Figure 3 – Barbados Coastal Cliff Types

2.2. Ecosystems

The coastal and marine ecosystems of Barbados include sandy beaches, saltmarshes, mangroves, coral reefs (mainly warm-water), and seagrass beds (UNEP-WCMC, 2023) (Figure 4).



Source: Integrated Coastal Zone Management: The Barbados ICZM Plan (2020 To 2030)

Figure 4 – Barbados Ecosystems and Habitat (Coral Reefs and Mangroves)

Sandy beaches cover approximately 21 km of the southwestern coastline (mostly calcareous), while 13 km of silica sand beaches occur in the eastern part. Sandy beaches are important breeding sites for threatened marine turtle species, namely, the green turtle (*Chelonia mydas*) (endangered, EN), hawksbill turtle (*Eretmochelys imbricate*) (critically endangered, CR) and leatherback turtle (*Dermochelys coriacea*) (CR) (IUCN, 2023).

Mangroves cover essential coastal swamps in the south, with the largest continuous unit occurring in the Graeme Hall Swamps. Mangroves in this area are threatened by reduced salinity and contaminated run-off water (Coastal Zone Management Unit, 2020b).

Benthic marine habitats are mainly constituted of hard coral framework, covering 6,3 km², and divided into bank reefs (4,9 km²) and fringing reefs (1,4 km²) (Figure 4). The latter occurs in the back reef, reef flat, and spur and groove zones, whereas the bank reefs develop on the narrow crest, steep landward, and seaward slopes. There are 10 species of soft coral and 31 of hard coral, including critically endangered staghorn coral (*Acropora cervicornis*) and elkhorn coral (*Acropora palmata*), and endangered *Montastraea faveolate* (UNEP-WCMC, 2023).

Barbados' coral reefs support artisanal fisheries, provide natural nursery areas for fish and invertebrates, support the maintenance of sandy beaches, and provide natural coastal protection. However, according to the national Coral Reef Monitoring Programme – which covers Brighton (northeast) and Carlisle Bay (south) – reefs have been in “very poor” and “poor” condition. Coral reef cover has been declining in Barbados, partly due to deteriorating water quality from pollution and land runoff (Coastal Zone Management Unit, 2020b). The deterioration of coral reefs and consequent reduction of their natural coastal protection leads to increased erosion, particularly along the west coast (ibidem.).

Seagrass meadows occurs mainly in the north-eastern and south-western coasts, most commonly of *Halodule wrightii*, *Syringodium filiforme* and *Thalassia testudinum*. These seagrass beds support shoreline stability, coastal biodiversity, also provide nursery areas, and opportunities for tourism and recreation. However, seagrass cover is also threatened by siltation and eutrophication (Coastal Zone Management Unit, 2020b), caused by coastal and land-based pollution sources (MENB, 2021) (2.4, Coastal water quality and pollution).

2.3. Economy

Barbados has evolved from a low-income agricultural economy dependent on sugar-cane cultivation and related activities, to a service-driven high-income one. The economy is currently highly reliant on the tourism sector, which accounts for 28% of the GDP (at 2,956 million Barbadian Dollars [BBD]) and 36% of employment (44.9 thousand jobs in 2019) (World Travel and Tourism Council, 2020).

In 2019, it was the accommodation and food services sector that contributed most to value added (16.5%), followed by real estate (12.1%) and the financial and insurance sector (10.1%). The Agriculture and Fishing sector represented 1.5% of total value added in 2019.

Regarding the tourism sector, according to the Barbados Statistical Service (2020), the reported purpose of most stay-over visits was recreation, at 84%; 91% of these corresponding to holidays. The majority of tourists stay in resorts along the southwest coast (Christ Church), Speightown (Saint Peter) or Holetown (Saint James).

A survey conducted by (Schumann, Skeete, & Waite (2017) reported that most visitors to Barbados take part in marine and coastal recreation activities such as visiting the

beach (87%) and swimming (72%). Almost half of visitors also engage in marine life observation through snorkelling, diving and glass-bottom boats. Effectively, the barrier reef located just off Barbados' west coast hosts numerous diving and snorkelling sites, including wreck diving spots.

The authors also showed that the **quality of marine life and seawater**, as well as coral health, were determinant factors for visitors when choosing Barbados as a destination. Visitors placed a higher value on seawater quality; indeed, the study's "willingness to pay" results suggested that a poor water quality (described as a higher than 10% probability of incurring a stomach infection from swimming) would prevent the average visitor from visiting Barbados.

Current local threats to the quality of the marine and coastal environment and, consequently, to tourism and the Barbadian economy, consist of overfishing, coastal overdevelopment, water pollution from sewage and runoff, as well as climate change impacts such as beach erosion and damage to coral reefs, affecting fish abundance and diversity (Schuhmann, Skeete & Waite, 2017; Cashman, Cumberbatch, & Moore, 2012; Economic Commission for Latin America and the Caribbean, 2011). Additionally, climate change mitigation measures that address the airline industry will negatively impact long-distance travelling, posing an added challenge to the attraction of tourists (Economic Commission for Latin America and the Caribbean, 2011).

Consequently, the quality of Barbados' marine and coastal natural resources is of extreme importance for the country's ability to attract tourists, with the consequences of the degradation of these resources flowing to the entire economy.

2.4. Coastal water quality and pollution sources

Pollution of the marine environment from land-based sources (soil erosion, sewage effluent, and liquid and solid wastes from households, hotels and commercial activities) has been recognized as the most significant stressor of the Caribbean Sea (Caribbean Environmental Health Institute, 2008), and of Barbados' coastal and marine waters in particular (Brewster, 2007). Pollution generated on the sea can also occur, such as oil slicks and cruise and cargo boat wastes.

Table 1 summarizes the main sources of pollutants in coastal and marine waters in Barbados.

Table 1 – Major sources of pollution in Barbados coastal waters

Marine pollutant	Main sources
Nutrients	<ul style="list-style-type: none"> • Terrestrial erosion and surface water runoff • Industrial and domestic sewage and waste water effluents • Nutrient enriched ground water discharge • Agricultural area surface water runoff
Sediments	<ul style="list-style-type: none"> • Terrestrial erosion and surface water runoff • Industrial and domestic sewage and waste water effluents • Coastal construction, dredging and land reclamation
Chemical toxins	<ul style="list-style-type: none"> • Industrial and domestic waste water effluents • Surface runoff and ground water discharge from intensive agricultural areas • Surface runoff and ground water discharge from urban areas • Accidental spillage and routine discharge from marine shipping • Poison fishing
Pathogenic bacteria	<ul style="list-style-type: none"> • Surface runoff and ground water discharge from residential areas • Domestic sewage effluents
Solid waste	<ul style="list-style-type: none"> • Surface runoff from urban areas • Direct littering of beaches and nearshore water • Garbage disposal from marine shipping

Raised temperature	<ul style="list-style-type: none"> • Heated effluent from power generating plant
Lowered salinity	<ul style="list-style-type: none"> • Surface runoff and groundwater discharge • Industrial and domestic waste water effluents

Source: Delcan, 1994, in Brewster, 2007

These pollution sources are responsible for the degradation coastal water quality especially around the south and west coasts and in the last decades. According to Brewster (2007), marine currents around the island help control pollution levels, however, since most of the pollution is derived from inland sources such as domestic and agricultural activities, which are intensifying, it is crucial to maintain monitoring and control efforts.

Regarding **land-based pollution, non-point sources** like agricultural and domestic runoff are the predominant ones in Barbados.

Point sources mainly consist of effluents from operational plants (cement factory, sand mining quarries, energy production, rum refineries, flour mills, and also an oil refinery, that ceased operation in 1998) (a total of 21 in 2007, monitored by the EPD), plus two (2) sewerage systems (Brewster, 2007).

Eroded soil may inclusively contain fertilizers and pesticides, sewage and household and municipal wastes and solid waste dumped on land, contaminating near-shore waters directly or through the contamination of groundwater and subsequent seepage (stakeholder interviews, February 2023). Runoff of terrestrial sedimentation may result from severe rainfall events mobilizing erosion material, debris and pollutants, and is associated with poor land management practices as well as inadequate stormwater management (stakeholder interviews, February 2023).

Indeed, the island's topography and abundance of water courses and gullies (especially along the east and west coast) facilitate the mobilisation of soil and pollutants into the coastal waters. Sources of sediments to coastal waters may also include industrial and domestic sewage effluent (Caribbean Environmental Health Institute, 2008).

It is also worth mentioning that only 4% of the Barbadian population are connected to the two national sewer systems and with the exception of the few package sewage

treatment plants, sewage is discharged to the subsurface via suck wells with no treatment or preliminary treatment using septic tanks.

In summary, there are several sources of pollution to the marine environment in Barbados, interacting in complex ways. Because of the islands' characteristics, virtually any activities done on land potentially affects the coastal and marine environment. The most referenced in the bibliography and during stakeholders' consultations are:

- Agriculture; for instance, through runoff of pesticides and nutrients (during rainfall and through groundwater seepage) and deforestation (causing increased soil erosion);
- Industry; mostly through waste discharge;
- Urban development (including tourism); through the discharge of untreated wastewater, through deforestation for construction, and the creation of solid waste;
- Illegal offshore dumping.

2.5. Climate change

Ongoing climate change is foreseen to mainly impact Barbados through an increase in the number and intensity of extreme weather hazards such as droughts, heavy rainfall, floods, and more intense hurricanes, together with rising sea levels, which will result in saline intrusion in groundwater.

In Barbados, extreme phenomena like heavy rain, strong winds and large waves, are closely connected to the occurrence of storms and hurricane events.

Increased frequency of these events and rising sea-level can cause operation problems for Bridgetown Sewage Treatment Plant (BSTP) and for onsite domestic wastewater treatment and effluent disposal systems, which could lead to more frequent episodes of accidental pollution discharge into coastal waters.

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3. Legal and regulatory framework

This Chapter provides an overview of the national legal and regulatory framework of Barbados in respect of marine pollution management in coastal and marine areas. Accordingly, it notes key national laws, regional agreements and international conventions relevant to the discourse, identifying notable provisions which advance efforts to prevent, manage and where possible eliminate pollution.

3.1. Oil in Navigable Waters Act

The first piece of legislation enacted related to marine pollution was the **Oil in Navigable Waters Act in 1927**. As amended in 1967, the Oil in Navigable Waters Act regulates oil's transportation, namely its discharge and transfer within Barbados' territorial waters.

It prohibits the discharge of oil in navigable waters and the transfer of oil at night, both punishable with a penalty fine on summary conviction of \$400 and \$96, respectively. The act deems the discharge of the liquid contained in spaces that carried oil as a discharge of oil. Thus, the master of a vessel to not commit an offence shall provide a certificate that proves cleaned liquid and tanks. In case the master of a vessel provides a false or misleading certificate he is guilty of an offense punishable by a fine of \$240 on summary conviction.

For the discharge of vessel's ballast waters in which a cargo of petroleum spirit has been carried, the Minister responsible for Shipping may select a place for a vessel to discharge. It is noteworthy that this provision only applies to ballast water containing petroleum spirit.

Any oil operation in vessels shall be recorded under the terms set by the Minister. Infringement of the record results in a fine of \$240 when a person fails to keep up the record or a \$480 fine if a person provides a false or misleading record. Each record may be inspected by the Harbour Master or any person designated by the Minister, who may also examine any vessel and procedures to prevent the escape of oil.

3.2. Barbados Territorial Waters Act

Barbados' Territorial Waters Act (as amended, 1978) establishes the delimitation of territorial waters and internal waters. The territorial waters cover the area of sea bounded in the landward limit by the baselines set by the Act to a breadth of 12 nautical miles or other distance as the Minister responsible for Foreign Affairs by order prescribes.

The baselines considered for the territorial waters are the low-water line along the coast or alternative baselines prescribed by the Minister (a mixture of straight lines drawn from points on the coast of Barbados and the low-water line). The internal waters comprise the sea on the baselines' landward side. Territorial and internal waters are under Barbados' jurisdiction, to which the Act regulates the right of passage and inspection of any foreign ship. The Act grants ministerial power to make regulations, e.g., on marine environment preservation and pollution control in Barbados.

3.3. Marine Pollution Control Act

The Marine Pollution Control Act seeks to prevent, reduce and control marine pollution in Barbados from any source. It designates the Head of the Environment Protection Department (EPD) as responsible for applying this act's provisions, whom the marine pollution control inspectors shall assist.

The Act describes the functions and powers of the Head of the EPD and its inspectors (Section 9). Likewise, it details the following marine pollution management tools:

- Register of Pollutants: provides a list of the sources of pollution;
- List of Prohibited Concentration Levels: provides a list of parameters and associate discharge standards.

The list of pollutants with the respective prohibited concentration levels is subject to public consultation. Any person may present objection to the inclusion of any of the items proposed to be included or to the prohibited levels of concentration recommended, within two weeks of the final publication of the notice given by the Minister. If an objection is made, the Minister shall hold a public enquiry, presenting both the list of pollutants and the respective prohibited levels of concentration, and the objections made.

Pursuant to this Act, any person who releases or causes the release of any pollutant into the environment that violates any applicable standards or requirements commits an offence subject to a penalty framework (Table 2).

The penalty framework prescribes:

- On the first conviction for that offence
 - on indictment, to a fine of \$200 000 or imprisonment for five (5) years, or both; or
 - on summary conviction, to a fine of \$100 000 or imprisonment for two (2) years, or both.
- On the second or any subsequent conviction for that offence
 - on indictment to a fine of \$400 000 or imprisonment for seven (7) years, or both; or
 - on summary conviction, to a fine of \$200 000 or imprisonment for two (2) years, or both.

Table 2 Penalty framework for release of any pollutant into the environment

Conviction	Indictment	Summary conviction
First	fine of \$200 000 or imprisonment for five (5) years, or both	fine of \$100 000 or imprisonment for two (2) years, or both
Second or any subsequent	fine of \$400 000 or imprisonment for seven (7) years, or both	fine of \$200 000 or imprisonment for two (2) years, or both.

For any other offence committed under this Act, the person is liable on summary conviction to a fine of \$5 000 or to imprisonment for two (2) years, or to both.

Under the implementation of this Act's provisions, the Minister and the Head of the EPD must consider Barbados' Integrated Coastal Zone Management Plan (2020).

3.4. Coastal Zone Management Act

Barbados' Coastal Zone Management Act (1998) describes and elaborates on the process of developing Coastal Zone Management Plans, establishing an enabling framework for the integrated management of coastal resources.

The management plan must be developed by the Director of the Coastal Zone Management Unit (CZMU), and may include the following provisions relating to marine pollution:

- Standards for environmental impact assessment for development projects which may affect the conservation and management of coastal resources;
- Standards for water quality in coastal and marine areas to effect the maintenance, rehabilitation, and enhancement of coastal and marine habitats.

The Act repeals the Beach Protection Act, Cap. 389 and the Marine Areas (Preservation and Enhancement) Act, Cap. 392. Additionally, it sets forth a framework to facilitate the conservation and enhancement of coastal resources. This framework comprises provisions regarding the establishment of restricted areas, coral reefs, and beach protection.

To preserve and protect marine life in submarine areas, the Director may consult the National Conservation Commission (NCC) to define marine areas within territorial waters as restricted areas. Before the Minister approves a restricted area, he shall prepare a public inquiry. Likewise, under Minister's approval, the NCC may establish underwater parks or art centers within restricted areas and their regulations.

As for coral reefs' protection, the Act prohibits the use of any explosive, poison, or other toxic substance to harvest coral or catch fish. Any person who infringes commits an offence punishable by summary conviction to a fine of \$300 for every square metre of coral reef damage or imprisonment for five (5) years or both. The Director of Analytical Services shall certify death or injury to a coral reef as a result of a toxic substance or chemical. Regarding beach or foreshore protection, any person who dumps garbage or any waste commits an offence. Which, according to this Act, is liable:

- On the first conviction for that offence
 - on indictment, to a fine of \$200 000 together with, where applicable, an amount equal to the value of the property seized or to imprisonment for not more than five (5) years, or both; or
 - on summary conviction, to a fine of \$5 000 or imprisonment for not more than two (2) years, or both.

- On the second or any subsequent conviction for that offence
- on indictment, to a fine of \$400 000 together with, where applicable, an amount equal to the value of the property seized or to imprisonment for not more than five (5) years, or both; or
- on summary conviction, to a fine of \$10 000 or imprisonment for two (2) years, or both.

Table 3 - Penalty framework for coral reef damaging and foreshore fouling

Offence	Conviction	Indictment	Summary conviction
Damage coral reefs by explosives or poison	Any	-	a fine of \$300 for every square metre of coral reef damage or imprisonment for five (5) years or both
Fouling of foreshore prohibited	First	fine of \$200 000 together with, where applicable, an amount equal to the value of the property seized or to imprisonment for not more than five years, or both	fine of \$5 000 or imprisonment for not more than two (2) years, or both
	Second or any subsequent	a fine of \$400 000 together with, where applicable, an amount equal to the value of the property seized or to imprisonment for not more than five (5) years, or both	a fine of \$10 000 or imprisonment for two (2) years, or both

Further, the Act lays out the institutional arrangements for coastal zone management. It designates the Director of the CZMU as responsible for applying the provisions of this Act, whom the coastal zone inspectors shall assist. Their functions and powers over coastal zone management are delineated by the Act (Part IV).

3.5. Health Services Act

The Health Services Act (2015) enactment aims to promote and preserve Barbados's population health. Its administration is the responsibility of the Minister responsible for Health, whose principal powers comprise the establishment of health services institutions, sanitation districts, boards, and committees and assign duties for their officers.

Additionally, the Minister may make provisions through sewerage disposal works or otherwise for effectively dealing with the contents of such sewers. To ensure the application of this Act, the Minister can prepare regulations and delegate functions. The regulations can be related to disease prevention and suppression, food and drug control, and sanitary conditions (water supply, sewage disposal, waste management), among other subjects. The Minister may establish boards or committees to facilitate the enforcement of the provisions of the Act. Likewise, assign a Public Health Inspector to certain private businesses in the interest of public health.

3.6. Health Services (Building) Regulations (S.I 1969 No. 233)

These Regulations have been developed further to the Health Services Act. The Regulations establish the requirements and procedures should a person be desirous of constructing, extending or effecting any material alteration to any building, noting the sanitary measures to be assured and implemented during the process. This legislation determines that an application must be submitted to the Chief Town Planner, and the Chief Town Planner is required to submit a copy of the application to the Minister for approval.

Upon receipt of an application, the Minister may refuse the application or Grant approval in respect of the application, citing any conditions to be applied to the approval.

The Regulations further determine that applications which are to be submitted to the Minister must be accompanied by scale drawings prepared in duplicate, which must illustrate the details of the proposed construction, extension or material alteration and of the proposed drainage and sanitary facilities.

The Regulations also establish several prohibitions which are to be complied with. Such proscriptions include:

- Prohibition on erecting a building on any ground which has been filled with any material full of faecal, animal or vegetable matter, or upon which any such matter has been deposited, unless in the opinion of the Medical Officer of Health, such matter has been properly removed or rendered innocuous;
- Prohibition on erecting a building on any ground which is below the level of the land or street adjacent, or on any land which is in a swampy condition, or which is flooded or liable to become so, unless such land shall have been graded and drained to the satisfaction of the Medical Officer of Health;
- Prohibition on discharging any sullage or any waste matter into any street or into any public place except as approved by the Medical Officer of Health;
- Prohibition on constructing or using any room for sleeping purposes unless an area of at least forty-four square feet is provided for each adult occupant.

The Regulations establish that any person who is non-compliant with the provisions of the Regulations (including non-adherence to the prohibitions) to be guilty of an offence and liable to

- a fine of \$5,000; or
- to imprisonment for 12 months, or
- both such fine and imprisonment,

In situations where a person continues to commit an offence against the Regulations, a further fine of two hundred dollars shall be imposed for each day or part thereof during which the offence continues after a conviction is first obtained.

Such fines are meant to serve as deterrents to the carrying out of unlawful acts.

The Regulations impose specific requirements to owners of buildings, contractors or builders in respect of the provision of temporary conveniences establishing that these must be provided to workmen and must be constructed in a manner approved by the Medical Officer of Health. Furthermore, the requisite arrangements for the maintenance

of sanitary and hygienic conditions associated with the conveniences must be made and upon completion of work, these temporary conveniences are to be removed.

To ensure the provisions as set forth in the Regulations are accurately interpreted, key terms are defined and described. The table below notes the terms and the definitions ascribed to each.

Table 4 - Key Terms and Definitions in the Health Services (Building) Regulations (S.I 1969 No. 233)

Terms	Definitions as established under the Health Services (Building) Regulations (S.I 1969 No. 233)¹
Building	means any structure used for the purposes of human habitation or in which any person is employed and includes a hospital, market or school
Construction	in relation to a moveable building includes the pulling down, removing and re-erecting thereof on another site
Convenience	means any receptacle for human excreta together with the structure comprising such convenience and the fittings and apparatus connected therewith and includes a bath tub, shower, wash basin or any other similar sanitary convenience

3.7. Health Services (Disposal of Offensive Matter) Regulations (S.I. 1969 No. 160)

The Health Services (Disposal of Offensive Matter) Regulations were developed further to the Health Services Act to establish requirements associated to the disposal of offensive matter including filth and night soil. Within the context of the Regulations, filth includes decomposing animal or vegetable matter, while night soil is to be interpreted to mean human excreta.

The Regulations prohibit several acts which involve the disposal of filth night soil and other offensive matter. These prohibitions are presented in Box 1.

¹Extracted verbatim from Regulation 2 of the Health Services (Building) Regulations (S.I 1969 No. 233)

Box 1: Prohibited Acts under the Health Services (Disposal of Offensive Matter) Regulations

- Depositing, letting out or placing any filth, night soil, dead animal or other offensive matter or thing of any kind on or about the premises of another person; any water-course or beach;
- any public street, road, lane, alley, passage or thoroughfare; or any other premises or place where such filth, night soil, dead animal or other offensive matter may create a nuisance or be detrimental to the public health.
- The carrying of any night soil through public streets, or generally in public before the hour of ten o'clock in the evening and after the hour of six o'clock in the morning.
- The use of any cart, vehicle or receptacle of any kind for the conveyance of any filth, night soil or other offensive matter of any kind unless the offensive matter is so closely covered so as to avoid the escaping of the associated smell or leakage. The carrying of the offensive matter must however be approved by a Medical Officer of Health, and a license must be obtained further to the granting of this approval. It must be noted that this license may be cancelled or revoked should it be in the best interest of the health of the public to so do.
- The release, throwing or depositing of any filth, night soil or other offensive matter into the sea except at such sites and in such manner as the Minister may approve.
- The burying of any night soil in any place except at sites and in a manner as the Minister may approve, noting that the night soil is to be covered by earth to a depth of not less than eighteen inches below the level of the surrounding ground.
- The disposal of sewage from a water closet except as allowed for under the Regulations for which the prior approval of a Medical Officer of Health is required.
- The causing or permitting of the effluent from any public sewerage system, private sewerage system or from any septic tank, to flow into the sea or on or into any other place except at such sites and in such manner as the Minister (in the case of public sewerage systems) or Medical Officer of Health (in the case of private sewerage system or septic tank) may approve.

The causing or permitting of any well, pit, or hole of any description to be used in connection with the disposal of any human or animal excreta or of any filth or of any other offensive matter unless

The Regulations further establish that it is an offence to contravene any of the provisions of the Regulations and any person guilty of such, upon summary conviction shall be liable to:

- a fine not exceeding \$5,000; or
- imprisonment for a term not exceeding 12 months; or
- both.

Furthermore, in the case of a continuing offence, a person shall be liable to a fine not exceeding \$200 for each day or part thereof during which the offence continues after a conviction is first obtained.

3.8. Offshore Petroleum Act

The Offshore Petroleum Act (as amended, 2017) regulates the licensing of activities related to petroleum exploration within the Barbados territorial waters, exclusive economic zone, and continental shelf. This Act enacts the Minister responsible for Energy as the Designated Authority responsible for its administration. Thus, the Minister assesses applications for reconnaissance or exploration licenses and oversees licensees' compliance with the license's provisions and this Act. When conducting petroleum operations, the licensee must comply with general duties, such as best industry practices, environmental, health and safety, etc. Regarding environmental practices, the Act establishes compliance with any standards, rules, or guidelines, issued, adopted, or approved by the Designated Authority, as it advocates measures to restore and preserve ecosystems and all-natural and physical resources. On health and safety practices, the A licensee shall develop, implement and maintain a health and safety management system in respect of the petroleum operations. When a licensee does not comply with the environmental or health practices, commits an offence, and is liable on summary conviction to a fine of \$275 000 or imprisonment for five (5) years.

