TROPICAL AMERICAS CLEAN OCEAN CO-DESIGN WORKSHOP "THE YEAR 2031, A CLEAN OCEAN - STEPS TO SUCCESS"

Snapshot of Marine Pollution in the Western Tropical Atlantic Region

By Darryl Banjoo

RAC LBS -IMA

United Nations Educational, Scientific and Cultural Organization · Intergovernmental Oceanographic Commission · 2021 2030 United Nations Decade of Ocean Science for Sustainable Development · IOCARIBE

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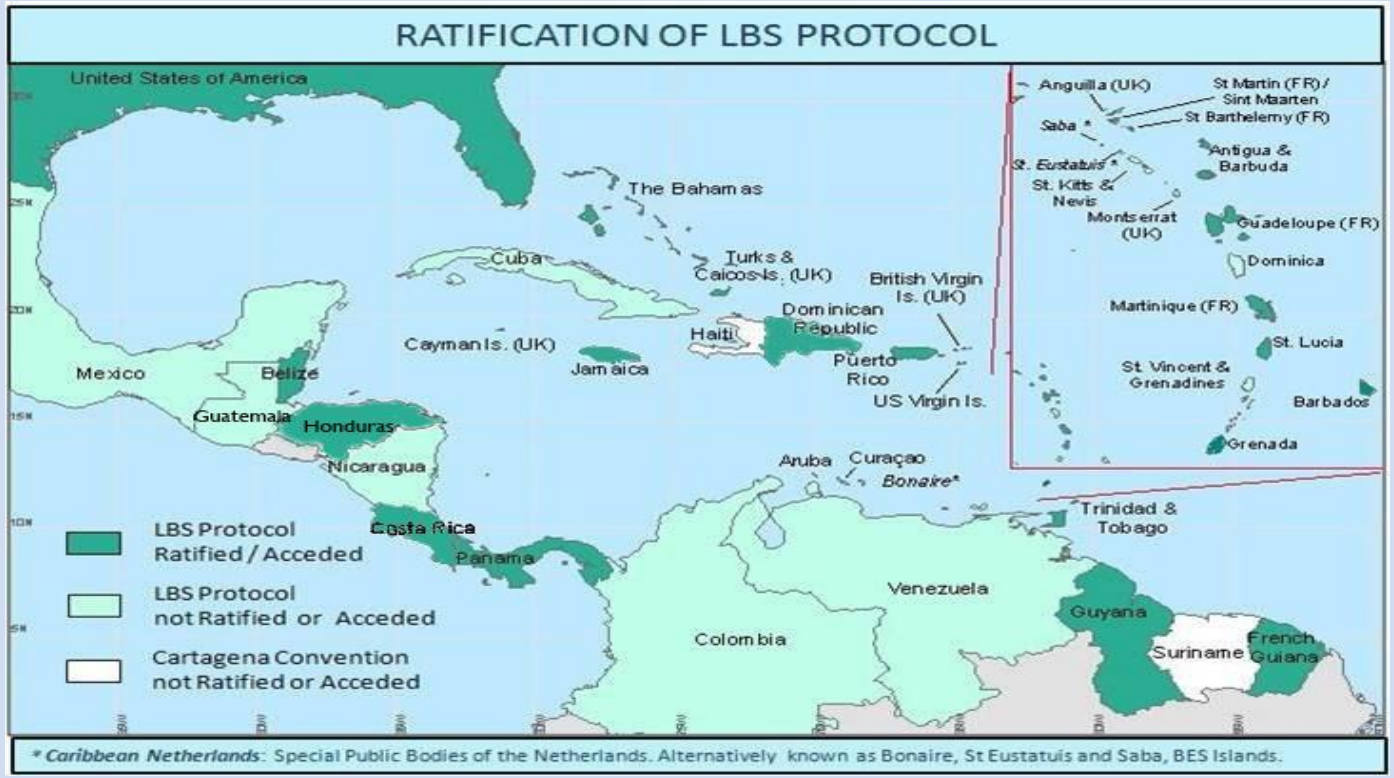
Economic Activities and Environmental Concerns WTA Region

Major Economic Activities	Environmental concerns
Population supports 100 million who live near the coast.	Excessive pollution loads, untreated wastes from agricultural, industrial domestic sources leading to environmental degradation.
Tourism (18% GDP). For 2004-2013, the Caribbean Sea Large Marine Ecosystem generated annual revenues of US$90 billion.	
High social and ecological value **environmental resources beaches, coral reefs, mangroves and sea grass beds.** Benefits from **regional coral reefs** are approximately US$391 million from **fisheries**, US$720 million from **coastal protection**, US$663 million from **tourism and recreation** and US$79 million **from biodiversity value** (Schumann, 2011).	Eutrophication, hypoxia, anoxia and dead zones in ocean. Harmful algal blooms. Pathogens affecting human health.
Latin American and Caribbean countries contribute 14% of the **global food production**, and 23% **of agricultural and fish exports**.	Invasive alien species (IAS) threatens biological diversity.
Shipping, which represents about 76% of the **Caribbean Ocean Economy**. The global container shipping volume passed through the Panama Canal represents 8% and generated an estimated US$53 billion (Rodrigue and Ashar, 2015).	Under water noise pollution Release of toxicants, hydrocarbons, heavy metal.
Petroleum and extractive industry, growing near-shore and offshore	Increasing treats with Climate Change

Western Tropical Atlantic Region

Region extends from Bermuda, southern Florida, and the southern Gulf of Mexico through the Caribbean and along South America's Atlantic coast to Brazil's Rio de Janeiro state.