After the approval of an exploration license, the Designated Authority may require an environmental impact assessment to be conducted by the applicant regarding any exploration activity to be developed in the concerned area, which has to be approved by the Minister responsible for the Environment. The Act prescribes the power of the Designated Authority to suspend any exploration activities in case of a major environmental incident, major hazard, major health, and safety incident, or an emergency.

3.9. Tourism Development Act (2002)

The Tourism Development Act (2002) (and later amendments) is an act that «[encourages] the sustainable development of the tourism industry by providing duty-

free concessions and income tax concessions for approved tourism projects and certain tourism entities and for other related matters».

It establishes the provisions for the application for approval of tourism projects, and, more importantly, establishes incentives for tourism operators to improve the wastewater disposal system through tax credit of 20% of the capital cost of fittings, pipes and pumps used in the improvement of the wastewater system.

3.10. Pesticides Control Act CAP 395

The Pesticides Control Act is an act that provides for the control of the importation, sale, storage and use of pesticides. The Act was amended by the Pesticides Control (Amendment) Act (No. 30 of 1982) and its implementation is facilitated through, among other instruments, the

- Pesticides Control Regulations, 1974;
- Pesticides Control (Amendment) Regulations, 2021; and the
- Pesticides Control (Labelling of Pesticides) Regulations, 1976

The Minister with responsibility for Agriculture is determined to be the Minister responsible for the implementation of the Act and that Minister is to be advised by the Pesticides Control Board which is established further to the Act.

An Inspector is empowered and authorised to undertake several functions pursuant to the implementation of the Act, notably:

- at any reasonable hour enter on land or premises:
- on which a pesticide is being, has recently been, or is about to be, used, manufactured, sold, packaged or stored;
- which is being used or has recently been used or is about to be used for a purpose connected with the use, manufacture, sale, packaging or storage of pesticides;
- on which apparatus and facilities required to be kept by the regulations are kept;
- which an inspector has reasonable cause to believe to be land or premises the bullets above.

An Inspector may require any person he finds on land or premises mentioned above to provide information in respect of the occupier of that land and who is the employer of workers employed to work on said land or premises.

Some of the powers bestowed on Inspectors include:

- Require the production of, inspection, examination and copying of registers, records or other documents required to be kept by the regulations;
- Make examinations and enquiries to assess compliance with the Pesticides Control Act;
- In cases where the Inspector is also a medical practitioner, conduct medical examinations of persons suffering or suspected to be suffering from toxic effects of pesticides;
- Confiscate for such time as may be required, any article which it is believed to contravene any provision of the Pesticides Control Act;
- Exercise such other powers as may be necessary for implementing the Pesticides Control Act and to subordinate legislation.

The Act empower the Minister with responsibility for Agriculture to make Regulations to support the implementation of the Act, across a range of areas in respect of manufacturing, importation, advertisement, utilisation, distribution and commercial activity associated with pesticides.

The Act establishes key offences and attaches penalties to the commission of these offences once guilt is so found in a summary conviction. The table below presents of summary of the offences and attached penalties.

Table 5 - Penalty framework under the Pesticides Control Act

Offences	Upon Summary Conviction
Assaults, resists, obstructs or intimidates an inspector in the execution of his duty	<ul style="list-style-type: none"> • First Offence: <ul style="list-style-type: none"> ○ a fine not exceeding \$250

Offences	Upon Summary Conviction
Uses indecent, abusive, or insulting language to an inspector in the execution of his duty	<ul style="list-style-type: none"> • Continuing offence: <ul style="list-style-type: none"> ○ a fine not exceeding \$50 for each day or part thereof during which the offence continues.
Interferes with or hinders an inspector in the execution of his	
By any gratuity, bribe, promise or other inducement prevents or attempts to prevent an inspector from carrying out his duty	
Without the authority of an inspector removes, alters or interferes in any way with an article seized under paragraph	
Contravenes any provision of this Act or the regulations	

3.11. Fisheries Act CAP 391

The Fisheries Act was developed to provide for the management and development of fisheries in Barbados and was later amended in 2000 through the Fisheries (Amendment) Act 2000.

The Act establishes provisions governing Fisheries Management and Development, the Safety of Commercial Fishing Vessels and Accidents at Sea and measures to support the enforcement of the Act.

The Act establishes a clear regime requiring the requisite licenses to be applied for in respect of a foreign fishing vessel, a local fishing vessel, a commercial fisherman or a sport fishing vessel. These categories of vessels require the applicable license in order to operate in the waters of Barbados.

The Act appoints key personnel to assist with the implementation of the Act, most notably a Chief Fisheries Officer, Fisheries Officers and Fisheries Assistants. The Chief Fisheries Officer is established to be the principal officer possessing responsibility for the management and development of the fisheries sector in Barbados and facilitate the maximization of fisheries resources in the waters of Barbados. Further to achieving this, the Chief Fisheries Officer is responsible for the development and review of fisheries management and development schemes.

The Act appoints a Fisheries Advisory Committee which possesses responsibility for advising the Minister with responsibility for Fisheries on the development and management of fisheries; legislative consideration, licensing requirements, policy coordination and other matters relevant to the implementation of the Act and regulations made thereunder.

Recognizing that marine and fisheries resources are linked with other countries, the Act also establishes provisions facilitating and governing regional cooperation in respect of fisheries in pursuit of the harmonization of:

- Systems for statistical purposes;
- Fisheries management and conservation measures;
- Licensing procedures;
- Conditions in respect of foreign fishing vessels, and the operation of joint licensing schemes in respect of specified fisheries, among other things.

Furthermore, the Act allows for the entering into of Fisheries Access Agreements on a bilateral, regional or sub-regional basis.

There are several prohibitions established under the Act. Accordingly, persons are prohibited from:

- Permitting or using any explosive, poison or other noxious substance in processing involving the killing, stunning, disabling or catching fish, or to ease the ability to catch fish;
- Carrying or having in their possession or control or is found in any vessel carrying any explosive, poison or other noxious substance in circumstances indicating any intention of using such items for any of the purposes above noted.

The prohibitions establish here have the effect of protecting fisheries stock and further protect marine resources against pollution, among other things.

Persons who contravene the provisions of the Act and commit these prohibited activities are determined to be guilty of an offence and liable on summary conviction to a fine not exceeding \$50 000. Furthermore, they are also liable to forfeiture of their vessel, gear and catch.

The Act also prohibits people from using prohibited fishing gear; or having in their possession any prohibited fishing gear on board any fishing vessel demonstrating an intention to use it for fishing, while in the waters of Barbados. Any person who contravenes this provision is determined to be guilty upon on summary conviction can be subject to a fine not exceeding \$50 000 and to forfeiture of vessel, gear and catch.

The Act also provides for the making of Regulations by the Minister.

3.12. Shipping (Oil Pollution) Act

This Act was drafted to establish clear requirements and provisions relating to oil pollution by ships in waters of Barbados and further addresses oil pollution of any navigable waters by Barbadian ships.

One of the principal areas of focus of this national legislative instrument is to prevent oil pollution. Accordingly, provisions in this regard are detailed in Part II of the Act.

The Act prohibits owners or masters of a Barbadian ship from discharging oil (including crude oil, fuel oil, lubricating oil and heavy diesel oil) or a mixture of oil with water or with another substance from its ship into the sea. There may be some exceptions to this prohibition, but these must be specifically detailed in Regulations. The contravention of this prohibition carries with a fine of \$240 000 upon summary conviction.

The Act further establishes a complementary prohibition in respect of discharging oil or a mixture of oil into the territorial waters of Barbados, determining that it is an offence to do so attaches the same fine of \$240 000 upon summary conviction. Specifically, Section 5 specifies the following:

- “5. (1) *Where oil or a mixture is discharged into the territorial waters in the manner set out in paragraphs (a) to (e), then subject to the provisions of*

this Part the persons referred to in those paragraphs are guilty of an offence:

- *(a) if the discharge is from a vessel, the owner or master of the vessel, unless he proves that the discharge took place and was caused as mentioned in paragraph (b);*
- *(b) if the discharge is from a vessel but takes place in the course of a transfer of oil to or from another vessel or a place on land, and is caused by the act or omission of any person in charge of any apparatus in that other vessel or that place, the owner or master of that other vessel or, as the case may be, the occupier of that place;*
- *(c) if the discharge is from a place on land, the occupier of that place, unless he proves that the discharge was caused as mentioned in paragraph (d);*
- *(d) if the discharge is from a place on land and is caused by the act of a person who is in that place without the express or implied permission of the occupier, that person;*
- *(e) if the discharge takes place otherwise than as mentioned in the preceding paragraphs and is the result of any operations for the exploration of the sea-bed and subsoil or the exploitation of their natural resources, the person carrying on the operations.”²*

Should the owner or master of a vessel be able to prove that oil or a mixture of oil was discharged for the purpose of securing the safety of any vessel, or to prevent damage to any vessel or cargo, or as a life-saving measure, this can serve as a defence against the offences established above. Furthermore, should the owner or master of a vessel be able to prove that the oil or mixture of oil escaped as a result of any damage to the vessel and can further prove that after such damage occurred, as soon as it was practicable, all reasonable steps were undertaken to preventing, reducing or arresting the escape of the oil or mixture, then this too may serve as a defence to a charge further to an offence noted above.

Should the owner or master of a vessel be able to prove that the oil or mixture escaped by reason of leakage, and that the neither the said leakage nor any delay in discovering it was as a result of lack of reasonable care, and that as soon as practicable after the

² **Section 5 of the Shipping (Oil Pollution) Act**

escape was discovered, all reasonable steps were taken for stopping or reducing it; this too can serve as a defence to a charge in respect of an offence listed above.

The Shipping (Oil Pollution) Act also establishes as an offence, the discharge of certain oils from pipeline and exploration areas. Establishes, unless the discharge was from a place in his occupation and it can be proven that it was due to the act of a person who was there without his express or implied permission. Any person determined to be guilty of this offence, upon summary conviction is subject to a fine of \$240 000.

The Act however recognizes as a defence, proof that neither the escape nor any delay in discovering the escape resulted from reasonable care. Furthermore, it must be proven that as soon as it was practicable, after the escape was discovered, all reasonable steps were undertaken to reduce or arrest it.

Additionally, the Act also determines that another defence can be proof that:

- *“(a) the oil was contained in an effluent produced by operations for the refining of oil;*
- *(b) that it was not reasonably practicable to dispose of the effluent otherwise than by discharging it into the water concerned; and*
- *(c) that all reasonably practicable steps had been taken for eliminating oil from the effluent.”³*

It is important to note that in an effort to prevent and/or reduce oil discharge from ships and prevent oil and oil mixtures in the sea, the Minister is empowered to make regulations for the purpose of preventing or reducing discharges of oil in ships to prevent oil and mixtures into the sea, the Minister may make regulations requiring Barbadian ships, to be fitted with such equipment and to comply specific requirements to achieve this intended purpose.

The Shipping (Oil Pollution) Act establishes an International Oil Pollution Compensation Fund and determines that Annual contributions shall be made to the Fund in respect of oil carried by sea to ports or terminals in Barbados.

³ Section 9 (2) of the Shipping (Oil Pollution) Act

The person who are to pay contributions to the Fund include the importer of the oil, in cases where oil which is being imported into Barbados, or, in any other case, the person receiving the oil.

The Act also promote adherence to and enforcement of key international agreements, including the International Convention on Civil Liability for Oil Pollution Damage and the International Convention on Tonnage Measurement.

3.13. Regional and International Regulations ⁴

3.13.1. Cartagena Convention⁵

The Convention for the Protection and Development of the Marine Environment of the Wider Caribbean Region (WCR) is often referred to as the Cartagena Convention and represents a regional agreement developed for the protection of the Caribbean Sea. Given the scope of the Convention, three technical agreements referred to as Protocols were developed to support the implementation of the Convention:

- Protocol on Oil Spills;
- Protocol on Specially Protection Areas and Wildlife (SPAW);
- Protocol on Land Based Sources (LBS) of Marine Pollution.

The Cartagena Convention establishes a legal framework for regional cooperation and the implementation of measures to prevent, reduce and control pollution of the Convention area and to ensure sound environmental management.

The Convention areas is defined as “*the marine environment of the Gulf of Mexico, the Caribbean Sea and the areas of the Atlantic Ocean adjacent thereto, south of 300 north latitude and within 200 nautical miles of the Atlantic coasts of the States referred to in article 25 of the Convention*”.

The Cartagena Convention addresses issues in respect of pollution from ships, pollution caused by dumping, pollution from land-based sources and pollution from sea-based activities, among others.

⁴ <https://www.imo.org/en/about/Conventions/Pages/ListOfConventions.aspx>

⁵ <https://www.unep.org/cep/who-we-are/cartagena-convention#:~:text=The%20Convention%20for%20the%20Protection,force%20on%2011%20October%201986.>

The Convention determines that all appropriate measures must be taken to prevent, reduce and control pollution of the Convention area, caused from the discharge of ships and further requires that all contracting Parties of the Convention implement the applicable international rules and standards.

The Convention further applies this same requirement in respect of dumping, stipulating that contracting parties must implement appropriate measures to prevent, reduce and control pollution of the Convention area caused by dumping of wastes and other matter at sea from ships, aircraft or man-made structures at sea. The provision further requires compliance with international rules and standards.

Provisions in respect of land-based sources establish that signatories to the Convention must implement appropriate measures to prevent, reduce and control pollution of the Convention area which results from coastal disposal or by discharge stemming from rivers, estuaries, coastal establishments, outfall structures, or any other sources on their territories.

The Convention also establishes that Contracting Parties must implement the requisite measures to prevent, reduce and control pollution of the Convention area which occur as a result from exploration and exploitation of the seabed and its subsoil.

In addition, the Convention establishes provisions governing airborne pollution, specially protected areas, scientific and technical cooperation, institutional arrangements and liability and compensation. Furthermore, it spells out the relationship between the Convention itself and its Protocols.

The Protocol Concerning Pollution from Land-Based Sources and Activities (LBS Protocol) to the Cartagena Convention was adopted in 1999 and entered into force in 2010 and represents a core pillar which supports the implementation of the Cartagena Convention.

The Protocol sets out provisions in respect of Cooperation and Assistance, Monitoring and Assessment Programmes and institutional mechanisms to support the implementation of the Protocol and by extension, the Convention.

The Protocol determines and promotes cooperation in respect of monitoring of activities which support and facilitate the implementation of the Protocol and the Convention; research on the chemistry, fate, transport and effects of pollutants; scientific and technical exchange; and research and development of technologies and practices for

the implementation of this Protocol, among other things. There is a further commitment under the Protocol to pursue:

- (a) The development of scientific, technical, educational and public awareness programmes to prevent, reduce and control pollution of the Convention area from land-based sources and activities in accordance with this Protocol;
- (b) Capacity building in respect of scientific, technical and administrative personnel;
- (c) The provision of technical advice, information and other assistance necessary to address the source categories, activities and pollutants;
- (d) Identification and sourcing of financing for projects necessary to implement this Protocol.

A Regional Coordinating Unit (UNEP-CAR/RCU) was established in 1986 in Kingston, Jamaica and represents the Secretariat to the Cartagena Convention and its Protocols.

3.13.2. International Convention Relating to Intervention on the High Seas in Cases of Oil Pollution Casualties (INTERVENTION), 1969

The International Convention Relating to Intervention on the high Seas in Cases of Oil Pollution Casualties was established to advance the interests against the consequences of a maritime casualty emanating from oil pollution of sea and coastlines. The Convention recognizes that in some instances these measures may require exceptional interventions to protect such interests and established that Parties to the Convention may be permitted to take measures on the high seas as required to prevent, mitigate or eliminate grave and imminent danger resulting from pollution or the threat of pollution which may impact their coastline or related interests, resulting from maritime casualty of related acts. The Convention however prohibits the taking of measures against warship or other ship owned or operated for government non-commercial services.

The Convention further specifies that measures taken must be proportionate to the damage actual or threatened to it and must therefore not go beyond what is reasonably necessary. Furthermore, the measures must end as soon as the intended purpose of the implementation of the measures has been achieved. There are other considerations and rules which are to be adhered to in relation to the unnecessary interference with the

rights and interests of the flag State, third States and of any persons, physical or corporate, concerned.

The International Convention further details arrangements to be followed in respect of negotiations and the settlement of controversies/disputes.

3.13.3. Convention on the Prevention of Marine Pollution by Dumping of Wastes and Other Matter (LC), 1972 (and the 1996 London Protocol)

This Convention represents one of the first international convention which pursues the protection of marine environment and human activities. The Convention therefore contributes to the international control and prevention of marine pollution by proscribing the dumping of certain categories of hazardous materials. Furthermore, the Convention determines the requirement of a special permit prior to the dumping of specific/identified materials and a general permit for the dumping of other waste material.

The Convention defines dumping as a deliberate act which results in the disposal of waste or other matter at sea, from vessels, aircrafts, platforms or other manmade devices. The term also considers the deliberate disposal of vessels, aircrafts, platforms or other manmade devices at sea to be included in the interpretation of the term “dumping”.

The Convention was amended in 1993 to include within its scope a prohibition on the dumping of low-level radioactive waste and a further proscription was included in 1995 which reflected a ban on the industrial waste incineration at sea. In the following year, a Protocol to the Convention was developed and is often referred to as the London Protocol. This Protocol intends to serve as the eventual replacement of the Convention and considers the international trends and developments which impact the marine ecosystem. Accordingly, the Protocol adopts the approach of prohibiting all forms of dumping but specifies an inventory of acceptable wastes which may be dumped, requiring however that the requisite permit be sought and obtained to so dump these items. Currently, items on the permitted list include:

- Dredged material;
- Sewage sludge;
- Fish waste, or material resulting from industrial fish processing operations;

- Vessels and platforms or other man-made structures at sea;
- Inert, inorganic geological material;
- Organic material of natural origin;
- Bulky items primarily comprising iron, steel, concrete and similar unarmful materials for which the concern is physical impact and limited to those circumstances, where such wastes are generated at locations, such as small islands with isolated communities, having no practicable access to disposal options other than dumping;
- CO₂ streams from CO₂ capture processes.

The London Protocol is hinged on the application of the precautionary principle and therefore advocates for the application of the appropriate level of preventive measures to be taken in circumstances where it is believed that the introduction of waste or other matter would likely result in harm, even in the absence of conclusive evidence to demonstrate this causal relationship. Furthermore, the Protocol advocates for the “polluter” to bear the cost of the pollution.

3.13.4. International Convention on Oil Pollution Preparedness, Response and Co-operation (OPRC), 1990

This Convention was developed to advance further measure to reduce and arrest pollution from ships. The provisions of the Convention establish an international cooperation architecture for addressing incidents and threats of a significant nature, relating to marine pollution.

The Convention determines that its Signatory Parties are to establish measures for dealing with pollution incidents, either nationally or in co-operation with other countries. It is also determined that there are key actions to be taken to ensure heightened preparedness, notably ships are to carry a shipboard oil pollution emergency plan. In addition, operators of offshore units under the jurisdiction of Parties are also required to have oil pollution emergency plan.

In situations where incidents occur, ships are mandated to report such occurrences of pollution to the relevant authorities. The Convention specifies measures which are to be taken when such oil pollution incidents occur and reports are filed. It requires Parties receiving the report to:

- Assess the occurrence and determine whether it is an oil pollution incident;
- Determine the nature, extent and possible consequences of the incident; and
- Inform all interested States affected or likely to be, with specific information emanating from its analysis of the event, identifying actions taken or planned to be implemented. In addition any other information regarding interventions to be undertaken to respond to the oil pollution occurrence should also be provided. This information must be shared, without delay, following an oil pollution occurrence. Ships are also required to report incidents of pollution to coastal authorities and the Convention details the actions that are then to be taken.

The Convention requires stockpiling of oil spill combating equipment, the undertaking of oil spill combating exercises and the development of detailed plans for addressing pollution incidents. Given the strong cooperation theme of the Convention, Parties are mandated to assist others in the event of a pollution incident.

Building on the Convention, a Protocol to the OPRC relating to hazardous and noxious substances was adopted in 2000.

3.13.5. Protocol on Preparedness, Response and Co-operation to pollution Incidents by Hazardous and Noxious Substances, 2000 (OPRC-HNS Protocol)

This Protocol is built on the precepts and fundamentals of the *International Convention on Oil Pollution Preparedness, Response and Co-operation*. The Protocol was developed to establish national frameworks for proactive and responsive measures and support the international cooperation framework for addressing marine pollution.

The Protocol stipulates the measures to be implemented to address pollution and requires ships to carry pollution emergency plans which focus on events involving hazardous and noxious substances. The Protocol therefore extends the same principles

and requirements in respect of oil pollution incidents to hazardous and noxious substances.

The Protocol describes a Hazardous and Noxious substance as any substance, apart from oil that if introduced into the marine ecosystem is likely to cause a hazard to human health, harm organisms and marine life, damage amenities or interfere with other legitimate uses of the sea.

3.13.6. International Convention for the Prevention of Pollution from Ships, 1973, as modified by the Protocol of 1978 relating thereto and by the Protocol of 1997 (MARPOL)

The International Convention and its Protocol establishes rules intended to prevent and reduce pollution from ships, whether accidental or as a result of routine operational processes. The Convention is supplemented by six (6) Annexes, described in more detail in Table 6.

Table 6 – Annexes of the International Convention for the Prevention of Pollution from Ships

Annexes	Description of Annexes
Annex I: Regulations for Prevention of Pollution by Oil	This Annex addresses the prevention of oil pollution which results from both operational measures/processes of a ship and accidental discharges. There were amendments instituted which imposes a requirement on new oil tankers to have double hulls and further allowed for a phase-in schedule for existing tankers to fit double hulls.
Annex II: Regulations for the Control of Pollution by Noxious Liquid Substances in bulk	Regulations as specified in this Annex address issues in respect of the discharge criteria and measures for controlling pollution by noxious liquid substances carried in bulk.

Annexes	Description of Annexes
	<p>These Regulations determine that the discharge of the ship's residue is allowed only to reception facilities until certain concentrations and conditions are adhered to.</p> <p>These Regulations further specify that no discharge of residues containing noxious substances is permitted within 12 miles of the nearest land.</p>
<p>Annex III: Prevention of Pollution by Harmful Substances Carried by Sea in Packaged Form</p>	<p>This Annex defines "harmful substances" in keeping with the Maritime Dangerous Goods Code (IMDG Code) or which meet the criteria in the Appendix of Annex III.</p> <p>Annex III sets out general requirements for standards in respect of labelling, packaging, documentation, stowage, quotas, etc.</p>
<p>Annex IV: Prevention of Pollution by Sewage from Ships</p>	<p>This Annex addresses issues in respect of requirements to control pollution of the sea by sewage. In addition, it establishes a prohibition on the discharge of sewage into the sea, determining that an exception exists when the ship has in operation an approved sewage treatment plant or when the ship is employing an approved system at a distance of more than three nautical miles from the nearest land.</p>
<p>Annex V: Prevention of Pollution by Garbage from Ships</p>	<p>This Annex addresses the different types of garbage, determining the required/acceptable distances from land and the manner in which they may be disposed.</p>

Annexes	Description of Annexes
	The Annex prohibits the disposal into the sea of all forms of plastics.
Annex VI: Prevention of Air Pollution from Ships	This Annex stipulates limits on sulphur oxide and nitrogen oxide emissions from ships. The Annex further establishes the framework for the prohibition of deliberate emissions of ozone depleting substances.

3.13.7. Convention on Civil Liability for Oil Pollution Damage

The Convention was developed and implemented to facilitate and ensure the adequacy and availability of compensation to persons who are Impacted from oil pollution damage resulting from maritime casualties involving ships.

The Convention determines that liability in respect of oil pollution damages lies with the owner of the ship from which the oil escaped or was discharged. This has been explicitly determined in the Convention, but there are some exceptions which may be considered, but the onus is on the operator to prove that any of the considered exceptions are applicable. Furthermore, it is important to note that except where the owner has been guilty of actual fault, they may limit liability in respect of any one incident.

The Convention is applicable to all seagoing vessels which are carrying oil in bulk quantities as cargo. Notwithstanding, only ships carrying more than 2,000 tons of oil are mandated to maintain insurance in respect of oil pollution damage.

The Convention imposes a requirement that ships must maintain insurance or some other form of financial security which equates to the total liability for one incident. This requirement however does not extend to warships or other vessels operated by Government for non-commercial purposes. The Convention however applies in relation to liability and jurisdiction provisions, to ships owned by a State and used for commercial purposes, save in situations where these ships are not required to carry insurance. As an alternative, they are required to carry a certificate indicating that the liability of the ship in respect of the Convention is covered.

There were Protocols developed in 1976, 1984 and 1992 which all served to strengthen the legislative and regulatory regimes to further support the implementation of the Convention. The 1992 Protocol amended the entry into force requirements through the reduction of the number of large tanker-owning countries that were needed for entry into force; this reduced from 6 to 4. Additionally, compensation limits were set. The table below summarizes these.

Table 7 – Compensation Liability Limits established under the 1992 Protocol

Compensation Liability Limits established under the 1992 Protocol to the International Convention on Civil Liability for Oil Pollution Damage	
Ship (Gross tonnage)	Liability
A ship not exceeding 5,000 gross tonnage	liability is limited to 3 million Special Drawing Rights (SDR)
A ship 5,000 to 140,000 gross tonnage	liability is limited to 3 million SDR plus 420 SDR for each additional unit of tonnage
A ship over 140,000 gross tonnage	liability is limited to 59.7 million SDR

The 1992 Protocol also expanded the scope of the Convention to include pollution damage caused in the exclusive economic zone (EEZ) or equivalent area of a State Party. Additionally environmental damage compensation now has a limit to costs incurred for reasonable measures to reinstate the contaminated environment. Furthermore, the Protocol permits that compensation is to be received for expenses incurred for preventive measures even when no spill of oil occurs, once it can be proven that there was a grave and imminent threat of pollution damage.

Other key developments under the 1992 Protocol include:

- Extension of the Convention to cover spills from sea-going vessels constructed or adapted to carry oil in bulk as cargo;
- Clarification that a shipowner is not able to limit liability should it be proven that the pollution damage occurred as a result of the shipowner's personal act or omission, which was committed with the intention to cause such damage;

- Denunciation of the Old Regime which resulted (in 1998) in the Protocol States no longer being Parties to the 1969 International Convention on Civil Liability for Oil Pollution Damage;
- Facilitation of the granting of certificates to ships registered in States which are not Party to the 1992 Protocol. This would therefore facilitate a shipowner being able to obtain certifications to both the 1969 and 1992 International Convention on Civil Liability for Oil Pollution Damage.

There were amendments made in 2000 which further raised the compensation limits from that which was previously determine in the 1992 Protocol. The Table below presents the most recent compensation liability limits.

Table 8 – Compensation Liability Limits established under 2000 Amendments

Compensation Liability Limits established under 2000 Amendments to the International Convention on Civil Liability for Oil Pollution Damage	
Ship (Gross tonnage)	Compensation Liability Limits
A ship not exceeding 5,000 gross tonnage	liability is limited to 4.51 million SDR (US\$5.78 million)
A ship 5,000 to 140,000 gross tonnage	liability is limited to 4.51 million SDR plus 631 SDR for each additional gross tonne over 5,000
A ship over 140,000 gross tonnage	liability is limited to 89.77 million SDR

3.13.8. International Convention for the Safety of Life at Sea (SOLAS), 1974

The SOLAS Convention governs and promotes the safety of merchant ships. While first drafted in 1914, there have been several amendments as the Convention sought to ensure that it adapts to global developments and the reality of the times.

The SOLAS Convention establishes the minimum standards in respect of the construction, equipment and operation of ships, compatible with their safety. The Convention therefore determines several certificates which are to be sought and obtained as proof that the minimum standards have in fact been implemented.

There are additional control provisions for inspection of ships, should it be determined that there are clear grounds for believing that the ship and its equipment are not compliant with the Convention. This is referred to as port State Control.

The Convention presents its prescribed provisions to promote government and facilitate merchant ship safety through the following Chapters:

- Chapter I - General Provisions;
- Chapter II-1 Construction - Subdivision and stability, machinery and electrical installations;
- Chapter II-2 - Fire protection, fire detection and fire extinction;
- Chapter III - Life-saving appliances and arrangements;
- Chapter IV – Radiocommunications;
- Chapter V - Safety of navigation;
- Chapter VI - Carriage of Cargoes;
- Chapter VII - Carriage of dangerous goods;
- Chapter VIII - Nuclear ships;
- Chapter IX - Management for the Safe Operation of Ships;
- Chapter X - Safety measures for high-speed craft;
- Chapter XI-1 - Special measures to enhance maritime safety;
- Chapter XI-2 - Special measures to enhance maritime security;
- Chapter XII - Additional safety measures for bulk carriers;
- Chapter XIII - Verification of compliance;
- Chapter XIV - Safety measures for ships operating in polar waters.

3.13.9. International Convention on the Control of Harmful Anti-fouling Systems on Ships (AFS), 2001

This Convention proscribes the use of harmful chemical compounds in anti-fouling paints which are used on ships. The Convention further establishes measures to prevent the potential future use of other harmful substances in anti-fouling systems. The effect and spirit of the Convention is to prevent the harmful impact or result of anti-fouling systems on ships on marine life and ecosystem.

3.13.10. International Convention for the Control and Management of Ships' Ballast Water and Sediments, 2004

The Convention intends to facilitate the prevention, minimization and elimination of the transfer of harmful aquatic organisms and pathogens. This will be achieved by controlling and managing ships' ballast water and sediments, permitting the Parties of the Convention to apply stringent measures consistent with international law.

4. Institutional and governance framework

This Chapter provides an overview of the institutional and governance arrangements involved in respect of marine pollution management in the coastal and marine areas of Barbados. A description of the principal entities most directly interplaying with marine pollution management is first presented. This is followed by summaries of other institutional stakeholders that are also relevant to the dialogue and strategic direction in respect of marine pollution management.

4.1. Environmental Protection Department

The EPD is a regulatory government agency (formerly the Environmental Engineering Division established in 1971) enacted under the Public Service (General) Order, 2020 (S.I. 2020 No. 41). This Department operates under the purview of the Ministry of Environment and National Beautification, Green and Blue Economy (MENB).

Its scope is to ensure the preservation and development of Barbadians' quality of life and natural environment by being responsible for environmental monitoring. The primary legislative instruments that regulate the agency's policy and management are the Health Services Act and related regulations, and the Marine Pollution Control Act.

Within the EPD, different sections oversee a specific area (Figure 5).

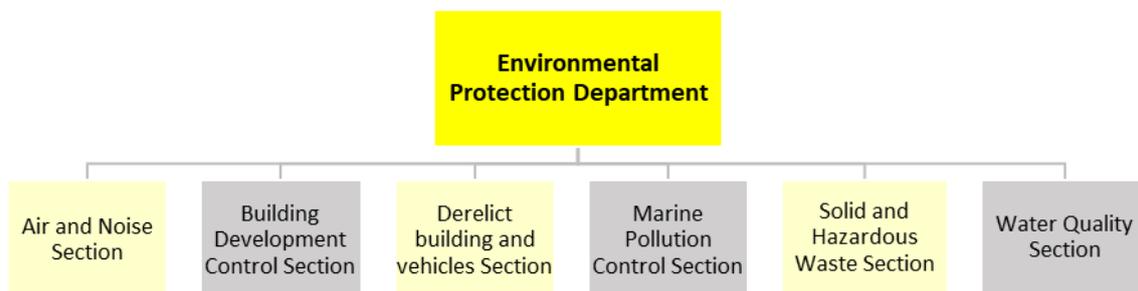


Figure 5 - Environment Protection Department Organization

Key areas of responsibility of the EPD include the following:

- Building Development Control;

- Hazardous Material Management;
- Solid Waste Management;
- Water Quality Monitoring and management;
- Marine Pollution;
- Multi-lateral environmental agreements (MEA).

The **Building Development Control Section** ensures that all development in Barbados complies with national laws, policies and approved standards that promote health, safety, and environmental protection (Environmental Protection Department, 2023). Applications for the construction, extension or material alteration of a building are dispatched to the EPD by the Town and Country Development Planning Office (TCDPO). Approval must be granted by both (EPD and TCDPO) before construction starts. Applications may also be made directly to the EPD, according with Regulation 3 of the Health Services (Building) Regulations 1969.

Also, EPD has a technical section responsible for reviewing environmental impact assessments and scoping studies, and for giving technical support on the risk and potential impacts. Likewise, it evaluates primary wastewater treatment systems.

EPD's **Solid and Hazardous Waste Section** oversees non-hazard and hazardous waste management governed by Health Services (Nuisances) Regulations (1969), Health Services (Disposal of Offensive Matter) Regulations (1969), and the Pesticides Control Act.

Regarding hazardous waste management, the **Solid and Hazardous Waste Section** shall:

- Identify the location of hazardous materials;
- Promote public awareness of the use, handling, and disposal;
- Regulate certain facilities using hazardous materials;
- Regulate and facilitate the disposal;
- Develop policies for hazardous materials management; and
- Set standards for the collection, transport, use, storage, and disposal.

On solid waste management, the same Section is responsible for:

- Monitoring and regulating the waste disposal sites operated by the Sanitation Service Authority;
- Regulating the disposal of commercial and industrial waste;

- Developing and providing advice on solid waste management policies.

The **Water Quality Section** seeks to conserve and preserve Barbados' water resources. Therefore it has developed four water monitoring programmes, namely:

- Ground Water Monitoring Programme – in partnership with Barbados Water Authority, EPD samples twenty-one (21) drinking water wells, eleven (11) agricultural wells, and seven (7) public springs to safeguard water quality for public consumption;
- Widescreen Ground Water Monitoring Programme – biannual monitoring of parameters not analysed in the previous monitoring programme;
- Nearshore Recreational Water Monitoring Programme – evaluates the impact of land-based activities through the sampling of eighteen (18) west and south coast bathing beaches;
- Wastewater Monitoring Programme – island-wide monitoring of wastewater treatment plants discharges.

Pursuant to the Marine Pollution Control Act, the EPD's **Marine Pollution Control Section** seeks to secure a healthy marine environment by overseeing activities that impact or might impact the marine environment. Its functions comprise:

- Responding to complaints or pollution incidents related to the marine environment;
- Monitoring and control of marine pollution;
- Conducting inspections of various sources to determine potential releases of pollutants;
- Oil spill contingency planning and response;
- Conducting research into marine pollution issues;
- Conducting research into marine pollution issues; and
- Preparing guidelines for various sectors and or activities aimed at reducing marine pollution.

The EPD accounts for several MEA (legally binding agreements concerning the environment), which ensure *the harmonization of national programmes and policies to achieve identified targets across these conventions as well as national priorities* (Ministry of Environment and National Beautification, 2023):

- Convention on the Prevention of Marine Pollution by Dumping of Wastes and Other Matter 1972 – London Convention;
- Convention for the Protection and Development of the Marine Environment in the Wider Caribbean Region – Cartagena Convention;
- Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and Their Disposal;
- Stockholm Convention on Persistent Organic Pollutants;
- Strategic Approach to International Chemicals Management;
- International Atomic Energy Agency;
- Chemical Weapons Convention.

The underlined MEA relate, direct or indirectly, to marine pollution.

4.2. Coastal Zone Management Unit

The CZMU is responsible for preparing a Coastal Zone Management Plan to ensure the management and conservation of coastal resources. As established in the CZM Act, the Coastal Zone Management Plan shall encompass policies, strategies, and standards regarding the spatial use of coastal zones (structures and activities) and protection of coastal resources (species, communities, and habitats).

Through the Coastal Zone Management Plan the CZMU may delineate provisions regarding multiple subjects related to marine pollution, namely:

- Standards for environmental impact assessment for development which may affect the conservation and management of coastal resources;
- Standards for water quality in coastal and marine areas to effect the maintenance, rehabilitation and enhancement of coastal and marine habitats;
- Standards for activities that may affect coastal resources, including beach rock removal, coral rubble removal, removal of seagrasses, offshore sandmining, dredging, use of explosives and chemicals, use of vehicles on beaches and the movement and the anchoring of vessels.

The Director of the CZMU is responsible for implementing the provisions of the CZM Act and any others Act's provisions that may impact the management and conservation of coastal resources. Therefore, the Director of the CZMU possesses responsibility for

proffering recommendations to Ministers, Boards, Commissions, and other statutory authorities whose policies and roles affect coastal zone management and assign functions to the coastal zone inspectors, which comprise:

- Enter and search any place to inspect any infringement of the provisions of this Act or any Act that affects coastal zone management;
- Stop and search any vehicle or vessel to oversee if there is any infringement of the provisions of this Act or any Act that affects coastal zone management;
- Require the production of any document that contains information relevant to an infringement;
- Require the production of any document required to be kept under the provisions of this Act or any Act that affects coastal zone management;
- Exercise any other power related to investigation under the provisions of this Act or any Act that affects coastal zone management or any regulations made under either Act.

The CZM Act vests both the CMZU's Director and inspectors with powers, rights, privileges, and protection of a member of the Police Force, in addition to the specific powers stated above.

4.3. Fisheries Department

The Fisheries Act (as amended, 2002) makes provisions for coastal resources protection, namely fisheries products. It establishes the Fisheries Department composed of a Chief Fisheries Officer, Fisheries Officers, Fisheries Assistants, and other officers. The Chief Fisheries Officer has responsibility for implementing the Fisheries Act provisions to ensure the management and development of sustainable fisheries in Barbados. The Department is further responsible for developing fisheries schemes that include:

- Identify each fishery and assess the present state of its exploitation;
- Specify the objectives to be achieved in the management of each fishery;
- Specify the management and development measures to be taken;
- Specify the licensing programmes to be followed for each fishery, the limitations to be applied to local fishing operations and the amount of fishing to be allocated to foreign fishing vessels.

Any fisheries officers within the Department for ensuring the enforcement of the Act may:

- Stop, board and search any foreign fishing vessel in the waters of Barbados and any local fishing vessel in or outside the waters of Barbados;
- Require to be produced, examine and take copies of any licence or other document required under the Fisheries Act;
- Require to be produced and examine any fishing net or other fishing gear on board a fishing vessel whether at sea or on land;
- Enter and search any premises or vehicles, where the fish or aquatic flora illegally taken are being stored or transported;
- Take samples of any fish or aquatic flora found in any fishing vessel, vehicle or premises;
- Seize any vessel (together with its stores and cargo), vehicle, fishing gear, net or other fishing appliance, when it has been used in the commission of the offence or in respect of which the offence has been committed;
- Seize any fish or aquatic flora which has been caught in the commission of the offence or is being possessed, imported or exported in contravention;
- Seize any explosive or poison which is being possessed in contravention;
- Arrest or detain any person whom is involved in the commission of an offence.

4.4. Planning and Development Department

The Planning and Development (Amendment) Act, 2020 presents the laws governing the planning process, making provision for:

- The orderly and progressive development of land;
- The grant of permission to develop land;
- Powers to regulate land use and development; and
- Related matters.

This Bill is divided into the following sections (Planning and Development Department, 2023):

- Administration;
- Physical Development Plans;
- Regulation of Land Development;
- Building, Engineering and Subdivision Plans;
- Protection of the Cultural and Natural Heritage;
- Control of Outdoor Advertisements;
- Enforcement;
- Acquisition of Land for Planning Purposes;
- Compensation;
- Planning Appeals;
- Miscellaneous.

The Planning and Development Board accounts for the determination of all applications for planning permission. The Board appoints a “Design and Engineering Committee” and an “Environmental Impact Assessment Committee”, as well as other committees or working groups fitted to assist in the proper development of its functions.

Environmental impact assessment regulations shall be made by the Minister providing for:

- The criteria and procedures for determining whether an activity is likely to significantly affect the environment so that an environmental impact assessment may be required;
- The procedures for settling the scope of works of the environmental impact assessment to be carried out;
- The minimum contents of an environmental impact statement to be submitted to the Director of Planning and Development;
- The qualifications, skills, knowledge or experience which shall be possessed by persons conducting environmental impact assessment studies;
- The procedures for public participation in the environmental impact assessment process and public scrutiny of the submitted environmental impact statement;
- The procedure and criteria for reviewing the environmental impact statement; and

- The consideration by the Planning and Development Board of an application with respect to which an environmental impact assessment has been required.

4.5. Barbados Water Authority

The Barbados Water authority possesses responsibility for providing the island of Barbados with potable water and further provides wastewater treatment and disposal services to the sewered areas of Bridgetown and the South Coast.⁶

Moreover, the Authority is also responsible for monitoring, assessing, controlling and facilitating the protection of the island's water resources. In this way, the Authority can contribute to the national efforts in respect of preventing and managing pollution from one sphere of the overall water management ecosystem.

4.6. Sanitation Service Authority

The Sanitation Service Authority is a statutory body of Barbados under the purview of the Ministry of the Environment and National Beautification, Green and Blue Economy, and was established under the Sanitation Service Authority Act CAP 382.

The responsibilities of the Sanitation Service Authority relate to the collection of solid waste and the management of the island's solid waste disposal sites.

4.7. Ministry of Transport, Works and Water Resources

The Ministry possesses responsibility for providing the efficient road network services and the proper maintenance of Government assets, notably buildings and vehicles. In addition, this Ministry also is responsible for effective drainage solutions and other services in respect of public works. The efficient delivery of the services of this Ministry contributes to the prevention of pollution and can also assist in managing pollution which relates to inadequate infrastructural arrangements.

⁶ <https://barbadoswaterauthority.com/>

4.8. Other

There are additional actors that may influence policy and other strategic interventions in respect of the prevention and/or management of marine pollution. The table below notes these institutional stakeholders and further provides an overview of their organisation.

Table 9 – Additional actors involved in the management of Barbados’ coastal and marine areas

Institutional/Organisational Stakeholders	Organisational Overview
Barbados Association of Non-Governmental Organisations (BANGO)	<p>BANGO stands as the national focal point for Civil Society Organisations (CSOs) in Barbados and as such advocate for and facilitates their participation in key national and regional decision-making processes and policy formulation initiatives.</p> <p>Given the scope of responsibility of BANGO, this Association can therefore serve to represent the interest of civil society in respect of issues related to and/or interplaying with marine pollution.</p>
Barbados Hotel and Tourism Association	<p>The Barbados Hotel and Tourism Association is an association established to serve the interests of its tourism and non-tourism entities.</p> <p>The principal aim of the Association is to facilitate the sustainable growth and development of the national tourism sector, in order to derive benefits to Barbados.</p> <p>The Barbados Hotel and Tourism Association participates in national and regional dialogue on a range of issues which impact and interplay with tourism including in respect of marine resources. Accordingly, the Barbados Hotel and Tourism Association can inform dialogue and strategic direction in respect of the development of strategy for the management of marine pollution.</p>

<p>Blue Green Initiative Inc.</p>	<p>The Blue Greene Initiative represents a Caribbean based organization that works towards sustainable development, focusing on strengthening vulnerable communities, enhancing public awareness and building capacity in Small Island Developing States. The interventions of the Blue Green Initiative Inc, include:</p> <ul style="list-style-type: none"> • Food Systems • Water Resources Management • Blue Economy (Coastal and Marine) • Climate Change <p>Accordingly, this organisation can be useful in the dialogue on polluting prevention and management. ⁷</p>
<p>Barbados Environmental Conservation Trust</p>	<p>The Barbados Environmental Conservation Trust was established to support national efforts to preserve and restore the natural resources and assets of Barbados. Marine conservation represents one of the areas of interest of the Trust and there have been projects previously undertaken in this area. Given the nexus between marine conservation and the elimination of pollution, this organization is noted to be another relevant institutional that can inform the dialogue and strategic development on the way forward in respect of marine pollution management.</p>
<p>Future Centre Trust</p>	<p>With a focus on sustainability, conservation and preservation, the Future Centre Trust was established in 1994.</p>

⁷ <https://bgibb.com/about-us/>

	<p>The Future Centre Trust is focused on contributing towards the achievement of the UN sustainable development goals through community action and inclusive participation. The Trust has instituted several programmes towards this end, inclusive of which are:</p> <ul style="list-style-type: none"> • Barbados Trailway • Green Business Barbados • Future Trees • Clean Up Barbados <p>Efforts under the Clean Up Barbados Programme include initiatives that address marine pollution.</p>
<p>University of the West Indies</p>	<p>Within the Faculty of Science and Technology, the Department of Biological & Chemical Sciences has undertaken research in respect of water quality/management and pollution assessment.</p> <p>Pollution Assessment and Ocean/Marine health are noted to be two of the principal areas of focus of the Department.</p> <p>The Department can therefore be instrumental in informing and contributing to the dialogue and formulation of strategic instruments in respect of marine pollution management.</p>
<p>McGill University</p>	<p>Bellairs Research Institute is the only research arm of the McGill University established in the Caribbean. This Institute focuses on research in respect of tropical terrestrial and marine environments.</p>

	<p>Bellairs Research Institute has undertaken research in areas in respect of marine pollution and has contributed to the advancement in research in this and other areas. This Institute therefore represents a key stakeholder that can influence and advance decisions, research and strategic directions in respect of the management of marine pollution.</p>
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In addition to the above, other notable organisations that are relevant to the discussion surrounding marine pollution management include Barbados Blue Water Sports; Barbados Divers Association; Barbados National Oil Company Limited; CORALL Barbados; Barbados National Trust; and the Caribbean Conservation Association.

5. Planning and implementation processes

5.1. Introduction

Planning and implementation processes relating to marine pollution in Barbados are shared among several entities. In essence, distinct sectoral legislations and plans deal with distinct components of the transversal issue that is marine pollution.

The primary agency that regulates any source of pollution to the marine environment is the EPD, including land-based sources. The CZMU, being tasked with the protection of coastal ecosystems, is also very much involved with this issue, and works closely with the EPD, mostly through monitoring of ecosystem health.

At present, because regulations under the Marine Pollution Management Act are not yet finalized, there are limited measures that the EPD can take in relation to polluting activities. They mostly act on a case-by-case basis, in response to routine monitoring done by them and companies, and in response to sporadic reports.

Regarding situational analysis, in addition to routine monitoring of nearshore and groundwater by the EPD, new developments may be required to conduct baseline studies as part of environmental assessments. This data is then reported to the EPD.

There are currently no plans in force that deal with marine pollution in an integrated way. While there was an attempt at a unified strategy towards marine pollution from land-based sources (c.f., 5.2), the implementation was unsuccessful, as explained later, and planning documents currently in force remain either sectoral (c.f., 5.4) or broader in scope (c.f., 5.3).

The next sections provide an overview of the main plans that have been developed in Barbados more closely relating to marine pollution.

5.2. Barbados' National Programme of Action for the Marine Environmental from Land Based Sources of Pollution

Prepared in 2007 for implementation in the ten-year period of 2005-2015, the "National Programme of Action for the Marine Environmental from Land Based Sources of Pollution" was Barbados' response to UNEP's Global Programme of Action against this kind of pollution, under the LBS (c.f., 3.13.1, Cartagena Convention).

Overall goal: to protect the Barbados coastal and marine environment from pollution derived from land-based sources and activities.

Supporting goals:

- To reduce the degradation of the marine environment;
- To promote the conservation and sustainable management of the coastal and marine environment;
- To develop the framework for the acquisition, analysis and use of data for decision making in the protection of the marine environment;
- To develop an institutional and planning framework to improve the planning process in order to ensure protection of coastal and marine environment for sustained economic development;
- To integrate the appropriate policies into the Barbados Coastal Zone Management Plan;
- To improve existing legal provisions for the enhanced protection of the marine environment.

The development of the National Programme of Action (NPA) started with a one-day consultation with a technical group joining representatives from relevant government agencies and statutory bodies, which produced a draft framework for action. Recommendations were made regarding the next steps for the programme's development, and for its contents. Sectoral and public consultation workshops were also held to collect information.

Through these meetings, together with an extensive literature review, pollution sources were identified, priorities were defined, and the Action Programme was developed, including of four (4) pilot projects, for each of which the following are defined: lead agencies, collaborating agencies, other partners, duration, goal, rationale, main project components, schedule and provisional budget.

In terms of pollution issues, the NPA lists the following priority areas:

- Sewage treatment and disposal;
- Agricultural practices;
- Changes in sediment dynamics;
- Water pollution and eutrophication;

- Degradation of ecosystems, loss of biodiversity and reduced nearshore fish stocks.

Building on this, the Action Programme itself is constituted of six (6) thematic areas, under which the following components are developed: diagnostic situation, quality objective, specific objectives, actions, agencies responsible, cost, financing sources, and time frame for implementation. These are:

- (1) Policy and management:
 - Ecosystem and biodiversity;
 - Technology and infrastructure;
 - Institutional and legal framework;
- (2) Knowledge technology and information;
- (3) Characterization of pollution and environmental monitoring;
- (4) Follow up and monitoring;
- (5) Promotion of awareness and capacity building;
- (6) Promotion of increased technical and operational pollution control capabilities and associated capacity building.

In its conclusion, the NPA advises for a phased implementation guided by priority setting, considering the high estimated costs.

According to the CZMU (stakeholder interviews, February 2023), the programme has not been implemented integrally. Some pilot projects may have been initiated, but the need for collaboration and articulation between multiple agencies depending on the project may have diffculted its implementation as a whole (c.f., Annex 4, 1 - Coastal Zone Management Unit).

5.3. Integrated Coastal Zone Management: The Barbados Policy Framework (2020 – 2030)

Barbados' ICZM Policy Framework was developed in 2020 and intends to guide “the planning and development of coastal activities in a rational and sustainable manner through the implementation of supporting guidelines, principles, and tools”.

Pollution is mentioned from the get-go, in the Framework's vision description, which reads that “Land and water management will be taking place in a way that ensures that

impacts on the coastal environment are minimised, particularly in relation to land-based pollution” (Coastal Zone Management Unit, 2020a).

The Framework reviews and describes in detail the environmental and socioeconomic baseline conditions, legal and institutional arrangements, international conventions and protocols, other plans and policies, the history of ICZM in the country, etc., and builds on this information to provide guidance at national and local scales (for different themes) on how to better manage the CZMA. It essentially integrates all available information, analyses all players and main concerns, and returns a unified guiding document for the area based on mutually agreed outcomes and goals. As such, it includes provisions related to marine pollution, although not in a dedicated section, but rather sprinkled under relevant sub-areas or themes.

The plan is constituted of the following components:

- Volume 1:
 - Part A: Background (purpose, geographic scope, vision and principles);
 - Part B: ICZM challenges and opportunities (climate change, legal instruments, plans and policies, etc.);
 - Part C: Policy framework itself (including outcomes and goals);
 - Part D: Coordination and implementation provisions;
- Volume 2:
 - Part A: Baseline;
 - Part C: National Guidance – this part provides guidance for risk-resilient ICZM from the national perspective to address Policy Outcomes as defined in Part B of Volume 1; it includes the following thematic areas (for each, current status, implications, management guidance, and action briefs):
 - Disaster risk management and climate change adaptation;
 - Beach management;
 - Development planning and setbacks;
 - Compliance with environmental and social safeguards;
 - Construction and maintenance of coastal structures;
 - Emerging issues;
 - Biodiversity conservation and coastal habitat restoration;
 - Part B: Creating an adaptive pathway (framework approach);
 - Part D: Action briefs for sub-areas;
 - Part E: Implementation procedures.

5.4. National Oil Spill Contingency Plan for Barbados

The National Oil Spill Contingency Plan (NOSCP) for Barbados was firstly approved in 2002, and after updated and approved in 2013, aiming to “prevent or, where prevention is not possible, mitigate and minimise adverse environmental impacts of oil pollution”.

The document establishes organisational and decision-making structures, namely, nominates the EPD as the lead agency for its upkeep and maintenance, and establishes a Response Committee whose functions are to:

- (a) Provide strategic oversight and direction for the effectiveness and efficiency of the National Plan;
- (b) Evaluate preparedness for response to an oil spill incident;
- (c) Oversee the ongoing effectiveness of arrangements between key stakeholders for Plan implementation;
- (d) Develop and implement mechanisms, including operational procedures, to ensure that the roles and responsibilities of stakeholders are clearly understood by all stakeholders in the National Plan;
- (e) Provide advice to the Environmental Protection Department and the Ministry of Environment and Drainage on the development and maintenance of co-operative arrangements for oil spill preparedness and response;
- (f) Provide advice on the funding direction for the Plan and on the collection and distribution of funds for the Plan.

The committee joins representatives from the CZMU, the EPD, the Fire Service, the National Oil Company, Barbados Port Inc., the Energy Division, among others.

Under the NOSCP, companies or terminal operators are responsible for taking action over incidents occurring at their facilities. Mutual assistance is provisioned under the Marine Oil Spill Action Plan (MOSAP), if a company requires resources beyond their capacity. When additional resources are required, after mutual aid has been put in place, the National Response Team comes into action.

Figure 6 presents the response flow chart defined in the National Plan.

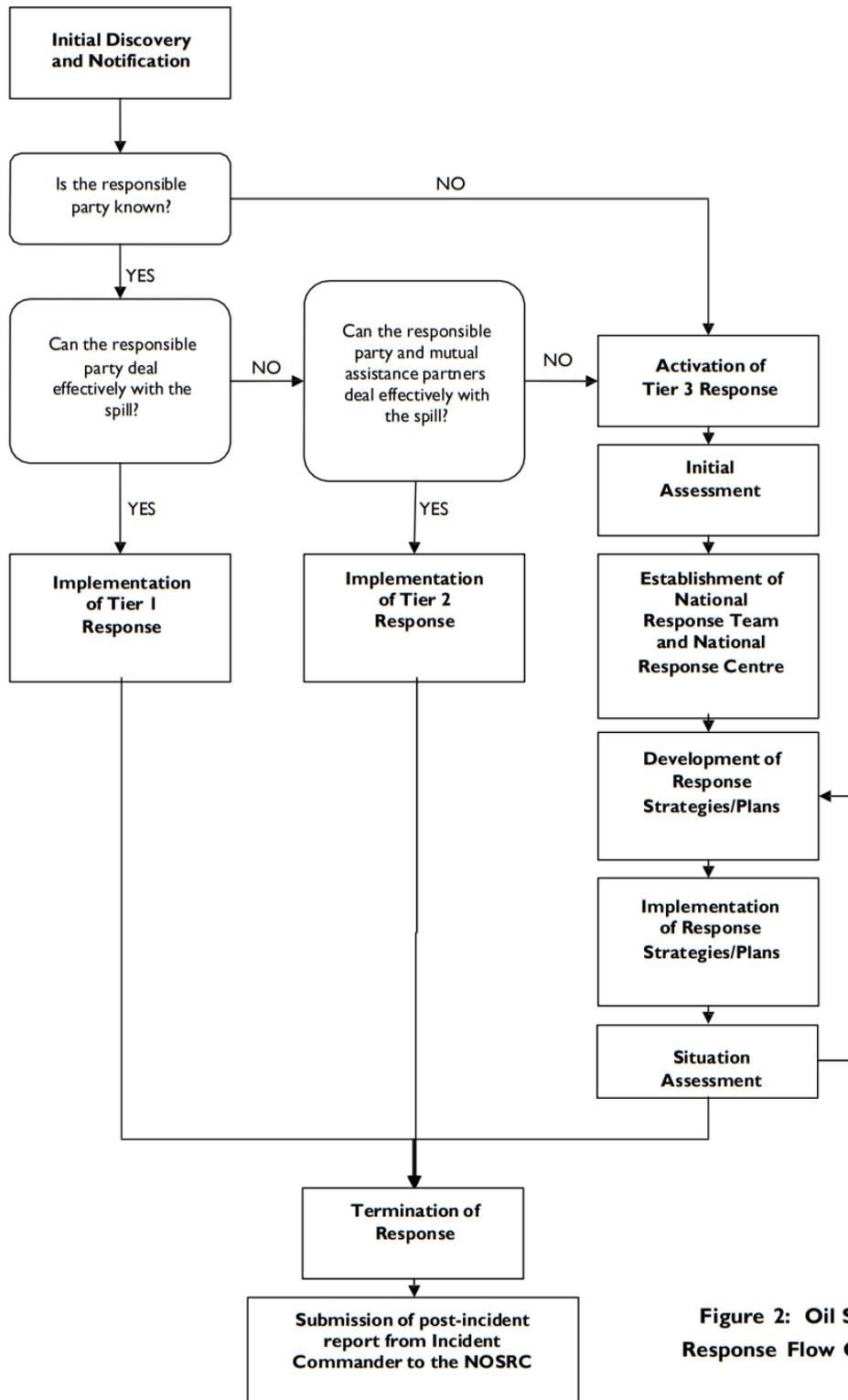


Figure 2: Oil Spill Response Flow Chart

Figure 6 – Oil Spill Response Flow Chart from the NOSCP

The Plan also establishes the need and responsibility for the development of several ancillary documents including a national risk assessment, the definition of response strategies, sensitivity and contingency maps, oil response field guides, among others.

5.5. Physical Development Plan (Amended, 2017)

The first Physical Development Plan for Barbados was published in 1970, and has been updated since then, following the changes in the economy, demography, and physical development of the country.

The current version of this Plan provides *a vision for sustainable growth and development of the nation by setting out policies to guide relationships among land uses, built form, mobility, community facilities and physical infrastructure* (Planning and Development Department, 2023).

The main purposes of the Plan are to:

- Foster the economic, environmental, physical and social well-being of the population of Barbados;
- Address the critical impacts of climate change on Barbados through policies and strategies;
- Establish a vision to guide the future form of development with respect to land use, settlement patterns, food production, infrastructure, mobility and environmental management;
- Guide the future form of development on the island and inform the public, business and government sectors as to the nature, scope and location of both development and protection areas for core assets; and
- Provide a clear and accessible framework for private and public investment in the physical environment (Town and Country Development Planning Office, 2017).

The Physical Development Plan Amendment process involved both a review of the considered policies, including a detailed assessment of the effectiveness of the existing policies, and considered new critical factors, initiatives and commitments.



5.6.2020 Water Protection and Land Use Zoning Policy

The 2020 Water Protection and Land Use Zoning Policy is under review in a process of open national consultation, under the Green Paper on the 2020 Water Protection and Land Use Zoning Policy.

This document assesses the existing groundwater protection zoning policy, while proposing a new integrated approach to protection of all water resources, including coastal waters. It addresses sources of pollution, applies the best practices, strengthens capacity and recommends a more adequate regulatory and legislative structure.

This consultative document submits for discussion:

- New groundwater protection zoning regulations;
- Sewering densely populated sites in the newly proposed Zone A areas;
- Discouragement of the use of absorption or “suck” wells alone as the primary means of domestic wastewater treatment and disposal;
- Use of proven technologies to remove contaminants from drinking water;
- Establishing a new Water Resources Agency (Ministry of Energy and Water Resources, 2020).

In this policy review, the proposed zones are as follow:

- Zone A – Strict exclusion zone, smaller in area than the current Zone 1, with no new developments and restricted agriculture;
- Zone B – Pathogen management zone, with stricter rules for sewage treatment and disposal;
- Zone C – Chemicals management zone, with restrictions on chemicals storage, use and disposal. Regulations for nutrient removal (nitrates and phosphates) from wastewater that recognises potential impacts on nearshore ecosystems;
- Zone D – Recharge controlling zone that includes the additional limestone areas, with continued standards for wastewater treatment;
- Zone E – Non-recharge contributing area, consisting on areas that do not contribute to the recharge of aquifers. Again, there will be minimum standards for wastewater discharge with the objective of protecting coastal water quality (Ministry of Energy and Water Resources, 2020).

The approval of this policy will allow:

- Stricter control of chemical usage and disposal, including agrochemicals;
- Sewering of communities around the Belle public supply well, which supplies almost one-third of Barbados' drinking water;
- Reduce the use of suck wells as the primary method of domestic wastewater disposal;
- Make developers of new developments to provide the means of protecting ground water and coastal waters whether by sewage treatment, wetlands, or other acceptable means as deemed appropriate (Ministry of Energy and Water Resources, 2020).

6. Review of good-practice cases

This section provides an initial overview of different monitoring and evaluation criteria applied in selected good-practice case studies for marine pollution management, across different geographies and social and institutional contexts.

This preliminary overview will fuel the work to be conducted under task 3, the review of marine pollution management methods and tools. Table 10 lists the documents selected and analyzed at this stage. It consists of a preliminary list which will be updated and built upon in subsequent stages.

Table 10 –Preliminary list of marine pollution management methods and tools, with a focus on monitoring and evaluation protocols

Title	Concerned pollutants	Reference
Guidelines and frameworks		
A General framework for indicator design and use with application to the assessment of coastal water quality and marine protected area management	General water quality	Beliaeff & Pelletier, 2011
Commission Decision (EU) 2017/848	General water quality	EU Commission, 2017
Monitoring Program and Program of Measures of the Marine Strategy Framework Directive	General water quality	MAM; SRMCT; SRA, 2014
Guideline for Monitoring Marine Litter on the Beaches in the OSPAR Maritime Area	Litter	OSPAR Commission, 2010
Guidance on Monitoring of Marine Litter in European Sea	Litter	TSG-ML, 2013

Peer-reviewed articles		
Assessment of Spatio-Temporal Variability of Faecal Pollution along Coastal Waters during and after Rainfall Events	Faecal particles (freshwater and coastal)	Manini <i>et al.</i> , 2022
Coastal Surveillance and Water Quality monitoring in the Rejiche Sea - Tunisia	General water quality (coastal waters)	Alibi <i>et al.</i> , 2021

6.1. Guidance documents and frameworks

6.1.1. A General framework for indicator design and use with application to the assessment of coastal water quality and marine protected area management

This article provides a broad framework for the creation and application of management-oriented indicators, fusing management issues with performance standards. Two (2) characteristics are evaluated for each indicator, its relevance and effectiveness:

- Relevance, including sensitivity and presence of quantitative reference values; it assists the selection of suitable indicators;
- Effectiveness is the indicator's capacity to accomplish its predetermined goals in light of ideal (or at the very least, enhanced) methods of collecting data.

The application of the framework serves as a reference to the administration of marine protected areas and the European Water Framework Directive (WFD). The overall framework, from the defining of objectives through the selection of indicators based on their relevance and efficacy, is depicted in Figure 8.

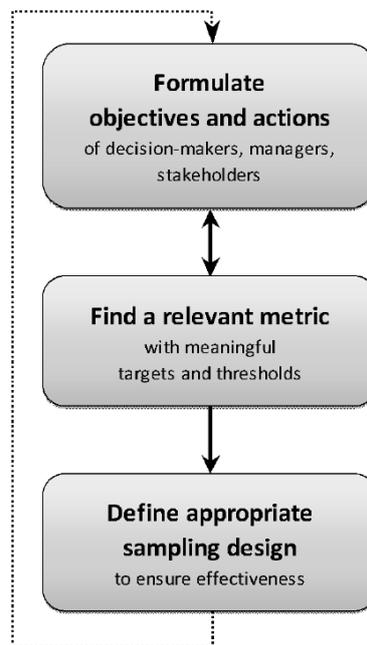


Figure 8 – General Methodological Framework

The first step consists of assisting decision-makers, managers, and stakeholders in setting goals and questions which then help ease the selection of indicators. Finding a useful metric or group of metrics for a specific goal or activity is the second step in this

framework. At this step, it is also essential to clarify precisely how the chosen metric will be assessed. The third step of the framework calls for the selection of a suitable sampling strategy to guarantee the efficacy of the chosen indicator. In this sense, a trade-off between the expense of data collection and the need to consider the sources of variation that have an influence on the information used for indicator estimation should be sought.

This article applies the framework approach to (i) coastal water quality within the WFD context and (ii) Marine Protected Area (MPA) management, by presenting indicator attributes such as metrics, relevance, and effectiveness, as illustrated from Figure 9 to Figure 11.

Table 1. Three metrics related to coastal water eutrophication: i) 90th percentile chlorophyll a (Chla) concentration ii) 10th percentile of dissolved oxygen concentration measured in estuarine and coastal waters; and, iii) number of hypoxic events, with estimated relevance and effectiveness.

Metrics	Indicator attributes					
	Relevance			Effectiveness		
	<i>Rationale</i>	<i>Sensitivity</i>	<i>Ref. value(s)</i>	<i>Required precision</i>	<i>observation and measurement system</i>	<i>Cost</i>
[Chla] mg.L ⁻¹ percentile 90%		high	yes	high	Water samples / Fluorimetry in laboratory	high
[O ₂] mg.L ⁻¹ percentile 10%	Indirect link with eutrophication through respiration	high	yes	medium	Water samples / <i>in situ</i> measurement	medium
Number of hypoxic events		low	no	high	<i>In situ</i> measurement	low

Source: (Beliaeff & Pelletier, 2011)

Figure 9 – Example of metrics to monitor coastal water related to eutrophication

Table 3. Three metrics related to MPA major management objectives: i) sustainable exploitation of resources (first metric); and ii) conservation of biodiversity (second and third metrics), with estimated relevance, effectiveness and cost. Relevance and effectiveness were evaluated from Pelletier et al. [14]. UVC stands for Underwater Visual Census.

Metrics	Indicator attributes					
	Relevance			Effectiveness		
	<i>Rationale</i>	<i>Sensitivity</i>	<i>Ref. value(s)</i>	<i>Required precision</i>	<i>Observation system</i>	<i>Cost</i>
Mean size of target species	Increases in no-take areas	High	No	High	UVC Catch	High Medium
Seagrass percent cover	Should increase in MPA	Medium	No	Medium	UVC	High
Nb of boats moored in MPA	Moorings destroy seagrass	High	No	Medium	Frequentation study	Low

Source: (Beliaeff & Pelletier, 2011)

Figure 10 – Example of metrics to monitor coastal water related to marine protected areas management

Table 2. Conceptual (chronological) framework for indicator use in a management context with an illustration from the European Water Framework Directive (WFD). Definitions of general goal and detailed objectives are followed by management actions linked to the indicator(s) through interpretation rule(s); then the definition of the observation system (sampling and measurement characteristics) leads to its cost estimation, allowing to assess the feasibility of the indicator. Communication between managers and scientists is essential at every step. \tilde{X}_{90} is the chlorophyll a concentration 90% percentile and \tilde{X}_{90c} the corresponding threshold value. \tilde{X}_{10} is the dissolved oxygen concentration 10% percentile and \tilde{X}_{10c} the corresponding threshold value. N is the number of hypoxic events and N_c the corresponding threshold value.

Goal	Objective	Management actions	Interpretation rule	Metrics	Observation system and sampling strategies	Feasibility / Cost
European water in good ecological status in 2015	Assessment of water body ecological status – eutrophication	Reduce water body nutrient enrichment	$\tilde{X}_{90} > \tilde{X}_{90c}$	Chlorophyll a concentration 90 th percentile	Satellite images provides high temporal and spatial frequency at the water body scale	Images and data processing algorithms available at low cost
		No mitigation measures taken	$\tilde{X}_{90} \leq \tilde{X}_{90c}$			
		Reduce water body nutrient enrichment	$\tilde{X}_{10} < \tilde{X}_{10c}$	Dissolved oxygen concentration 10 th percentile	Water samples and analysis at the laboratory	High cost related to the number of samples required to reach a given power
		No mitigation measures taken	$\tilde{X}_{10} \geq \tilde{X}_{10c}$			
		Reduce water body nutrient enrichment	$N > N_c$	Number of hypoxic events	<i>In situ</i> instrumentation allows high temporal frequency	Technically feasible Good ratio number of data/acquisition cost
		No mitigation measures taken	$N \leq N_c$			

Source: (Beliaeff & Pelletier, 2011)

Figure 11 – Example of metrics to monitor coastal water ecological status

6.1.2. Nineteenth Intergovernmental Meeting on the Action Plan for the Caribbean Environment Programme and Sixteenth Meeting of the Contracting Parties to the Convention for the Protection and Development of the Marine Environment of the Wider Caribbean Region

This meeting took place in July 2021, and proposed to review the achievements of the Caribbean Environment Programme during 2019-2020 and to approve the Draft Work Plan outlined for 2021-2022 (UN Environment Programme, 2022).

Several decisions resulted from the Meeting, including:

- Approval of the Work Plan and Budget for the Caribbean Environment Programme for the biennium 2021-2022;
- Request the Secretariat, with the support of the Contracting Parties, to mobilize financial resources for implementing the yet unfunded activities within the 2021-2022 work plan;
- Urge the Secretariat to continue to identify new partnership opportunities to enable the most effective implementation of the 2021-2022 work plan of the Cartagena Convention, while ensuring synergy, harmonization of efforts, and optimization in the use of resources;
- Request the Secretariat, in close collaboration with Contracting Parties, to enhance synergies with other Multilateral Environmental Agreements, Regional Seas Programme conventions and action plans;
- Note the urgent call for marine and coastal issues to be duly included and incorporated into the new post-2020 global framework for biodiversity, which is currently being negotiated;
- Endorse the Decisions of the Fifth Meeting of the Contracting Parties to the Protocol Concerning Pollution from Land-Based Sources and Activities in the Wider Caribbean Region;
- Recommend that the Secretariat strengthen collaboration in the region on oil spill monitoring;
- Request the Secretariat, Regional Activity Centres and other partner agencies to actively explore opportunities for replicating and upscaling training for detection of oil spills using satellite remote sensing technology as well as for other emerging pollutants (UN Environment Programme, 2021).

6.1.3. State of the Cartagena Convention Area: an Assessment of Marine Pollution From Land-Based Sources and Activities in the Wider Caribbean Region

This report has as key objective to assist the Contracting Parties of the Land-Based Sources Protocol to fulfil their reporting obligations, but also to:

- Provide a quantitative baseline for monitoring and assessment of the state of the marine environment with respect to Land-Based Sources (LBS) pollution;
- Increase awareness and understanding of LBS pollution, its sources, and environmental and human impacts;
- Trigger action at all levels and facilitate improved decision-making and enforcement;
- Promote and inform the development of legislative and policy initiatives and action plans for pollution prevention, reduction, and control, including a regional strategy and investment/action plan for nutrient reduction;
- Help mobilize and better target resources for national interventions to address LBS pollution;
- Strengthen national and regional systems for monitoring environmental status with respect to key international agreements, and facilitate monitoring and evaluation of the Strategic Action Programme for the Caribbean and North Brazil Shelf large marine ecosystems;
- Support Governments in reporting on progress towards achieving relevant Sustainable Development Goals;
- Contribute to global and regional marine environmental assessments and reporting;
- Contribute to the development of a regional environmental indicators compendium (UNEP/CEP, 2019).

Eight core water quality indicators were assessed based on relevance to the LBS Protocol, Sustainable Development Goal 14.1. (*By 2025, prevent and significantly reduce marine pollution of all kinds, in particular from land-based activities, including marine debris and nutrient pollution*), and Regional Seas indicators, using data submitted by countries:

- Dissolved inorganic nitrogen;
- Dissolved inorganic phosphorus;
- Chlorophyll-a;

- Dissolved oxygen;
- Turbidity;
- pH;
- *Escherichia coli*;
- *Enterococcus species*.

In addition, a review of marine litter/plastic and mercury was also included due to their impacts of increasing concern on biodiversity and habitats.

The assessment was based on the Driver-Pressure-State-Impact-Response (DPSIR) framework, highlighting the interactions between human society and the environment.

The main findings of this report can be summarised as follows:

- The impacts of pollution resulting from land-based sources will compromise the achievement of the remaining Sustainable Development Goals;
- Production and consumption patterns of human populations are major drivers of change in the condition of marine environment and its ecosystems. In the WCR, population, urbanization, and tourism – which are all concentrated in coastal areas – are estimated to continue to increase over the next decades;
- As a result, pressures on the marine environment from land-based sources and activities will intensify under the existing scenario of poor urban planning, unsuitable wastewater treatment facilities and solid waste management, and unsustainable land use and agricultural practices;
- Land-based pollution is degrading WCR's ecologically and economically valuable marine ecosystems such as coral reefs and seagrass beds. Due to the region's high dependency on marine ecosystem goods and services, this poses a direct threat to its socioeconomic development and direct and indirect threats to public health, livelihoods, and important economic sectors such as tourism and fisheries, while also hinders development of a blue economy by reducing its natural resource base;
- Considerable advances have been made at national, sub-regional, and regional levels in the WCR to address land-based pollution, but this overall progress has been slow, with many challenges continuing to persist;
- There is an urgent need for WCR governments to adapt and increase existing experiences, best practices, and technologies, and undertake the

required institutional, policy, legislative, and budgetary reforms to address land-based pollution, particularly at its source (UNEP/CEP, 2019).

This document also presents a set of recommendations, directed both to Contracting Parties of the LBS Protocol and to the Convention Secretariat, organized according to the following core themes:

- Technical/Monitoring and Assessment;
- Capacity Building and Training;
- Governance: Institutional, Policy, and Legal frameworks;
- Knowledge Management, Communication, and Stakeholder Engagement;
- Sustainability.

6.1.4. Regional Nutrients Pollution Reduction Strategy and Action Plan for The Wider Caribbean Region

This document aims to provide a collaborative framework for progressively reducing the impact of excess nutrient loads on priority coastal and marine ecosystems in the WCR.

Addressing the major land- and sea-based sources of nutrient pollution in the Wider Caribbean Sea, this Strategy and Action plan are in line with the scope of the Cartagena Convention for the Protection of the Marine Environment of the Wider Caribbean Region and its Protocol on Land-Based Sources of marine pollution, and it is based on nine pillars, distributed by three major core domains and an implementation enabler:

- Nutrient Sources
 - Nutrient management in agriculture/livestock farming;
 - Nutrient mobilization from nonpoint sources;
 - Domestic wastewater effluents;
 - Industrial effluents;
 - Marine sources;
- Ecological Impacts
 - Coastal water quality;
 - Coastal and marine habitats;
- Socio-Economic Consequences
 - Human health and wellbeing;

- Blue economy;
- Enabling Conditions.

A multi-level institutional framework and an action framework are proposed for the implementation of this Strategy and Action plan. With the support of international, regional and sub-regional organizations and partners, implementation will be gradual and mostly through national initiatives.

A monitoring framework is provided, proposing for each objective of each pillar, global targets, regional targets and indicators.

6.1.5. Commission Decision (EU) 2017/848

Regarding Directive 2008/56/EC of the European Parliament and of the Council from the 17th of June 2008, the Commission Decision (EU) 2017/848 of 17th of May 2017 outlines requirements and standardized techniques for monitoring and evaluation of member states' waters, as well as standards and criteria for determining the environmental health of marine waters.

The following tables present the criteria and methodological standards for determination of good environmental status related to relevant pressures such as the contamination and discharge of substances into the marine environment.

Table 11 - Monitoring criteria linked to nutrient and organic matter

Criteria elements	Criteria ¹	Methodological standards
Nutrients in the water column: Dissolved Inorganic Nitrogen (DIN), Total Nitrogen (TN), Dissolved Inorganic Phosphorus (DIP), Total Phosphorus (TP).	Nutrient concentrations are not at levels that indicate adverse eutrophication effects.	<p>Scale of assessment:</p> <p>Hid1. within coastal waters, as used under Directive 2000/60/EC,</p> <p>Hid2. beyond coastal waters, subdivisions of the region or subregion, divided where needed by national boundaries.</p> <p>Use of criteria: The extent to which good environmental status has been achieved shall be expressed for each area assessed as follows:</p> <p>Hid3. (a) the values achieved for each criterion used, and an estimate of the extent of the assessment area over which the threshold values set have been achieved;</p> <p>Hid4. (b) in coastal waters, the criteria shall be used in accordance with the requirements of Directive 2000/60/EC to conclude on whether the water body is subject to eutrophication;</p> <p>Hid5. (c) beyond coastal waters, an estimate of the extent of the area (as a proportion (percentage)) that is not subject to eutrophication (as indicated by the results of</p>
Chlorophyll - a in the water column	Chlorophyll - a concentrations are not at levels that indicate adverse effects of nutrient enrichment.	
Harmful algal blooms (e.g. cyanobacteria) in the water column	The number, spatial extent and duration of harmful algal bloom events are not at levels that indicate adverse effects of nutrient enrichment.	
Photic limit (transparency) of the water column	The photic limit (transparency) of the water column is not reduced, due to increases in suspended algae, to a level that indicates adverse effects of nutrient enrichment.	
Dissolved oxygen in the bottom of the water column	The concentration of dissolved oxygen is not reduced, due to nutrient enrichment, to levels that indicate adverse effects on benthic habitats (including on associated biota and mobile species) or other eutrophication effects.	
Opportunistic macroalgae of benthic habitats	The abundance of opportunistic macroalgae is not at levels that indicate adverse effects of nutrient enrichment.	

Criteria elements	Criteria ¹	Methodological standards
Macrophyte communities (perennial seaweeds and seagrasses such as fucoids, eelgrass and Neptune grass) of benthic habitats	The species composition and relative abundance or depth distribution of macrophyte communities achieve values that indicate there is no adverse effect due to nutrient enrichment including via a decrease in water transparency,	all criteria used, integrated in a manner agreed where possible at Union level, but at least at regional or subregional level). Beyond coastal waters, the use of the secondary criteria shall be agreed at regional or subregional level.
Macrofaunal communities of benthic habitats	The species composition and relative abundance of macrofaunal communities, achieve values that indicate that there is no adverse effect due to nutrient and organic enrichment,	

1-Threshold values set in accordance with Directive 2000/60/EC
Source: Adapted from Commission Decision (EU) 2017/848

Table 12 - Monitoring criteria linked to contaminants

Criteria elements	Criteria	Methodological standards
<p>Within coastal and territorial waters:</p> <ul style="list-style-type: none"> • (a) contaminants selected in accordance with Directive 2000/60/EC: <ul style="list-style-type: none"> ○ contaminants for which an environmental quality standard is laid down in Part A of Annex I to Directive 2008/105/EC; ○ River Basin Specific Pollutants under Annex VIII to Directive 2000/60/EC, in coastal waters; • b) additional contaminants, if relevant, such as from offshore sources, which are not already identified under point (a) and which may give rise to pollution effects in the region or subregion. Member States shall establish that list of contaminants through regional or subregional cooperation. 	<p>Within coastal and territorial waters, the concentrations of contaminants do not exceed the following threshold values:</p> <ul style="list-style-type: none"> • (a) for contaminants set out under point (a) of criteria elements, the values set in accordance with Directive 2000/60/EC; • (b) when contaminants under the point (a) are measured in a matrix for which no value is set under Directive 2000/60/EC, the concentration of those contaminants in that matrix established by Member States through regional or subregional cooperation; • (c) for additional contaminants selected under point b of criteria elements, the concentrations for a specified matrix (water, sediment or biota) which may give rise to pollution effects. Member States shall establish these concentrations through regional or subregional cooperation, considering their application within and beyond coastal and territorial waters. 	<p>Scale of assessment:</p> <ul style="list-style-type: none"> • Within coastal and territorial waters, as used under Directive 2000/60/EC, • Beyond territorial waters, subdivisions of the region or subregion, divided where needed by national boundaries. • Use of criteria: The extent to which good environmental status has been achieved shall be expressed for each area assessed as follows: <ul style="list-style-type: none"> ○ For each contaminant under criterion, its concentration, the matrix used (water, sediment, biota), whether the threshold values set have been achieved, and the proportion of contaminants assessed which have achieved the threshold values, including indicating separately substances behaving like ubiquitous persistent, bioaccumulative and toxic substances (uPBTs), as

Criteria elements	Criteria	Methodological standards
<p>Beyond territorial waters</p> <ul style="list-style-type: none"> a) the contaminants considered under the first point, where these still may give rise to pollution effects; b) additional contaminants, if relevant, which are not already identified under second point and which may give rise to pollution effects in the region or subregion. Member States shall establish that list of contaminants through regional or subregional cooperation. 	<p>Beyond territorial waters, the concentrations of contaminants do not exceed the following threshold values:</p> <ul style="list-style-type: none"> (a) for contaminants selected under point (a) of criteria elements, the values as applicable within coastal and territorial waters; (b) for contaminants selected under point 2(b) of criteria elements, the concentrations for a specified matrix (water, sediment or biota) which may give rise to pollution effects. Member States shall establish these concentrations through regional or subregional cooperation. 	<p>referred to in Article 8a(1)(a) of Directive 2008/105/EC;</p>

Criteria elements	Criteria	Methodological standards
<p>Species and habitats which are at risk from contaminants. Member States shall establish that list of species, and relevant tissues to be assessed, and habitats, through regional or subregional cooperation.</p>	<p>The health of species and the condition of habitats (such as their species composition and relative abundance at locations of chronic pollution) are not adversely affected due to contaminants including cumulative and synergetic effects.</p>	<p>Scale of assessment:</p> <ul style="list-style-type: none"> • within coastal and territorial waters, as used under Directive 2000/60/EC, • beyond territorial waters, subdivisions of the region or subregion, divided where needed by national boundaries. • Use of criteria: The extent to which good environmental status has been achieved shall be expressed for each area assessed as follows: <ul style="list-style-type: none"> • for each species assessed under criterion D8C2, an estimate of the abundance of its population in the assessment area that is adversely affected; • for each habitat assessed under criterion D8C2, an estimate of the extent in the assessment area that is adversely affected.

Criteria elements	Criteria	Methodological standards
<p>Significant acute pollution events involving polluting substances, as defined in Article 2(2) of Directive 2005/35/EC of the European Parliament and of the Council, including crude oil and similar compounds</p>	<p>The spatial extent and duration of significant acute pollution events are minimized.</p>	<p>Scale of assessment: Regional or subregional level, divided where needed by national boundaries.</p> <p>Use of criteria: The extent to which good environmental status has been achieved shall be expressed for each area assessed as follows:</p> <ul style="list-style-type: none"> • An estimate of the total spatial extent of significant acute pollution events and their distribution and total duration for each year.
<p>Species of the species groups, as listed under Table 1 of Part II, and benthic broad habitat types, as listed under Table 2 of Part II.</p>	<p>Secondary (to be used when a significant acute pollution event has occurred):</p> <p>The adverse effects of significant acute pollution events on the health of species and on the condition of habitats (such as their species composition and relative abundance) are minimised and, where possible, eliminated.</p>	<p>Scale of assessment: Subdivisions of the region or subregion, divided where needed by national boundaries.</p> <p>Use of criteria: The outcomes of assessment of criterion shall contribute by providing:</p> <ul style="list-style-type: none"> • (a) an estimate of the abundance of each species that is adversely affected; • (b) an estimate of the extent of each broad habitat type that is adversely affected.

Source: Adapted from Commission Decision (EU) 2017/848

Table 13 - Monitoring criteria linked to contaminants in fish and other seafood

Criteria elements	Criteria	Methodological standards
<p>Contaminants listed in Regulation (EC) No 1881/2006.</p> <p>For the purposes of this Decision, Member States may decide not to consider contaminants from Regulation (EC) No 1881/2006 where justified on the basis of a risk assessment.</p> <p>Member States may assess additional contaminants that are not included in Regulation (EC) No 1881/2006.</p> <p>Member States shall establish a list of those additional contaminants through regional or subregional cooperation. Member States shall establish the list of species and relevant tissues to be assessed, according to the conditions laid down under 'specifications. They may cooperate at regional or subregional level to establish that list of species and relevant tissues.</p>	<p>The level of contaminants in edible tissues (muscle, liver, roe, flesh or other soft parts, as appropriate) of seafood (including fish, crustaceans, molluscs, echinoderms, seaweed and other marine plants) caught or harvested in the wild (excluding fin-fish from mariculture) does not exceed:</p> <ul style="list-style-type: none"> • (a) for contaminants listed in Regulation (EC) No 1881/2006, the maximum levels laid down in that Regulation, which are the threshold values for the purposes of this Decision; • (b) for additional contaminants, not listed in Regulation (EC) No 1881/2006, threshold values, which Member States shall establish through regional or subregional cooperation. 	<p>Scale of assessment:</p> <p>The catch or production area in accordance with Article 38 of Regulation (EU) No 1379/2013 of the European Parliament and of the Council.</p> <p>Use of criteria:</p> <p>The extent to which good environmental status has been achieved shall be expressed for each area assessed as follows:</p> <ul style="list-style-type: none"> • for each contaminant, its concentration in seafood, the matrix used (species and tissue), whether the threshold values set have been achieved, and the proportion of contaminants assessed which

Source: Adapted from Commission Decision (EU) 2017/848

Table 14 - Monitoring criteria linked to marine litter

Criteria elements	Criteria	Methodological standards
<p>Litter (excluding micro-litter), classified in the following categories: artificial polymer materials, rubber, cloth/textile, paper/ cardboard, processed/worked wood, metal, glass/ceramics, chemicals, undefined, and food waste.</p>	<p>The composition, amount and spatial distribution of litter on the coastline, in the surface layer of the water column, and on the seabed, are at levels that do not cause harm to the coastal and marine environment. Member States shall establish threshold values for these levels through cooperation at Union level, taking into account regional or subregional specificities</p>	<p>Scale of assessment: Subdivisions of the region or subregion, divided where needed by national boundaries.</p> <p>Use of criteria: The extent to which good environmental status has been achieved shall be expressed for each criterion separately for each area assessed as follows:</p>
<p>Micro-litter (particles < 5mm), classified in the categories 'artificial polymer materials' and 'other'.</p>	<p>The composition, amount and spatial distribution of micro-litter on the coastline, in the surface layer of the water column, and in seabed sediment, are at levels that do not cause harm to the coastal and marine environment.</p>	<ul style="list-style-type: none"> • the outcomes for each criterion (amount of litter or micro-litter per category) and its distribution per matrix used and whether the threshold values set have been achieved;

Criteria elements	Criteria	Methodological standards
<p>Litter and micro-litter classified in the categories ‘artificial polymer materials’ and ‘other’, assessed in any species from the following groups: birds, mammals, reptiles, fish or invertebrates. Member States shall establish that list of species to be assessed through regional or subregional cooperation.</p>	<p>The amount of litter and micro-litter ingested by marine animals is at a level that does not adversely affect the health of the species concerned. Member States shall establish threshold values for these levels through regional or subregional cooperation.</p>	<p>Scale of assessment: Subdivisions of the region or subregion, divided where needed by national boundaries.</p> <p>Use of criteria: The extent to which good environmental status has been achieved shall be expressed for each criterion separately for each area assessed as follows:</p> <ul style="list-style-type: none"> the outcomes of amount of litter and micro-litter per category per species and whether the threshold values set have been achieved.
<p>Species of birds, mammals, reptiles, fish or invertebrates which are at risk from litter. Member States shall establish that list of species to be assessed through regional or subregional cooperation.</p>	<p>The number of individuals of each species which are adversely affected due to litter, such as by entanglement, other types of injury or mortality, or health effects. Member States shall establish threshold values for the adverse effects of litter, through regional or subregional cooperation.</p>	<p>Scale of assessment: Subdivisions of the region or subregion, divided where needed by national boundaries</p> <p>Use of criteria: The extent to which good environmental status has been achieved shall be expressed for each area assessed as follows:</p> <ul style="list-style-type: none"> for each species assessed under criterion, an estimate of the number of individuals in the assessment area that have been adversely affected.

Source: Source: Adapted from Commission Decision (EU) 2017/848

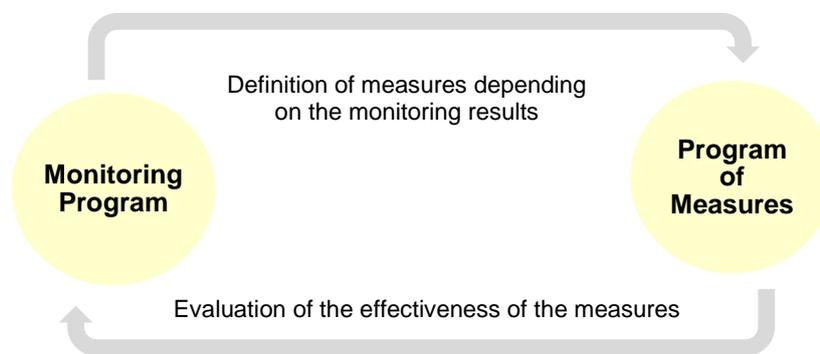
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6.1.6. Monitoring Program and Program of Measures of the Marine Strategy Framework Directive

This document comprises the second part of the preparation phase of the four (4) marine strategies for each subdivision (Continent, Madeira, Azores and Extended continental platform) of Portugal’s marine environment. Which includes the development of Monitoring Program (MPo) and a Program of Measures (PMe).

The Monitoring Program seeks to comprehensively monitor the environmental condition of national maritime waters in relation to the environmental goals set forth in the Initial Report, taking into account pertinent biotic and abiotic elements as well as the primary pressures and consequences. While the Program of Measures intends to promote or maintain a healthy environment.

The monitoring and measures programs are therefore related in that, while the PMe uses the monitoring to identify, define, and create new measures that may be necessary in light of the data acquired in the MPo. In turn, the MPo, must be structured to assess the success of the measures described in the PMe (Figure 12).



Source: Adapted from (Government of Portugal, 2014)

Figure 12 - Relationship between the Monitoring Program and the Measurement Program

The first part of the preparation phase of marine strategies included an initial assessment of the current environmental status of national marine waters and the environmental impact of human activities in these waters. From this initial assessment a range of MSFD environmental goals were developed for each subdivision. The assessment addressed eleven descriptors, of which four (4) are related to marine pollution, namely:

- Anthropogenic Eutrophication;
- Contaminants in the marine environment;

- Contaminants in fish and seafood for human consumption;
- Marine litter.

For the development of the MPo the following procedure should be taken accordingly to the MSFD:

1. Provide information for an assessment of the environmental status and for an estimate of the distance from, and progress towards, good environmental status in accordance with Annex III and with the criteria and methodological standards to be defined pursuant to Article 9(3);
2. Ensure the generation of information to identify appropriate indicators for the environmental goals in Article 10;
3. Ensure the generation of information that allows the evaluation of the impact of the measures referred to in article 13;
4. Include activities to identify the cause of the change to good environmental status, and subsequently, the possible corrective measures to be taken to restore the good environmental status when deviations from the desired status range are identified;
5. Provide information on the presence of chemical contaminants in species intended for human consumption from commercial fishing areas;
6. Include activities to confirm that the corrective actions produce the intended changes and not undesirable side effects;
7. Aggregate the information based on marine regions or sub-regions, as per Article 4;
8. Ensure comparability of assessment approaches and methods within and between marine regions and/or subregions;
9. Formulate technical specifications and standardized methods for monitoring at the community level in order to enable comparability of information;
10. Ensure, as far as possible, compatibility with existing programs established at the regional and international level, in order to foster coherence between these programs and avoid duplication of efforts, using the most relevant monitoring guidelines for the marine region or subregion concerned;
11. Include, as part of the initial assessment provided for in Article 8, an assessment of major changes in environmental conditions as well as, where necessary, new or emerging problems;
12. Analyse, as part of the initial assessment provided for in Article 8, the relevant elements set out in Annex III and their natural variability and assess trends with

regard to the achievement of the environmental targets established pursuant to Article 10(1), using, as appropriate, the established indicators and their limit and target reference points.

For the development PME this document presents the following methodology:

1. Identify the MSFD Environmental Goal;
2. Check the existence of a measure already foreseen (implemented, not fully implemented or yet to be implemented) in legislative instruments, such as Water Framework Directive, Birds Directive, Habitats Directive, Common Fisheries Policy, commitments undertaken by Portugal under international agreements or conventions or other instruments - Existing measure;
3. Analyze whether the Existing Measure is sufficient for the achievement of Environmental Goal MSFD;
4. Define additional measure, within the scope of the instruments referred to in point 2 or within the scope of the MSFD, in cases where the measure foreseen is not sufficient, for the achievement of the target, or there is no Existing Measure - New Measure;
5. Conduct impact assessment, including cost-benefit analysis and cost-effectiveness assessment, for the new measures.

During the initial assessment, a range of MSFD environmental goals were developed for each subdivision. Thus, the monitoring and measures programs present respectively monitoring projects and measures to be implemented in each subdivision that address the descriptors related to marine pollution to achieve those environmental goals (**Table 15** and **Table 16**).

Table 15 - Monitoring projects for marine pollution

Descriptor	Monitoring project	Ecosystem components, pressures and impacts monitored	Indicators ¹
Contaminants in fish and seafood for human consumption	Chemical contaminants in species of commercial interest in the portuguese maritime area	Contamination of commercial pelagic, demersal and deep-sea species by hazardous substances	<ul style="list-style-type: none"> • Levels, number and frequency of contaminants • Actual levels of contaminants detected and number of contaminants exceeding maximum regulatory levels • Frequency of regulatory levels exceeded
Contaminants in the marine environment	Monitoring of surface sediment contamination in the coastal area between Peniche and Sines	Contamination of surface layers of sediments by hazardous substances	<ul style="list-style-type: none"> • Contaminant concentration • The concentration of the above contaminants, measured according to the applicable matrix (biota, sediment and waters) to ensure the comparability of these measures with the assessments under Directive 2000/60/EC

Descriptor	Monitoring project	Ecosystem components, pressures and impacts monitored	Indicators ¹
Marine litter	Properties and Spatial Distribution of Marine Litter and Impacts on Marine Life	Marine litter and systematic and/or intentional release of substances into seabed and water column habitats and associated biological communities	<ul style="list-style-type: none"> • Characteristics of the garbage present in the marine and coastal environment • Trends in the amount of litter washed ashore and/or deposited on the shore, including analysis of its composition, spatial distribution and, where possible, origin • - Trends in the amount of litter in the water column (including that floating on the surface) and deposited on the seabed, including analysis of its composition, spatial distribution and, where possible origin • - Trends in the quantity, distribution and, where possible, composition of micro-particles (in particular micro-plastics) • Impacts of litter on marine life • Trends in the amount and composition of litter ingested by marine animals (e.g, through analysis of stomach contents)

1- In accordance with Commission Decision n° 2010/477/UE, of September 1st
Source: Adapted from **(Government of Portugal, 2014)**

Table 16 - Measures to implement for marine pollution

Descriptor	Measure	Goal	Subdivision
Anthropogenic Eutrophication	NUTRI - Identify nutrient sources and vectors of introduction into the marine environment	Assess and characterize the main sources of nutrients for the marine environment of the portuguese continental coast	P
Contaminants in fish and seafood for human consumption	Select bioindicator species of contamination, establish periodicity and sampling parameters	Establishment of a reference point for contamination levels, and identification of sources of contamination, whether natural or man-made,	Azo
Contaminants in the marine environment	TOXIMAC - Establish an initial baseline status and indicators that should be monitored	Identify, monitor, analyze the effects and possible solutions of the presence of anthropogenic contaminants and microcontaminants (including emerging contaminants) in Macaronesian marine ecosystems	Mad
Marine litter	BDLixLit - Developing a database on marine litter on the coast	Quantifying marine litter on the coast	P

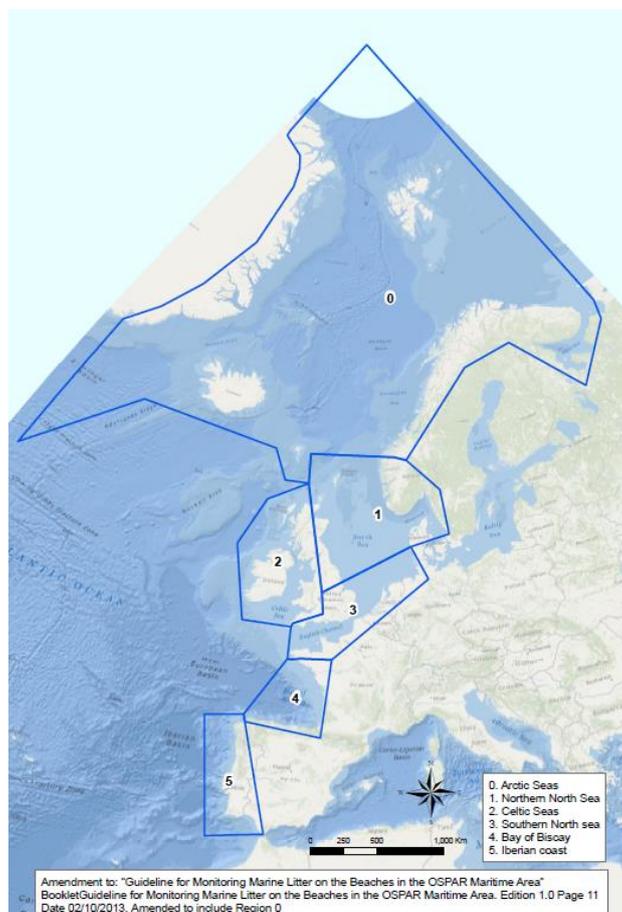
Descriptor	Measure	Goal	Subdivision
	LiMar - Determine bioindicators for marine litter	Choosing bioindicators for portuguese marine waters	P; Azo; Mad
	EduMar - Educate and raise awareness about the marine environment	Increase literacy about the value of marine ecosystems	P; Mad
	Implement waste management program on board fishing vessels	Decrease the amount of marine debris from ships	Azo
	VEGAS - Assess the potential of the Selvagens islands	Assess the potential of the Selvagens Islands as a prime location for monitoring marine debris in the Atlantic and how it is transported by currents.	Mad

Note: P – Continental Portugal subdivision ; Azo – Azores subdivision; Mad – Madeira subdivision

Source: Adapted from **(Government of Portugal, 2014)**

6.1.7. Guideline for Monitoring Marine Litter on the Beaches in the OSPAR Maritime Area

This guideline operates as a practical guide for monitoring marine litter on beaches as a tool to collect data on litter in the marine environment. As a standardized methodology, it allows for regional interpretation of the litter situation in all OSPAR countries (Figure 13).



Source: OSPAR Commission, 2010

Figure 13 - Geographical scope of the OSPAR Maritime Area

The purpose of this guideline is to provide information on amounts, trends and sources of marine litter, so that it can be used to focus efforts on effective mitigating measures and to test the effectiveness of existing legislation and regulations. Ultimately, the goal is to minimize the amount of litter entering the marine environment.

According to UNEP’s Regional Seas Programme, marine litter (or marine debris) can be defined as “any persistent, manufactured or processed solid material discarded, disposed of, abandoned or lost in the marine and coastal environment”, including items entering the marine environment via rivers, sewage outlets, storm water outlets or winds.

The monitoring methodology consists of four (4) critical steps, as depicted in Figure 14.

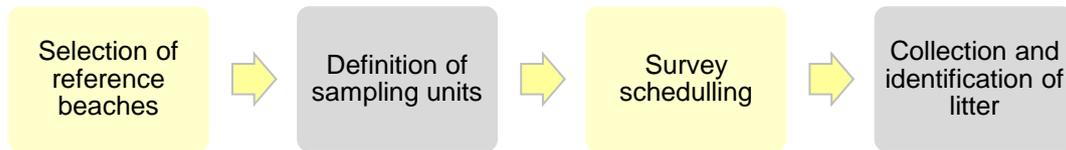


Figure 14 - OSPAR marine litter monitoring methodology

Regarding the selection of reference beaches, the guideline defines a set of criteria to which it should be followed as closely as possible. In this sense, reference beaches should:

- Be composed of sand or gravel and exposed to the open sea;
- Be accessible to surveyors all year round;
- Be accessible for ease of marine litter removal;
- Be a minimum length of 100 meters and if possible, over 1 km in length;
- Be free of 'buildings' all year round;
- Ideally not be subject to any other litter collection activities.

For each of the reference beaches, physical and geographical features are documented, together with its proximity of possible sources of marine litter.

There are two types of sampling units applied to marine litter monitoring within the OSPAR region, namely:

- 100-meters: for identifying all marine litter items;
- 1-km: for identifying objects generally larger than 50 cm.

A distinct survey form has been developed for each of the typologies, whereas the 100 meters sampling unit is the standard unit, while the 1-km sampling unit is optional depending on practical issues. The 100 meters sampling units that occurs on the same beach must be apart at least 50m, and be part of the 1-km sampling unit when this exists in the reference beach (Figure 15).



Source: (OSPAR Commission, 2010)

Figure 15 - Types of sampling units within the OSPAR Region

Concerning to the scheduling of the surveys of reference beaches, this must be done four (4) times a year, covering all year's seasons (winter, spring, summer and autumn). The monitoring schedule must ensure the safety of the surveyors. Thus, it shall take into consideration the high tide to prevent surveyors from being cut off by the incoming tide.

During the collection and identification of litter within the sampling unit, all items observed shall be registered on the survey forms and removed from the beach. For the identification of marine litter, a photo guide has been developed to assist the surveyors with the identification and categorization of litter items, according to a unique OSPAR identification number.



Source: (OSPAR Commission, 2010)

Figure 16 – Example of OSPAR’s Photo Guide for monitoring of beach litter

The litter collected must then be disposed of properly, according to regional or national regulations.

A central database should be developed for the data collected in each survey. It is not clear from this document what the data treatment and analysis consist of, and how the information is then used in decision-making.

6.1.8. Guidance on Monitoring of Marine Litter in European Sea

As a guiding document, the “Guidance on Monitoring of Marine Litter in European Sea” provides each European Member State (MS) with a range of recommendations and guidelines to begin the monitoring of the Marine Strategy Framework Directive Descriptor 10 – Marine Litter (see section 6.1.2).

This document describes specific protocols and considerations for the collection, reporting and assessment of data on marine litter in the different marine environmental components (beach, water column, water surface, and seafloor), as well as to determine the impacts of litter on marine life (biota) **(TSG-ML, 2013)**.

The following sections present the proposed harmonized methodologies for marine litter monitoring in each environmental component by the Technical Subgroup on Marine Litter (TSG-ML). These harmonized methodologies aim to **ensure data comparability** within and across regions.

6.1.8.1. Beach Litter

The TSG-ML advocates for an assessment of litter on all coastlines through a harmonized method similar to OSPAR's methodology (Figure 16). The monitoring method provides reliable information on the trends in the amount of litter washed ashore and/or deposited on coastlines, its composition, spatial distribution and possible source.

Survey site selection should represent litter abundance and composition for a given region. Therefore, it must adopt the following criteria:

- A minimum length of 100 m;
- Low to moderate slope (15 – 45°), which precludes very shallow tidal mudflat areas that may be many kilometers wide at low tide;
- Clear access to the sea (not blocked by breakwaters or jetties) such that marine litter is not screened by anthropogenic structures;
- Accessible to survey teams year-round, although some consideration needs to be given to sites that are iced-in over winter and the difficulty in accessing very remote areas;
- Ideally the site should not be subject to any other litter collection activities, although it is recognized that in many parts of Europe large scale maintenance cleaning is carried out periodically; in such cases the timing of non-survey related beach cleaning must be known such that litter flux rates (the amount of litter accumulation per unit time) can be determined;
- Survey activities should be conducted so as not to impact on any endangered or protected species such as sea turtles, sea birds or shore birds, marine mammals or sensitive beach vegetation; in many cases this would exclude national parks but this may vary depending on local management arrangements.

Within the above criteria mentioned, the location of survey sites should be stratified to encompass beaches exposed to different litter sources, including:

- Urban coasts may better reflect the contribution of land-based inputs;
- Rural coasts may better reflect background values for litter pollution levels;
- Coasts close to major rivers, if downstream from the prevailing drift, may better reflect the contribution of riverine input to coastal litter pollution.

Concerning the number of survey sites, pilot studies must be conducted to assess their representativeness. In this sense, a broad number of beaches would first be surveyed, and afterwards, through statistical analysis, a selection of representative beaches from these sites would be made.

Once the sites are selected, it is crucial to document and describe them according to the Marine Litter Beach Documentation and Characterization Form of the OSPAR Marine Litter Beach Questionnaire. After the site selection, within each beach, a sampling unit can be chosen. A sampling unit represents a fixed section of the beach covering the whole area between the water edges or from the strandline to the back of the beach.

For monitoring purposes, it is recommended that:

- At least 2 sections of 100 m on the same beach are surveyed on lightly to moderately littered beaches; and
- At least 2 sections of 50 m for heavily littered beaches.

The surveying of sites should occur at least four (4) times per year comprising the survey periods of winter, spring, summer and autumn. Monitoring Coordinators have the responsibility of scheduling the survey events, which must fulfill the following requirements:

- The surveys for all participating beaches in a given region should be carried out within the shortest timeframe possible within a survey period;
- A given beach should be surveyed on roughly the same day each year if possible;
- Monitoring should start about one hour after high tide.

Within the sampling unit, all items found with a size over 2.5 cm in the longest dimension must be listed on the survey forms with the respective identification number, ideally while

picking up the litter. The standard method recommended to quantify the amount of litter along the coast is in counts of items, instead of weighting or volume estimation.

For the correct identification and allocation of recorded items, this guidance document provides a master list that includes a list of categories and items to be recorded during surveys. Monitoring the litter should be done at the same time as litter removal. After collection, litter must be disposed of correctly.

To guarantee that litter collection and characterization are consistent across surveys, quality assurance and quality control should focus primarily on educating the field workers. So, it is essential to invest in communication and training for local, national, and regional survey coordinators and managers.

It is recommended for the MS to follow the quality assurance protocol of the National Marine Debris Monitoring Program (USA) of Ocean Conservancy, which requires that a percentage of all locations be independently re-surveyed right after the planned assessment of litter. The litter collected during the follow-up survey is then be combined with the litter from the primary collection to assess the survey's error level.

6.1.8.2. Floating litter

This section addresses litter floating in the water column, close to the surface, within coastal areas, excluding the litter deeper in the water column and at open sea. Fishes, marine animals, reptiles, and birds are all directly threatened, due to the ingestion of the whole items or pieces, or to entanglement.

The method recommended for monitoring floating litter is visual observation in ship surveys. The protocol offers a standardized method for ship-based observers to quantify floating marine litter. Several variables related to observation conditions influence the performance of this method, namely:

- Operational observation parameters (observation height, width, distance, etc.);
- Environmental parameters (wind speed, sea and light conditions, etc.);
- Marine litter object properties (object size, shape, categories, etc.).

Regarding the spatial distribution of monitoring, in regions where there are gaps of knowledge on the abundance of marine litter, it is recommended to start surveying in

different areas, to better comprehend the variation in litter distribution, specifically, to identify hot spots and pathways.

Selected areas should comprise both low density areas (e.g., open sea) and high-density areas (e.g., close to ports). Areas close to cities, as estuaries, with high tourist or commercial activity, incoming currents from nearby areas, or outgoing currents should all also be considered. This approach allows the collection of data on minimal to maximal conditions and to train the surveyors. Within the selected areas, it is advisable to delineate short transects for surveying.

The monitoring of floating marine litter is an iterative process whereupon in the initial phase, which identifies hot spots and pathways, a routine programme can be designed for the quantification of trends.

To meet appropriate observation conditions, the scheduling of monitoring should be flexible. The observation should ideally be conducted after at least a brief period of calm seas to avoid bias from trash particles that have recently been agitated into the water column by storms or large waves. To comprehend the variability of litter quantities over time, a higher frequency of the initial, exploratory monitoring should be carried out. Even burst sampling, which involves high sampling rates over brief periods, may be necessary to comprehend the variability of the occurrence of floating marine debris.

Concerning the report of monitoring, it is necessary to group litter objects into different classes based on their substance, type, and size. Hence, when observations cover short time periods, it will most likely be possible to establish rough categories only. Chosen categories must therefore be as practical and coherent as the ones selected for other environmental components having as common ground the master list. Since it is only possible to estimate size classes, these must be predefined for reporting purposes, and include the following, starting at 2.5 cm, which is again the lower size limit for harmonized observations:

- 2.5 – 5 cm;
- 5 - 10 cm;
- 10 – 20 cm;
- 20 – 30 cm;
- 30 – 50 cm.

The output application of the protocol should be a **list of georeferenced objects organized into the different categories**. For reporting purposes, data should be accessible for the various categories and sizes in **items/km²**.

6.1.8.3. Seafloor litter

From the intertidal to abyssal depths, sea floor has been recognized as a major sink for marine litter. Data has been gathered from a variety of depths and locations through observations made by divers, video footage from ROVs, as well as sampling by bottom trawls, with multiple methodologies being used.

TSG-ML presents a straightforward protocol built on current trawling surveys and two (2) alternative protocols based on diving and video imagery to support the harmonization of the seafloor monitoring at European level, at:

- Shallow coastal waters (<20m);
- Margin / continental plate (<800m);
- Deep sea floor.

Concerning the monitoring of shallow coastal waters, the common method for estimating marine litter abundance is underwater visual surveys performed by SCUBA/snorkeling divers. For each site, surveys are carried out using two (2) line transects with lengths varying between 20 m and 200 m, depending on the depth, depth gradient, turbidity, habitat complexity, and litter density. The divers record all litter within 2 m of the line in each side and when possible, estimate the perpendicular distance between the line and litter size category. Transects should be allocated randomly within the study area or on a grid of consistently spaced lines randomly superimposed. A site should be sampled at least once every year, although ideally it should be surveyed every three (3) months. Findings are given as litter density (items per square meter or things per square meter).

Regarding the protocol for the continental plate (20-800 m) TSG-ML strongly advises to keep using of current regional programmes in place to gather information on marine litter on the seafloor, as presented in Table 17.

Table 17 - Standardized methods for sea floor monitoring

Region	Standardized method
<p style="text-align: center;">Atlantic and Baltic Seas</p>	<p>The sampling grids are based on statistical rectangles of one degree longitude x 0.5-degree latitude (# 30 x 30 nautical miles). Each rectangle is usually fished by ships of two different countries (two hauls per rectangle) or a single country fishing more than once in every rectangle. All countries have a standard haul duration to 30 minutes (defined as the moment when the vertical net opening and door spread are stable), using the same 36/47 GOV-trawl with 20 mm mesh nets and sampling at 3.5-4 knots between 0 and 200 m depth.</p>
<p style="text-align: center;">Mediterranean and Black Seas</p>	<p>The hauls are positioned following a depth stratified sampling scheme with random drawing of the positions within each stratum. The number of positions in each stratum is proportional to the surface of these strata and the hauls are made in the same position from year to year. The following depths (10 – 50; 50 – 100; 100 – 200; 200 – 500; 500 - 800 m) are fixed in all areas as strata limits. The total number of hauls for the Mediterranean Sea is 1385; covering the shelves and slopes from 11 countries in the Mediterranean. The haul duration is fixed at 30 minutes on depths less than 200m and at 60 minutes at depths over 200m (defined as the moment when the vertical net opening and door spread are stable), using the same GOC 73 trawl with 20 mm mesh nets and sampling between May and July, at 3 knots between 20 and 800 m depth.</p>

Source: Adapted from **(TSG-ML, 2013)**

6.1.8.4. Litter in biota

The main task for implementing effective monitoring for this indicator is to develop methods for analyzing patterns in ingested litter, thus it is required to select an array of species to monitor. The second primary effect to take into account is the problem of marine species becoming entangled in marine litter.

For the development of the ingestion protocols, all vertebrate ingestion studies must use the same classification of marine litter as for the other marine environment components. This guidance document presents protocols for litter ingestion and entanglement monitoring for the following fauna groups:

- Seabirds;
- Sea turtles;
- Fish.

The protocol for seabirds' ingestion monitoring in Europe focuses primary on shearwater species which are species that feed on the surface of the sea. Hence, when measuring the amount of litter in the stomachs, the marine compartment addressed is the water column, particularly the water surface.

Birds that have died on the beaches or accidentally, such as long-line victims, fledgling road deaths, etc., are collected for stomach content analyses. For this analysis, stomach contents are washed over a sieve with a mesh size of 1mm. Hence, the plastics' minimum size range under observation is 1 mm. When possible, the TSG ML group's "Master List" should be used to describe the items and give them a litter category number.

For each litter category/subcategory an assessment is made of:

- Incidence (percentage of investigated stomachs containing litter);
- Abundance by number (average number of items per individual); and
- Abundance by mass (weight in grams, accurate to 4th decimal).

It is essential to sample continuously. For the purpose of determining an accurate annual average for a particular area, a sample size of at least 40 birds is advised. Data over periods of four (4) to eight (8) years (depending on the category of litter) are required for reliable findings on changes or stability in the quantities of swallowed litter.

Since stomach anatomy, foraging ecology, and regurgitation of indigestible stomach contents vary among seabird families and can influence scientific approaches, procedures may need to be adjusted for certain seabirds.

The protocol for sea turtles' ingestion monitoring in Europe focuses primarily on loggerhead sea turtles (*Caretta caretta*) which feed in the water column and at the seafloor. Hence, when measuring the amount of litter in gastrointestinal system (GI), the marine compartments addressed are the water column and the seafloor.

For the assessment of GI contents, dead sea turtles are recovered from beaches or at sea from unintentional casualties as victims of longline fishing (bycatch) or boat collisions. Once collected and dissected, the liquid portion, mucus, and digested unidentifiable debris should be removed by first washing the contents with freshwater through a filter mesh of 1 mm, then rinsing all the material captured by the filter in 70% alcohol, and finally again in freshwater. The organic component needs to be kept apart from any other materials or products for the GI contents examination. With the aid of a stereo microscope and in accordance with the technique for bird ingestion, the fraction of marine litter should be analyzed and classified.

As with the seabird methods, the main measure that is valuable for the monitoring program is **abundance by mass** (weight in grams, exact to the third decimal place). For other studies and impact analysis, additional data such as item color, litter volume, litter kind, litter incidence in the esophagus, intestine, and stomach, and litter incidence and abundance by category of litter, are also helpful.

Regarding survey frequency, it is essential to sample continuously. For accurate findings on change or stability in swallowed litter volumes, a minimum sample population size for the year and time of sampling must be set.

The protocol for fish ingestion monitoring applies to pelagic and benthic fish species, which feed at the seafloor and the water column respectively. Hence, when measuring the amount of litter in stomachs (GI), the marine compartments addressed are the water column and the seafloor.

As there are numerous fish monitoring programs, it is simple to collect fish samples from these. For monitoring purposes, the following parameters should also be recorded:

- Location;
- Trawl/fishery type;

- Species;
- Length and standard length;
- Age;
- Sex;
- Visible deformations and skin condition (e.g., ulcers).

It should be noted that there is currently no accepted protocol for handling fish-related litter. Procedures similar to those used for seabirds and turtles may be sufficient for large fish, such as adult cod, while smaller fish or juvenile life stages may require more in line with requirements for micro litter research.

The basic morphology of the plastic materials found—sheet-like, filament-like, foamed, fragment-like, or other—is used to classify the stomach contents. When possible, the TSG ML group's "Master List" should be used to describe the items and give them a litter category number.

For each litter category/subcategory an assessment is made of:

- Incidence (percentage of investigated stomachs containing litter);
- Abundance by number (average number of items per individual), and
- Abundance by mass (weight in grams, accurate to 4th decimal)

Continuous sampling is required and depending on the type of litter (macro or micro litter) to be chosen, different size ranges, from juveniles to adults, should be considered.

The protocol for seabirds' entanglement and plastic as nest material monitoring in Europe focuses primarily on seabird breeding colonies whose species collect litter for nest construction in the surroundings of the colonies on beaches and at the sea surface. For surveying birds' colonies, a colony (or a segment of a colony) should be chosen where the boundaries of the study area(s) may be clearly seen from one or more fixed viewpoints. If only a portion of the colony is being observed, it should be typical of the entire colony and include at least 5 to 10% of all nests.

Photography, GPS and ground marks must be used to fix the points of observation and the borders of the pilot study. Regarding survey frequency, standard periods for conducting surveys are:

- Prior to the nesting season, to establish potential remainders of entangled corpses still present from the previous year;

- Peak of the breeding season to receive the maximum number of ‘apparently occupied nests’ and respective total number of breeding birds for all species in the colony/monitoring plot;
- Shortly after fledging of the chicks, to establish litter rates in the nests, and presence of (new) corpses of birds that died from entanglement.

A thorough count of the buildings in the previous count that have obvious marine synthetic trash must be conducted, and whenever feasible, pollution should be recorded with digital photos. The ratio of visible litter-containing nests to the total number of nests in the research plot is used to calculate the "nest litter rate". When possible, the TSG ML group's "Master List" should be used to describe the items and give them a litter category number.

Another measure to be calculated is the number of birds that are clearly entangled, identifying their species, age (adult, immature, or chick), and whether they are alive or dead (other species besides the breeders may become entangled).

The number of dead or dying animals (given for species and age classes) divided by the overall number of breeding birds in the research plot (also known as the "entanglement mortality rate") is then used to calculate the impact level from litter in nests.

6.1.8.5. Micro litter

In essence, microparticles occupy the extremely small end of marine litter size range. These microparticles are made of identical components to other categories of litter. The marine environment undoubtedly contains microscopic fragments of a variety of common material groups, such as glass, metal, plastic, and paper litter.

There is no clear lower size restriction stated in currently definitions, although 5 mm has been commonly (but not entirely) accepted as the upper size restriction. The lower size limit is considered to be represented by the mesh size of the net or sieve through which the sample was passed during the sampling.

Microplastics differ in terms of their size, shape, color, particular density, kind of polymer, and other features. Thus, determining the right size range and defining methodological criteria to quantify such metrics will be the first step in developing standard monitoring practices and processes to ensure meaningful comparisons.

Despite the limited knowledge regarding sources, distribution, and consequences of micro litter in the environment, the TSG ML recommends protocols for four (4) components, briefly described below:

- Intertidal sediments;
- Sea surface;
- Subtidal sediment; and
- Biota.

Intertidal beach sediments

The strand line and, where applicable, sandy coastlines (0.1 – 0.0125 mm sediment diameter) should be assessed for microplastics. Each site's strandline should yield five replicate samples, each of which should sample the top five (5) cm of the surface sediment. For each of the two size groups, namely microplastics ranging from 1 – 5 mm and from 20 μ m – 1 mm, sampling should be done independently.

Microplastics with a size between 20 μ m – 1 mm must be gathered as a bulk 250 ml sediment sample, and then extracted in the lab via density separation. After collection, the sample should be stored in metal or glass containers. Concerning to microplastics ranging from 1 – 5 mm, their collection must occur after sampling the smaller size fraction. The top 5 cm of the sediment can be sampled by using a metal trowel or spoon, then passing it through a 1 mm metal sieve and storing it in metal or glass containers.

For both size groups the required reporting units are items / ml of sediment, and the size of microparticles.

Sea surface

For monitoring micro litter in surface waters, a net is released from a vessel, away from the wake zone. During trawling, the observer keeps a tight check on the net to monitor its performance and, if required, modify speed and cable lengths. Sampling during plankton blooms should be avoided since it can choke the net and make subsequent analysis more difficult.

After recovering and securing the trawl on the deck, a range of procedures are taken from sample storage to counting and weighting, which are presented in the Table 18.

Table 18 - Recommendations for sampling surface waters

Procedures	Steps
Sample storage	<ul style="list-style-type: none"> • You will need a large bowl, squirt bottles, sample container, spoon, tweezers, and a preservative (isopropyl alcohol or formalin). • Remove the cod end over a bucket, as a precaution to catch any spillage. • Transfer sample into a large bowl. • Invert the cod end and wash it out from the outside using very little water, scrape left over sample into the large bowl using the spoon. Rinse the spoon into the bowl. • Pour entire sample into the sample container and add preservative. A sample may consist out of several containers.
Sample Preparation	<ul style="list-style-type: none"> • Drain sample through 5 mm sieve into one large bowl. • Use fresh water wash bottle to rinse off plastic particles adhering to the inside of the sample jar. • Rinse sample inside sieve in order to separate plastics thoroughly. • Transfer each size class to a different large Petri dish. • Rinse equipment gently with the wash bottle so that no plastic particles are left behind. • If the process above does not result in adequate liquid in the Petri dishes for sorting, then add sufficient water to float all plastic bits – do not overflow.
Separating sample into size classes >5mm and <5mm	<ul style="list-style-type: none"> • Place each Petri dish under a microscope. • Using forceps, remove all recognizable pieces of floating plastic. • Rinse off plastic bits with fresh water wash bottle to make sure smaller particles or plankton are not sticking to them. • Place rinsed bits of plastic in a separate labelled empty vial and set aside for later drying, typing, counting and weighing.
Drying of separated plastic	<ul style="list-style-type: none"> • Set your drying oven at 20°C. • Sieve sample and spread onto Petri dishes or leave in sieves. • Place sample in oven or a secure dry location. • Dry samples at 20° for about 30 minutes. If the samples are still wet after 30 minutes, leave them in the oven and check regularly. If they are left in a dry location, then check every few hours.

Procedures	Steps
Sorting plastic to determine type, count and weight	<ul style="list-style-type: none"> • With each size class dried in its own Petri dish or sieve, use forceps to sort sample into different types of plastic as categorized on the data sheet. • Count number of plastics for each type for each size category. • Tare the scale with Petri dish and weigh sample on a gram scale. • Record weight and count on the data sheet. • Transfer sorted and weighed plastic to labelled vials.

Source: Adapted from (TSG-ML, 2013)

For purposes of monitoring reports, the required reporting units are items/ m³ of water, size, color and shape.

Subtidal sediment

Any method that retrieves a sample of largely undisturbed surface silt from the ocean floor can be used to gather material (e.g., van veen grab, multi corer, box core etc.). To accurately depict the location of the original 5 cm surface to subsurface of the seabed, a tiny sample of sediment, ideally approximately 250 ml, is collected once it has been recovered onto the vessel. The sample is moved to a glass or metal container for spectroscopic or density separation.

For purposes of monitoring reports, the required reporting units are items / ml sediment, size, color and shape.

Biota

Currently, it is not possible to suggest certain species or seasons that would be ideal for precisely monitoring microplastics through biota. The TSG ML advises routinely checking any organisms that are already being evaluated for macro litter for the presence of microplastics (see section 6.1.8.4, Litter in biota).

6.2. Peer-reviewed articles

6.2.1. Assessment of Spatio-Temporal Variability of Faecal Pollution along Coastal Waters during and after Rainfall Events

The present study took place at the Arzilla River along the bathing beaches in front of Fano city (Marche Region, north-western Adriatic Sea). The city is characterized by a

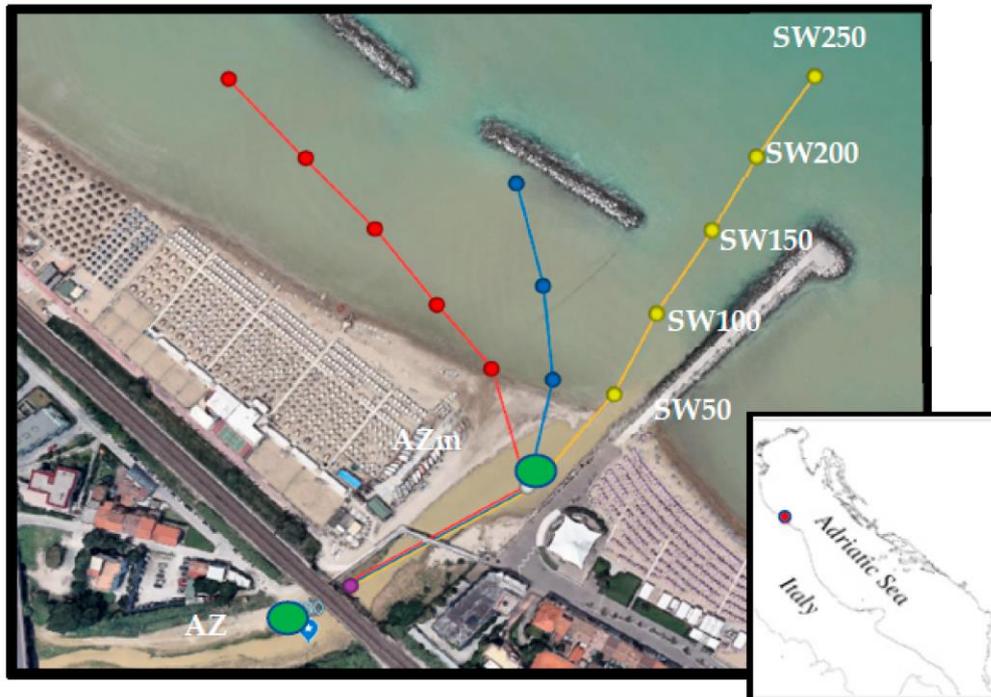
deeply urbanized environment with a touristic marina close to the river mouth and a number of man-made barriers against beach erosion along its shore. Sewage from both the inland and Fano Combine Sewer Overflow (CSO) is discharged into the Arzilla River, which is located close to one of the busiest beaches in the summer. Thus, considering the probable risk of faecal microbiological contamination, bathing is prohibited throughout the city whenever there is a sewage outflow.

The study was conducted over the course of two bathing seasons in 2019 and 2020, which were notable for the area's numerous, distinct rainy occurrences. The aims of the study were to:

- Assess the levels of faecal pollution and its spatial-temporal variability along a coastal area affected by freshwater discharges linked to strong storm rainfall events;
- Explore the potential relationships between the abundance and distribution of bacteria as faecal indicators and the main environmental variables; and
- Identify the potential processes to control the decay/persistence of coastal faecal contamination during river flow events.

During both bathing seasons considered, samples of both freshwater and saltwater were collected. To characterize the Arzilla River, the following parameters were obtained from freshwater samples: faecal bacteria, dissolved inorganic nutrients (ammonia-NH₄, nitrite-NO₂, nitrate-NO₃, total nitrogen, total phosphorus), total suspended matter (TSM) and chlorophyll-a (Chl-a) content. These samples were collected with an autosampler positioned at the Arzilla mouth every six (6), 12, 24 hours after the rainfall occurrences, and during a time period of 30 minutes. For comparative chemical and microbiological investigations, surface seawater samples were manually collected at the end of each rainy event in front of the Arzilla mouth, within 250 m the shoreline.

A grid made up of three (3) transects (Transects 1, 2, and 3) and a sample location in the Arzilla mouth comprised the spatial sampling scale (Figure 17). Sites along each transect are located 50, 100, 150, 200, and 250 m from the coast.



Source: (Manini, et al., 2022)

Figure 17 – Study site and sampling strategy

The coastline topography, local bathymetry, water currents, and the presence of manmade obstacles that affect microbial dispersion led to the adoption of this small spatial scale sampling technique. Using a CTD multiparametric probe (Idronaut model Ocean Seven 316 Plus), temperature (°C), salinity, pressure, density, oxygen concentration and saturation, pH, redox, and Chl-a were monitored at each site. *Escherichia coli* and intestinal *enterococci* abundance were determined in samples for microbiological studies of faecal contamination using membrane filtration.

6.2.2. Coastal Surveillance and Water Quality monitoring in the Rejiche Sea - Tunisia

The present study took place along the coast of Rejiche, which is a town with low population density. The current study was conducted during 3 seasons (summer, spring and autumn) from April to September of 2019. Winter sampling was avoided due to the unfavorable weather conditions. The current study's goals were to ascertain seawater's physiochemical makeup and microbiological composition Rejiche Coast, a fishing and tourism destination in Tunisia, and the trends of *Enterococcus* strains' antibiotic resistance were isolated from oceanic habitats.

To assess the environmental impact of the municipal discharge point, surface and sediment samples were collected from five (5) fixed locations within 10km of the discharge point (Figure 18). For sample collection Niskin bottles and Van Veen grabs were used by scuba divers at each site to collect surface waters and sediments at depths of 0.5 and 7 meters, respectively.



Source: (Alibi, et al., 2021)

Figure 18 – Map of sampling sites in Rejiche coast

From the surface seawater and sediment samples physicochemical parameters and bacteria analysis were monitored on a monthly basis. Table 19 presents the parameters and respective methods for water samples under the physicochemical analysis, while membrane filtering was used to perform bacterial analyses. At the five (5) distinct sites, a composite sample was created by combining sediment and water samples, and samples were carried out in triplicate.

Table 19 - Parameters and respective methods for physicochemical analysis

Parameters	Method
Electrical Conductivity (EC)	The conductivity was measured using previously calibrated Hach Conductivity meter. A potassium chloride solution (0.1 mol/L) was used as control, and the temperature was adjusted automatically.

Parameters	Method
Total Suspended Solid (TSS)	To determine the TSS, samples were filtered using Whatman GF/C glass fiber filter (1.2 µm; Sigma Aldrich) and then the filter with solids was dried in a drying oven and the weight was determined.
Turbidity	Turbidity was assessed using a spectrophotometer (Fisher Scientific Thermo Scientific™ GENESYS™ 10S UV-Vis).
pH	pH was measured using pH electrodes, and two standard solutions were used as control (Citric acid: pH = 3; NaOH: pH = 13).
Chemical Oxygen Demand (COD)	Performed by Pastel UV multiparameter water analyzer (Secomam, aqualabo) according to the manufacture guidelines.
Biochemical Oxygen Demand (BOD)	
Dissolved Oxygen (DO)	
Organic Matter (OM)	Performed by Pastel UV multiparameter water analyzer (Secomam, aqualabo) according to the manufacture guidelines.
Absorbable Organic Halogen (AOX)	
Nitrate (NO ₃)	

Source: Adapted from (Alibi, et al., 2021)

7. Stakeholder involvement

7.1. Introduction

Stakeholder engagement and consultations are essential in strategic planning processes and the like, throughout the whole of the process. Relevant international, regional, national and local actors and interested parties must be engaged from the start, in the tasks of data collection, analysis, assessment, and recommendations, to assess and validate the data and methodologies to be considered, as well as the outputs.

These actions also aim to guarantee the appropriation of the results of the assignment by the managing entities, so that its implementation can succeed.

Within **Task 2** of the assignment, initial interviews were conducted with key stakeholders to gain insight into the marine pollution management processes in Barbados, ensuring the situational analysis – which will feed the subsequent steps - is accurate.

The following topics were covered:

- Roles and powers of different stakeholders;
- Principles and tools of marine pollution management (including available tools for the detection, reporting and management of pollution events);
- Issues, key gaps and barriers (human, financial and technical) in the processes;
- Main marine pollution issues in Barbados / pollution concerns affecting natural ecosystems.

7.2. Stakeholder involvement process

The involvement of stakeholders within the scope of Task 2 consisted of online interviews followed by e-mailed questionnaires to be completed by stakeholders. The following steps were carried out (Figure 19):

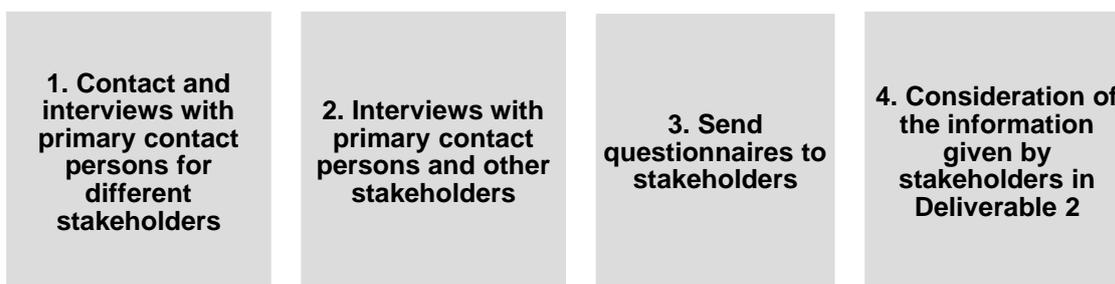


Figure 19 – Steps for stakeholder involvement within the scope of task 2 / deliverable 2

Firstly, Permanent Secretaries for whom contact details were available in official online sources were contacted (Table 20) in order to schedule meetings to address the main issues the team needs information on, including to gain insights into coastal and marine pollution control processes. To ensure the participation of as many entities as possible, assistance was given to NEMUS' team by the EPD.

Table 20 – Contacts made for scheduling meetings

Date	Entities	Description
25/01/2023	MENB; MHW; MTWW; MEBD; MAFNS; CZMU	First contact to schedule a meeting between the 7 th and 24 th of February 2023
07/02/2023	EPD; NRD	First contact to schedule a meeting between the 13 th and 24 th of February 2023
07/02/2023	MENB; MHW; MTWW; MEBD; CZMU	Follow up e-mail to schedule a meeting
08/02/2023	Barbados Port Inc.; CORALL Barbados	First contact to schedule a meeting between the 13 th and 24 th of February 2023
07/02/2023- 20/02/2023	NRD; MEBD; MHW	Contact by the EPD spokesperson and forwarding of a Consultant Introductory Letter
15/02/2023	CORALL Barbados; MAFNS; MTMW; FD; EPD	Follow up e-mail to schedule a meeting

Secondly, virtual meetings were conducted between the 14th and 24th of February 2023. As of late February 2023, total of four (4) entities were involved in Task 2’s stakeholder engagement activities, and are identified in Table 21.

Table 21 – Meetings held

Date	Entity
14.02.2023	Coastal Zone Management Unit
22.02.2023	Sanitation Service Authority
22.02.2023	Natural Resources Department
24.02.2023	Ministry of Agriculture and Food and Nutritional Security
07.03.2023	Environmental Protection Department

The agenda of the meetings was as follows (the meeting PowerPoint presentation is accessible in Annex 2):

- Welcome and introductions (NEMUS);
- Brief presentation of the project and the objectives of the meeting (NEMUS);
- Stakeholder discussion;
- Conclusion (NEMUS).

The main findings of the meetings are presented in Annex 3 and summarized in the following table.

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Table 22 - Matrix of Key challenges, Enablers and Barriers based on stakeholders' engagement

Stakeholder	Key challenges	Enablers	Barriers
Coastal Zone Management Unit	<ul style="list-style-type: none"> • Non-point sources as main sources of pollution • Offshore polluting events, such as illegal dumping by vessels • National Programme of Action for the Protection of the Marine Environment from Land-Based Sources of Pollution 2005-2015 has not been implemented • Developers get away with damaging practices due to lack of effective structures 	<ul style="list-style-type: none"> • Institutional articulation and collaboration: CZMU works closely with several government agencies, all having some level of input into the coastal zone management process • CZMU can have funding from multilateral institutions if implementing specific projects that require level of monitoring that needs to be outsourced • Currently on the process of updating and upgrading the legislation of the ICZM Act • Growing interest in the coastal zone, and investment in its integrated and sustainable management and spatial planning 	<ul style="list-style-type: none"> • Limited human resources – technical unit is composed of 2 people • Lack of legislation update • Lack of financial resources • High degree of commitment required on implementation of the National Programme of Action for the Protection of the Marine Environment from Land-Based Sources of Pollution 2005-2015, leading to lack of agencies' willingness to commit
Natural Resources Department	<ul style="list-style-type: none"> • Agricultural run-off as a major source of pollution • Dumping of solid debris, wastewater, and ballast water from ships and platforms • Heat pollution from explosions and fires 	<ul style="list-style-type: none"> • Drafting of Offshore Energy Legislation, and Ocean Energy Legislation, since the Government of Barbados is actively seeking to develop ocean energy technology, and is looking at new sources of revenue for the offshore area, for maximising the blue economy 	<ul style="list-style-type: none"> • Lack of human resources • Lack of technical and financial resources • Lack of resources to monitor the activity of operators and ensure the established standards are being respected

Stakeholder	Key challenges	Enablers	Barriers
	<ul style="list-style-type: none"> • Lack of strategies or plans addressing what pollution is already there • Lack of data availability – there are no baseline studies against which to measure environmental impacts 		<ul style="list-style-type: none"> • Oil and gas industries tend to be heavily self-regulated according to national contexts, but in Barbados, there are no national (or institutional) health, safety and environmental standards specifically fitted for the country's context
Sanitation Services Authority	<ul style="list-style-type: none"> • Use of old quarries as dumping sites • Illegal dumping of hazardous chemicals • Need for better, tighter, enforcement for industrial waste management • Need for awareness about hazardous waste • Need for waste treatment laws that make it the companies' responsibility to treat the waste to a point where the SSA can then deal with it 		<ul style="list-style-type: none"> • No chemical disposal facility on the island • No leachate treatment facility on the island • Lack of human resources in the government agencies to inspect companies' activities
Ministry of Agriculture and National Food Security	<ul style="list-style-type: none"> • Soil erosion and coral smothering • Need for technical capacity building to test for pesticide residues • There are no studies on pesticide runoff / pesticide pollution in the marine area 	<ul style="list-style-type: none"> • Purchase of technical equipment allowing a higher processing capacity • The shift towards organic pesticides and safe chemicals is being encouraged • Resistant crops are being looked at • Replot of grass along hedgerows of sugar cane field to retain the soil 	<ul style="list-style-type: none"> • Lack of human resources • Lack of technical resources – lack of equipment with low detection capacity as required for marine monitoring • Cost of organic pesticides and safe chemicals is prohibitive and has

Stakeholder	Key challenges	Enablers	Barriers
		<ul style="list-style-type: none"> • Wells on government properties have been cleaned to increase groundwater retention • Drip irrigation has been widely used, together with target pesticides (relevant for specific crops) to move away from general chemicals • Zones for aquifer recharge protection have been defined 	<p>prevented farmers from going into organic</p>
<p>Environmental Protection Department</p>	<ul style="list-style-type: none"> • Lack of an unifying document considering marine pollution as a whole • Regulations that should accompany the Marine Pollution Management Act have not been finalized yet, which limits EPD's range of action • List of prohibited concentrations is only a draft, thus EPD does not have enough enforcement power 	<ul style="list-style-type: none"> • Regulations accompanying the Marine Pollution Management Act are close to finalization and will: <ul style="list-style-type: none"> ○ Officialise the list of prohibited concentrations; ○ Provide EPD with more power to enforce concentration limits; ○ Hold companies accountable – they may be requested to report to the EPD about potentially polluting activities 	<ul style="list-style-type: none"> • Lack of human and financial resources

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Thirdly, after the meetings, a brief questionnaire was sent for each participant to complete, in order to complement the information that was provided during the video calls. The questionnaire, presented in Annex 4, focuses on the following subjects:

- Principles and tools of marine pollution management;
- Key gaps, barriers and issues in the process;
- Coastal and marine pollution concerns.

No completed questionnaires were received until the 7th of March 2023.

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8. Conclusion and next steps

Task 2 of the Consultancy for the *Development of a Marine Pollution Management Strategy and Action Plan in Barbados* consisted of the compilation of baseline information regarding the processes currently in place for pollution management in Barbados.

At present, management of marine pollution falls primarily under the EPD, who does not yet possess the necessary enforcement capacity because regulations are under conclusion still.

Planning and decision-making is mostly done on a sectoral basis, with the consultation of relevant agencies or the creation of committees joining representatives from different areas. Data collection is done routinely for some parameters and regions, and sporadically in the scope of projects or environmental impact assessments. All the information is reported back to the EPD.

Management actions are mostly corrective and triggered on a case-by-case basis following reporting and investigation by the EPD.

The next steps in the consultancy will involve a more in-depth look at available strategies, directives, guidelines, case-studies and other sources, applied in the Caribbean as well as in other geographic contexts, in light of Barbados' institutional, economic and environmental contexts, characterized in Task 2.

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10. Annexes

The following Annexes are included ahead:

- Annex 1 – Contacted stakeholders;
- Annex 2 – Meetings PowerPoint presentation;
- Annex 3 – Main findings of the meetings / interviews;
- Annex 4 – Questionnaire form.

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Annex 1 – Contacted stakeholders

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Contacted stakeholders and contact information

Entity	Division/ department	Stakeholder and contact information
Ministry of Environment and National Beautification, Blue and Green Economy (MENB)	-	Permanent Secretary ps.menb@barbados.gov.bb
	Environmental Protection Department	Secretary epd.secretary@epd.gov.bb
		Deputy Director lisa.senhouse@epd.gov.bb
		Sanitation Services Authority ps.menb@barbados.gov.bb
	Ministry of Marine Affairs and Blue Economy (MMABE)	-
Coastal Zone Management Unit (CZMU)		Director director@coastal.gov.bb lbrewster@coastal.gov.bb
		Fisheries Division Chief Fisheries Officer shelley-ann.cox@barbados.gov.bb
Barbados Port Inc.		Administrator administrator@barbadosport.com
Ministry of Energy and Business Development (MEBD)		-
	Natural Resources Department (NRD)	Director jwhite@energy.gov.bb
Ministry of Agriculture and National Food Security (MANFS)	-	Permanent secretary ps@agriculture.gov.bb
Ministry of Health and Wellness (MHW)	-	Permanent Secretary ps-secretary@health.gov.bb
Ministry of Transport, Works and Water Resources (MTWW)	-	Permanent Secretary psmtwm@barbados.gov.bb
CORALL Barbados	-	Corall Communications Coordinator cgaskin17@gmail.com

Participants at the meetings

Entity	Participants
Coastal Zone Management Unit	<ul style="list-style-type: none"> • Dr. Leo Brewster, Director (lbrewster@coastal.gov.bb)
Natural Resources Department	<ul style="list-style-type: none"> • Jamar White, Director (Geologist by training) (jwhite@energy.gov.bb) • Nesha Nurse, Geologist (nnurse@energy.gov.bb) • Jamal Gill, Geologist (jgill@energy.gov.bb) • Jade Harding, Geologist (jharding@energy.gov.bb)
Sanitation Services Authority	<ul style="list-style-type: none"> • Leona Deane, Assistant Manager (leonadeane@gmail.com)
Ministry of Agriculture and Analytical Services Department	<ul style="list-style-type: none"> • Michael James, Officer in charge of Land Protection in the Ministry of Agriculture (mjames@agriculture.gov.bb) • Beverly Hood, Director of the Analytical Services Department (bwood@agriculture.gov.bb)
Environmental Protection Department	<ul style="list-style-type: none"> • Ann-Marie Eversley, Marine Pollution Officer (ann-marie.eversley@epd.gov.bb) • Lisa Senhouse, Deputy director (lisa.senhouse@epd.gov.bb)

Annex 2 – Meetings PowerPoint presentation

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nemus

Development of a Marine Pollution Management Strategy and Action Plan in Barbados to promote the preservation of marine habitats, marine ecosystem services, healthy ocean space and sustainable marine-based livelihoods

Interviews with Stakeholders

February 2023

Development of a Marine Pollution Management Strategy and Action Plan in Barbados to promote the preservation of marine habitats, marine ecosystem services, healthy ocean space and sustainable marine-based livelihoods – Interviews with stakeholders



Development of a Marine Pollution Management Strategy and Action Plan in Barbados to promote the preservation of marine habitats, marine ecosystem services, healthy ocean space and sustainable marine-based livelihoods – Interviews with stakeholders

- 1. Welcome and introductions**
- 2. Brief presentation of the project**
- 3. Objectives of the meeting**
- 4. Stakeholder discussion**
- 5. Conclusion**



1. Welcome and introductions

- 1. Nemus Team presentation**
- 2. Stakeholders presentation**

2.1. Project objectives

Overall Objective:

- Promote the **preservation of marine habitats, marine ecosystem services, a healthy ocean space and sustainable marine-based livelihoods** in Barbados, through the development of a **Marine Pollution Management Strategy and Action Plan**.

Specific Objectives:

- Conduct a review of the **national and local governance structures** for marine pollution management .
- Identify **suitable methodologies, tools and frameworks** for pollution management.
- Prepare a **Marine Pollution Management Strategy and Action Plan**.

5

2.2 Project tasks



TASK 2

- Data collection
- Analyses of legislative and regulatory context and governance structures of marine pollution management
- Analyses of planning and plan implementation processes for marine pollution management and related plans
- Analyses of monitoring and evaluation criteria applied in selected good practice case studies for marine pollution management
- Interviews and engagement with key stakeholders**

Technical Report 1: Situational Analysis

6

2.3. Project study area

Land Cover: 432 km²

Coastline: 114 km

Exclusive Economic Zone (EEZ): 185 000 km²

Population: 287 025

Administrative Division:

- 11 Parishes(ChristChurch, St. James, St. Lucy, St. Michael, St. Peter, St. Thomas, St. Andrew, St. George, St. John, St. Joseph, St. Philip)

Coastal Environment:

- Sandy beaches, coral reefs, saltmarshes, mangroves, seagrass beds



3. Objectives of the meeting

Gain insight into the **marine pollution management processes** in Barbados, including:

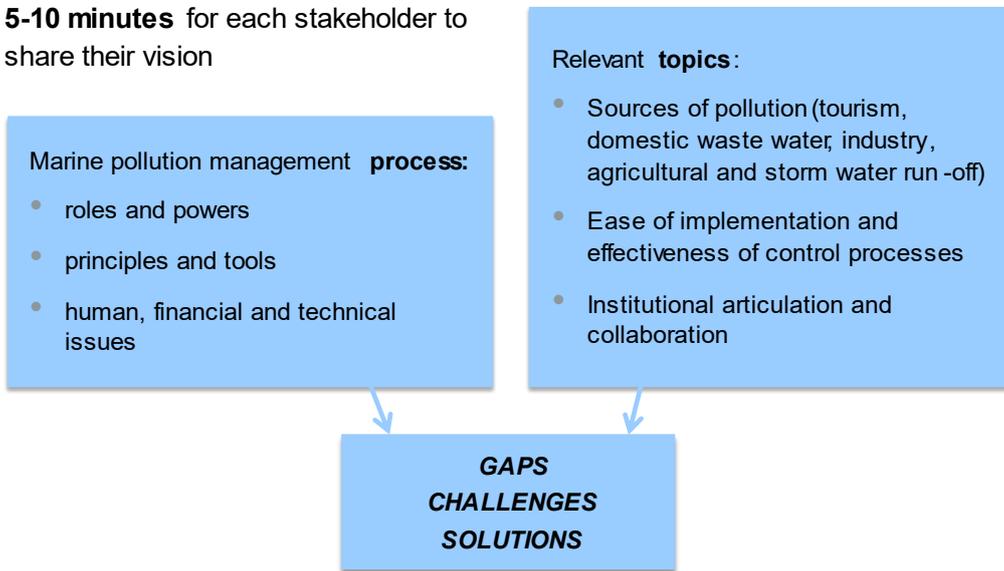
- Roles and powers of different stakeholders;
- Principles and tools of marine pollution management;
- Issues, key gaps and barriers (human, financial and technical) in the processes;
- Main marine pollution issues.

Topics relevant to the **management of coastal pollution** :

- Ecosystems and resources that are most affected by coastal pollution
- Main sources of pollution and current solutions.
- Control, reporting, monitoring, management and enforcement mechanisms;
- Institutional articulation and collaboration in marine pollution management

4. Stakeholders discussion, comments and suggestions

5-10 minutes for each stakeholder to share their vision



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5. Conclusions

- The information provided at this meeting will be considered in the next consultancy report (Deliverable 2, Situational Analysis).
- To complete the information that was provided today, we will send each stakeholder a brief **questionnaire about marine pollution in Barbados**.
- The questionnaire focuses on the **following subjects** :
 - Principles and tools of marine pollution management ;
 - Key gaps, barriers and issues in the process;
 - Coastal and marine pollution concerns ;
 - Additional comments and/or suggestions to be considered in Barbados' Marine pollution Strategy and Action plan;
- We would appreciate to receive the questionnaire back by **27th of February**.

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Thank you for your participation!

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Annex 3 – Main findings of the meetings / interviews

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1. Coastal Zone Management Unit

Roles & responsibilities

The CZMU is a regulator, and works closely with the Environmental Protection Department, where the responsibility for dealing with marine pollution falls. Since the CZMU has as one of their main interests to protect coastal and marine ecosystems and habitats, the management of marine pollution also overlaps with its responsibility.

In this scope, the CZMU monitors normal environmental parameters for water quality (oxygen, temperature, salinity, chlorophyll a, bacteria and faecal coliforms) and coastal ecosystems, in particular coral reefs, since the representation of seagrass and mangroves does not justify monitoring. Monitoring activities aim to follow ecosystem health and identify pollution sources. Detailed coral reef assessments are undertaken every five (5) years, in about 50 different sites, including indicators of reef health, abundance, diversity, fish biomass, among others.

Monitoring activities are done quarterly, in pre-defined sites along the west and south coast. The CZMU is looking to increase the frequency of monitoring but has not yet been able to due to limited human resources capacity. Monitoring is not done along the east and southeast coasts, the Atlantic coasts, because of the rougher conditions which difficult vessel access. Boats are hired for the monitoring activities.

When pollution incidents or infringements (such as illegal discharges) are reported to the CZMU or detected, they then write a memorandum reporting it to the EPD, whose responsibility it is to investigate the claim and deal with it.

The technical unit of the CZMU is composed of two (2) people, and most of the staff is trained in diving to assist operations and alleviate the insufficient staffing.

Functioning & institutional articulation

The CZMU works closely with several other government agencies, all that have some level of input into the coastal zone, such as: Fisheries Division; Environmental protection Department; International Transport section; Port Authority. The apparent complexity and the overlap of these institutions is actually not a problem. It has been like that for a long time. In 1998, the development of the first Integrated Coastal Zone Management Plan included the identification and clarification of all the layers of responsibility

concerning the coastal zone, and related legislation. Until then, management was not really articulated.

The interviewee stated also that there is normally a good working relationship between the different departments and agencies, and that the CZMU is normally called in to consultation processes when other agencies are dealing with coastal matters. Because of this level of working relationship, it was deemed that an integrated coastal zone management committee was not actually necessary.

The CZMU can have funding from multilateral institutions if implementing specific projects that require other level of monitoring that needs to be outsourced to consultancies.

Legislation

The CZMU is currently on the process of updating the legislation of the ICZM Act for increased robustness. The original one focuses more on the power of the minister and of enforcement of illegal activities such as coral damaging and harvesting.

The changes are meant to make it more comprehensive in terms of scale and reach. It will integrate the need for memorandums of understanding between the CZMU and other agencies to ensure responsibilities are clear and to promote a more dedicated approach (and strengthened financial responsibility) when project elements are delegated to other agencies.

Pollution issues & history

Main sources of pollution according to the CZMU are non-point ones. There are two main pathways for non-point pollution to reach the marine environment. The first is through groundwater seepage, and the second through stormwater running along watercourses directly into the coastal area in heavy rainfall events.

Historically, hotels would have their own wastewater outfalls into the ocean, but the sewage system from Bridgetown now serves these, and there are regulations that incentivize hotels to install water treatment facilities within their premises so they can have their own outfalls. Hotels are further advised to have secondary treatment equipment so they can use their wastewater – treated in house - for irrigation.

There are two water treatment plants with long outfalls, 1 to 1.5 km offshore, in the prevailing current direction to minimize the chances the wastewater will return to the coast.

However, offshore polluting events such as illegal dumping by vessels passing through are also important to consider. Incidents occur where waste bags will wash on the eastern shore. These concerns are related to the MARPOL convention and the Maritime Division of the International Transport has been working to make the necessary updates of legislation regarding this. According to the interviewee, there are pieces of legislation already drafted and under revision by the attorney general and the public.

Plan-making & implementation processes

The National Programme of Action for the Protection of the Marine Environment from land-based sources of pollution for 2005 and 2015 has not been implemented, to the author's knowledge. This was possibly due to the lack of financial resources and the lack of willingness to commit. Other agencies were in fact involved in the development of the Programme (through round table discussions and such), however, on the long run the high degree of commitment from all agencies necessary of its implementation made it difficult. Some elements may have been implemented ad hoc, but not in its entirety nor in an integrated way.

According to the interviewee, climate change and marine pollution issues are gaining traction in Barbados, accompanying global trends. However, financial resources are likely to continue to be an issue. The urgency to tackle marine pollution has increased, as has public awareness regarding the environment and its importance in Barbados. There is a growing awareness that developers have been getting away with damaging practices because of a lack of effective structures. The growing interest in the coastal zone and investment in its integrated and sustainable management or spatial planning is also calling for the consideration of waste. It is not only about creating conservation and protection areas, but also managing harmful practices with human origin.

2. Natural Resources Department

Pollution issues

According to the NRD, there are several things that contribute to marine pollution, particularly, in the onshore environment. Agricultural run-off is a major contributor; however, other agencies such as the CZMU, the EPD and the Ministry of Agriculture are better positioned to speak to it.

As a department of essentially geologists, the NRD does look at the drainage component. There's an aquifer that covers about 85% of the country and surface and subsurface drainage contributes to the accumulation of potable water, which is then pumped for consumption. Only one surface water body is pumped, a brackish one on the coast, for the desalinization plant.

Roles & responsibilities

The responsibility of the NRD lay mostly in offshore resources, particularly the oil and gas industries, through the administration of the Offshore Petroleum Legislation. The NRD award licences and blocks to interested companies to explore and produce hydrocarbons offshore.

Considering the environmental footprint and impacts that these activities have, the OPL and related regulations (the Offshore Petroleum regulations, the Offshore Petroleum Taxation Act and various amendments to those pieces of legislation) include environmental protection provisions, such as the requirement to submit environmental impact assessment studies for every offshore operation these companies need to do, be it seismic activities, seabed sampling, sub-surface sampling, or actual drilling of wells.

The EA concerns all aspects of the operations and the social-economic impacts as well as the environmental impacts, health and safety impacts. The legislation lays specific deliverables and documents that the companies need to submit, and studies that the companies need to do to certify the government that they will operate in a safe and efficient manner. These include the environmental and social assessment, the environmental management plan, safety case, drilling plans, decommissioning plans, health and safety plan, training plan, and a few other deliverables. Stakeholder consultations are also required, across the government, private sector, NGOs, and the average Barbadian, to understand how the operations will impact each of them and then

provide risk assessment analysis to either mitigate, avoid or address some of the various risks that would come from the activities under assessment.

Seeing as Barbados is signatory to a number of International Conventions and Protocols in relation to offshore activities, the NRD also oversees the observation of these. The NRD makes these protocols/ conventions' requirements known to companies and ensure that they are adhered to.

Locally there are a number of other crosscutting pieces of legislation that are administered by other agencies, such as the Ministry of the Environment, to the Coastal Zone Management Unit, the Environmental Protection Department, the Planning and Development Department, and the Labour Department, that companies also have to adhere to. In other words, there are a number of legislations that crosscut various ministries that would also be relevant in respect of offshore oil and gas exploration.

The Government of Barbados is actively seeking to develop ocean energy technology, and is looking at new sources of revenue for the offshore area, for maximising the blue economy – offshore windfarms, wave energy, etc.

The NRD is drafting Offshore Energy Legislation, and Ocean Energy Legislation, since this sector would have impacts on the environmental that need addressing.

There is a National Oil Spill Response Committee under the EPD, which joins representatives from different companies and governmental departments, and it is this committee which is tasked with responding to polluting events such as spills. The committee was created for oil spills, but it is of general understanding that its processes and structure can be used for other incidents.

These response protocols haven't been applied enough to assess whether they are effective. They had a lot of trial runs and mock trials to go through all aspects of escalation but have not yet had the necessity of putting it into practice, so they do not really know if it all works. During these trials, different agencies would make recommendations regarding the optimization of processes.

Challenges

One of the main challenges of the NRD is in terms of monitoring the activity of operators, ensuring established standards are being respected, and ensuring the information they report is true. There are deficiencies in terms of human, equipment, technical and financial resources.

Oil and gas industries tend to be heavily self-regulated according to national contexts. In Barbados, there are no national (or institutional) health, safety and environmental standards specifically fit for the context of Barbados – a small development island state. Such standards must take into consideration the importance of the marine space for the productive sectors, particularly tourism, fisheries, international transport, etc., and need to ensure that the marine space is shared among users sustainably.

In terms of pollution per se, the NRD mentions dumping of solid debris, wastewater, ballast water from ships and platforms. Heat pollution from explosions and fires was also mentioned as potentially harmful and in need of addressing.

In terms of shortcomings, it was reported that although there are protocols for what to do when incidents happen, quickly and short-term, there aren't assessments or strategies or plans addressing what pollution is already there, nor are there long-term strategies.

Another critical issue is data availability. There are no baseline studies against which to measure environmental impacts. "Severely lacking". There is a better abundance of information for marine protected areas, in terms of biodiversity. Offshore, there's a huge gap. The only source of data for the offshore is through impact assessment of new oil and gas projects, which include the assessment of current conditions in terms of physical-chemical parameters (temperature, salinity, turbidity, etc.), currents, flora and fauna, faunal movements, and including sediment and water column samples across two seasons.

3. Sanitation Services Authority

Roles & responsibilities

The SSA is the operator of regulations created by the EPD and the EHD mainly.

The SSA's responsibility is to collect and dispose of waste across the island, as defined in the SSA Act, to dispose of the dead, to manage public cemeteries, to clean all public roads across the island, and to clean the drains in Bridgetown. The Drains Division cleans all the drains outside of Bridgetown.

Like reiterated, anything done in the island will impact the coast. It is the SSA's responsibility to ensure litter does not get in the drains, from the roads, and ends up in the sea.

Challenges

A problem they have been dealing with is the use of old quarries as dumping sites. They are currently covering these so that there is no more illegal dumping. Since these are not engineered, the probability of litter and pollution seeping down to the marine area is heightened. There are also safety concerns for people getting too close to these old quarries.

There is no chemical disposal facility on the island. The EPD defined the protocol for dealing with waste – chemicals are either neutralised, diluted, or shipped out of the island by the EPD.

There is, however, a concern that hazardous chemicals are being dumped illegally and contaminating the land. People are likely to be disposing of these chemicals – such as paint cans – through regular waste streams. So, although there are mechanisms in place for dealing with different wastes, it is not clear whether users are properly aware/informed.

Construction companies who sell a quarry need to back fill it with demolition waste (rocks, soil, wood, cement blocks, etc.), to bring it back to the original topography. It is possible that unappropriated material are going in together with the demolition waste. The government does not control the activities in these quarries, which are privately held.

There is a need for more awareness raising about hazardous waste, how does it impact ground water and ultimately marine resources. There was some awareness raising when the law was first enacted (they even did a mock trial), but it seems to have “died down”.

There is a need for waste treatment laws that make it the companies' responsibility to treat the waste to a point where the SSA can then deal with it.

Many of the government agencies that should inspect these activities have staff issues. Typically you hear about incidents after a fact, when it is already a crisis.

Need for better, tighter, enforcement for industrial waste management.

The main concern at the moment for the SSA is for a new landfill, since the one in use currently is approximately 2 years from filling. This is in process.

The other concern is the need for a leachate treatment facility. Leachate is currently recirculated, in the landfill in use, but this is not sustainable long-term. Because leachate volume increases as you increase the number of engineered cells, the SSA is trying to appeal to the government for a leachate treatment facility, which should also be able to treat the pre-treated industrial waste.

4. Ministry of Agriculture and National Food Security

Responsibilities

The Analytical Services Department (ASD) does not hold legislative powers to set up monitoring programmes.

The ASD of the Ministry of Agriculture is the agency responsible for analysing samples from Barbados Water Authority, specifically, they test the outflow water from sewage treatment plants to make sure it is at the required levels for being disposed of in the ocean – monthly. They analyse microbial content and chemical parameters.

There is a registry programme for private companies who treat and dispose of their wastewater in-house. These companies must also bring samples into the ASD so they can test their wastewater and report it back to the EPD.

Certain chemicals entering the island are monitored by the Pesticides Control Board, to see how they react to the soil, for instance, how well are they retained. This must be done before they are registered and allowed to use in the island. The chemical profile of the pesticide is sent to different agencies so they can comment on its usability.

The ASD analyses beach water samples for the EPD's monitoring programme for certain parameters, including nutrients. The Best dos Santos laboratory (Ministry of Health)

conducts analysis for the EPD's monitoring programme for bacteriological parameters. No work is currently done for the CZMU.

Issues

Main shortcomings, or needs:

- The problem with the ASD is they do not have the equipment with low enough detection capacity as required for marine monitoring. Also, they monitor total nitrogen, which is not the correct indicator according to the Cartagena Convention. The ASD can do nitrate phosphates using qualitative kits.
- There is a need for technical capacity building so that they can test for pesticide residues.
- Because the EPD is pressuring the private sector to treat their wastewater – which they must test through the ASD – there are human resources shortages.
- Soil erosion and coral smothering is the main concern as related the agriculture management in Barbados, according to the Ministry.
- There have been no studies on pesticide runoff / pesticide pollution in the marine area.
- The ASD calls for automatization of processes so they can have a higher processing capacity. They are considering a BOD analyser, a continuous flow analyser and a discrete auto-analyser for nutrients. They are set to get it in the scope of a IWECO project.
- Chlorophyll a is not analysed. They would like to embrace this area, through gas chromatography probably.
- In the plan under development, it is important to include which parameters need to be monitored and the levels they should be at.
- The plan under development must consider the processing capacity of the ASD, since they already have problems of reduced human resources. If the plan were to recommend new monitoring programmes, it should take into consideration the laboratory's capacity, processes, etc., and the officers at the ASD are willing to

collaborate in the plan making process so that challenges can be overcome, and an effective plan can be put in place.

Pollution sources

Regarding pollution sources, there have not been assessments yet, so it is not actually possible to say where the pollution comes from, if it really originated predominantly from agricultural runoff. There is no monitoring programme for that.

On the other hand, the increase in mechanization, especially in the sugar cane industry, there is more mobilization and more removal of vegetation, which increase soil erosion, especially during heavy rainfall.

Implemented measures

- The Ministry has started to replot grass along hedgerows of sugar cane field to retain the soil.
- Wells have also been cleaned on government properties to increase groundwater retention.
- Water harvesting is recommended by the ministry, which is also aimed at reducing runoff to the gullies and the ocean.
- Drip irrigation is widely used, together with target pesticides, relevant for specific crops, in an attempt to move away from general chemicals.
- The shift towards organic pesticides and safe chemicals is also being encouraged. But cost is prohibitive and has prevented a lot of farmers from going into organic. It is not realistic to ban pesticides altogether.
- Resistant crops are also being looked at.
- Zones have been defined in Barbados for aquifer recharge protection, based on the travel time of a microbe from the surface to the aquifer, not agricultural nutrients, and chemicals.

5. Environmental Protection Department

Responsibilities

The EPD is responsible, among other things, for all matters related to the pollution of marine and coastal areas, from all sources – air, seabed, land, etc. – through the Marine Pollution Management Act.

The act gives the EPD some powers, however, the agency is somewhat limited in what it can do in practice. This is because the regulations that should accompany the Act have not been finalized yet. They are close to finalization; they are in the final stages and could be ready by the end of 2023 if everything runs well.

The regulations are set to “give the teeth to their operations”, as they will:

- Officialise the list of prohibited concentrations;
- Provide the EPD with more power to enforce concentration limits;
- Hold companies accountable in the sense that all companies – even the ones operating on land – may be requested to report to the EPD about potentially polluting activities.

The EPD may request polluters to do a number of things, such as sampling, reporting, and implement corrective action, through several processes. These include:

- Industries or companies intending to start operating in Barbados may be required to do an ESIA (or other forms of EA), in the scope of which they can be required to sample before the project to construct a baseline, during the project construction and after;
- The EPD conducts inspections at facilities and assesses what is going in, what is coming out, what waste is being produced, etc., and through that they can request certain analyses from the company;
- The EPD receives reports or claims of pollution incidents or infringements, which will trigger an inspection and, potentially, the request for testing from the company in question.

The EPD then has different reporting forms in place that companies may be requested to fill, such as: discharge forms, agreement forms, among others. In cases where a company cannot reach a particular concentration/ limit, for instance, an agreement can be made allowing them to discharge at a higher concentration until measures are put in place.

Once a company is required to sample, it must then submit the results (with or without a more thorough report) to the EPD.

Regarding the results, if a company is above certain limits, at the moment, because the regulations are not finalized, the EPD can only inform the company as to what needs to be corrected, i.e., at what level they need to bring the concentrations to. Because the list of prohibited concentrations is only a draft, the EPD does not have enough enforcement power. Still, most companies will comply when the issue is brought to their attention.

Regarding planning processes, there are national level plans and sectoral plans where the EPD can be included (National Development Plans, Integrated Coastal Zone Management Plan, etc.), but there is not one unifying document that looks at marine pollution as a whole.

In terms of routine Monitoring, there are three (3) main programmes in place under the EPD:

- **Nearshore water quality monitoring programme** – sampling from the nearshore area throughout the west and south coast, every week, two days a week (one in each coast), in selected beaches (mostly in beaches that are used by the public); the following parameters are tested: bacteria; pH; turbidity; total suspended solids; total phosphorus; total nitrogen; faecal coliforms; faecal strep; faecal enterococci;
- **Groundwater monitoring programme** – done at various public potable and not potable springs, once a week (each catchment is done once a month); a longer list of parameters is tested;
- **Widescreen analysis** - twice a year, in the dry and wet seasons, samples are taken abroad for more complete testing.

In addition to these regular monitoring activities, there is data collected in the scope of specific projects and studies.

When they start to see any trends or such from monitoring results, the EPD will be activated to do further research to figure out what is happening, what the source may be, and from there, depending on the findings, they must mediate and define what needs to be put in place. It is done on a case-by-case basis.

Regarding oil spill response, because most incidents are small to medium, they can typically be dealt with nationally, and even normally by the polluter themselves. They then notify the EPD and report on what happened.

According to the EPD, they do “fairly well” in emergency responses, but there is “always room for improvements”, and they engage in drills and tests to improve the system.

Each company is required to have their own response equipment and inform the EPD about this and its conditions, annually. Contact details for all companies are shared, so they can be called in emergency situations. Most of the time when something happens it is connected to one of these companies and they are the ones that mobilize their means to deal with it. The EPD then comes in and mobilizes further needs, if more equipment is necessary, they can activate other companies for assisting.

Issues

The EPD already suffers from human and financial resources, as such, the implementation of the new Marine Pollution Management Strategy and Action Plan should ideally require or predict the mobilization of new resources, so that the responsibilities currently held by the EPD can be adequately maintained.

It is of crucial concern that the consultancy looks at the systems and determines the gaps and areas to be worked at, to enhance the response. The personal staff does not have the time capacity to do this assessment and complete routine tasks as well.

Of particular importance is to develop a better trigger system for recognizing signs that things are going to happen or as they are happening, so the response may be easier to put in place – perhaps through software, to better reach the goals of protecting the marine environment.

Pollution sources

Because of how the island is, anything that happens in the island will end up at sea.

Mostly they deal with specific situations such as permanent outfalls from some industries, incidents (oil spills), and illegal discharges directly into the marine environment.

In general, in the nearshore area, fluctuation of nutrient concentration is what is detected, normally from wastewater discharges, from runoff, etc. There is a wide spectrum of activities that impact this parameter.

Regarding oil spills, on average they have about 3 per year, sometimes none. These are typically small to medium incidents such as when a vessel is transferring to land, does not pay attention, and spills.

Annex 4 – Questionnaire form

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**Consultancy Services for the Development of a
Marine Pollution Management Strategy and
Action Plan in Barbados to promote the
preservation of marine habitats, marine
ecosystem services, healthy ocean space and
sustainable marine-based livelihoods**

Questionnaire Q1

Entity: _____

Name: _____

Function: _____

Please send the completed questionnaire to maria.espiritosanto@nemus.pt by February 27, 2023.

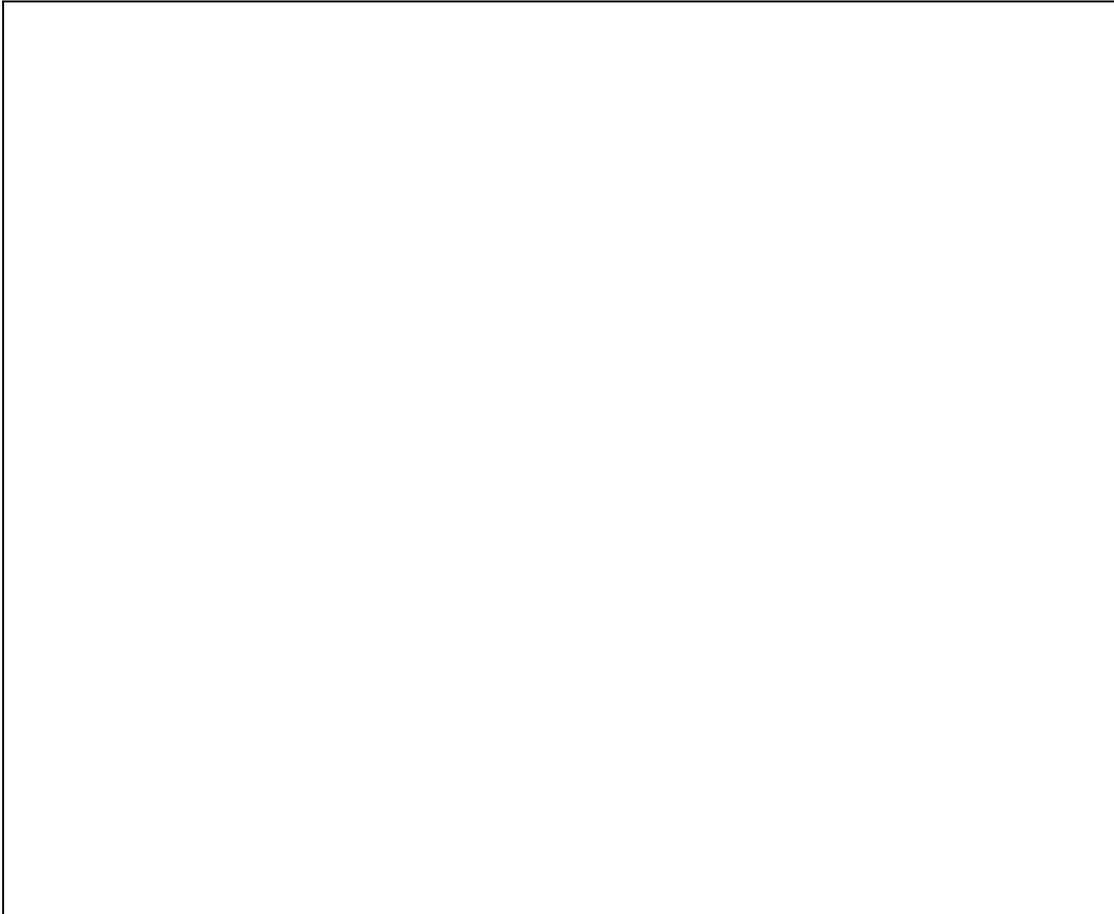
1. Principles and tools of marine pollution management

How are the decision-making processes around marine pollution management in Barbados? What methodologies are used to measure, quantify and manage the contributions of various activities to marine pollution?



2. Key gaps, barriers and issues in the process

What are the main issues with the marine pollution management processes in Barbados? What gaps and opportunities exist, and how should these be addressed?



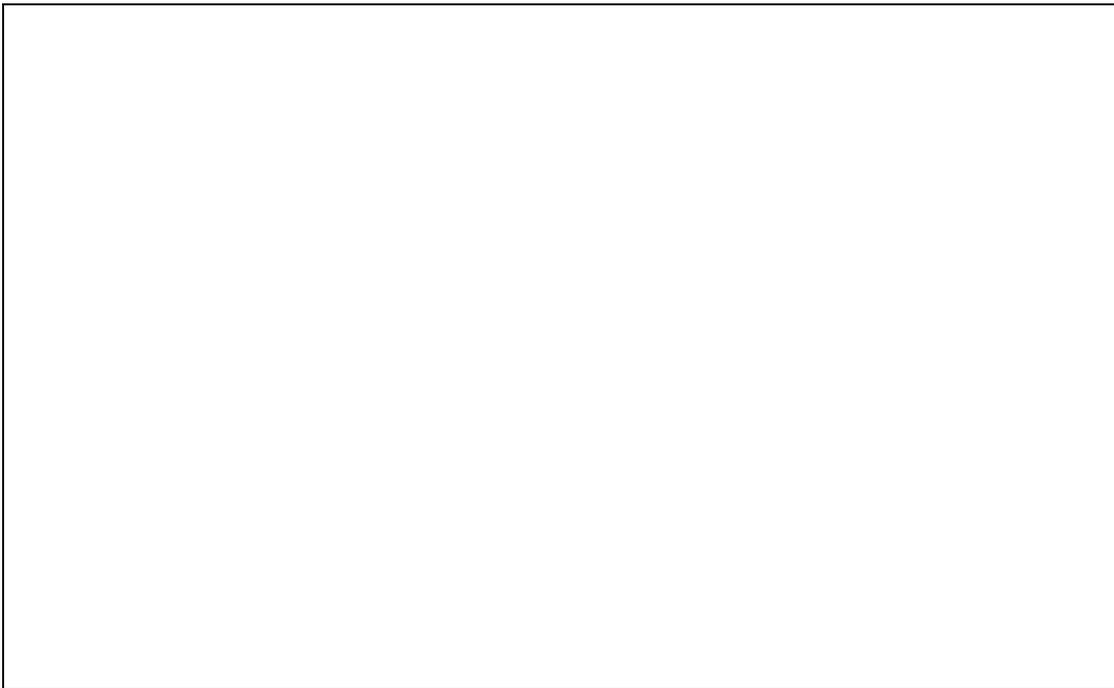
3. Coastal and marine pollution concerns

What are the main concerns about coastal and marine pollution in Barbados? How are ecosystems and resources being impacted, and what should be done to address this?



4. Additional comments

Any additional comments and/or suggestions to be considered in the Marine Pollution Management Strategy for Barbados?



Thank you very much for your participation.