Cartagena Convention - A total of 26 United Nations Member States in the Wider Caribbean Region have ratified the Convention. The Cartagena Convention **is the only legally binding, regional agreement for the protection and development of the Wider Caribbean Region**. The Assessment & Management of Environmental Pollution (AMEP) Sub-programme of the Caribbean Environment Programme (CEP) provides regional co-ordination for the implementation of the LBS Protocol.

Countries, Associated States and Territories of **the Western Tropical Atlantic**: Antigua and Barbuda, Aruba, Bahamas, Barbados, Belize, Bermuda, Brazil, Colombia, Costa Rica, Cuba, Curacao, Dominica, Dominican Republic, France, Grenada, Guatemala, Guyana, Haiti, Honduras, Jamaica, Mexico, Netherland, Nicaragua, Panama, Saint Kitts and Nevis, St. Lucia, St. Maarten, St. Vincent and the Grenadines, Surinam, Trinidad and Tobago, United Kingdom, United States of America, Venezuela. Puerto Rico (United States of America), Anguilla (United Kingdom), British Virgin Islands (United Kingdom),Cayman Islands (United Kingdom), French Guiana (France), Guadeloupe (France),Montserrat (United Kingdom), Martinique (France), Bonaire, Saint Eustatius, Saba (Special Municipalities of the Netherlands), Saint Barthelemy (France),Saint Martin (France), Turks and Caicos (United Kingdom), United States Virgin Islands (United States of America). https://cbei.blog/regional-workshop-western-tropical-atlantic-un-decade-of-ocean-science-for-sustainable-development/

Landmark Documents in Pollution Assessment of WCR

1. CEP Technical Report # 33 (1994, USEPA) -Regional Overview of Land-based Sources of Pollution in the Wider Caribbean Region.
2. CEP Technical report No. 52 (2011,RAC -CUBA). Update of the domestic and industrial pollutant loads discharged in the WCR.
3. UNEP CEP, 2019. State of the Convention Area Report (SOCAR).
4. Wider Caribbean Regional Nutrient Pollution Reduction Strategy and Action Plan (WCR-RNPRSAP, 2021).

1. **CEP Technical Report # 33 (1994, USEPA) -Regional Overview of Land-Based Sources of Pollution in the Wider Caribbean Region (WCR).**

- Greatest treats from **sewage, oil hydrocarbons, sediments, nutrients, pesticides, litter and marine debris and toxic wastes.**
- Very little information from countries. Based on reports and information from countries in the 1980's (indirect measurements).
- Inadequate number of sewage treatment plants in operation
- 10% of the sewage generated in the Central American and Caribbean island countries were properly treated.
- only 25% of the treatment plants operated by hotels and resort complexes were in good operating condition.
- increasing traffic of ships and recreational vessels, Annex IV of MARPOL 73/78 not in force. Lack of holding tanks and reception facilities for sewage.

2. CEP Technical report No. 52 (2011,RAC -CUBA). Update of the domestic and industrial pollutant loads discharged in the WCR.

- **Sediment loading is the main pollutant** contribution from watersheds in the WCR.
- **Highest runoff discharge rates** and **average annual loads** of **TSS**, **TP, TN** and **industrial loads** drain from **sub-region I** (Gulf of Mexico).

Domestic pollutant loads

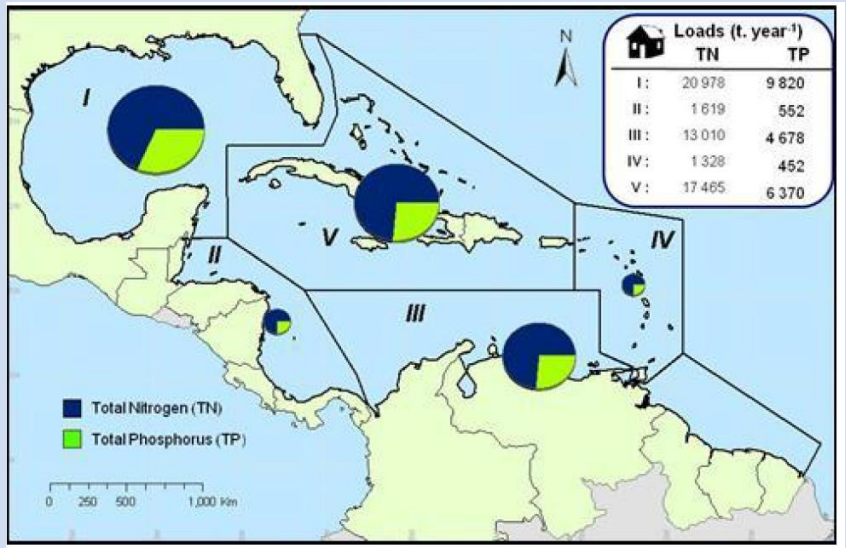


Figure 6. Nutrients inflow (TN and TP) of domestic origin by sub-region in WCR (t.yr^{-1}).

Industrial pollutant loads.

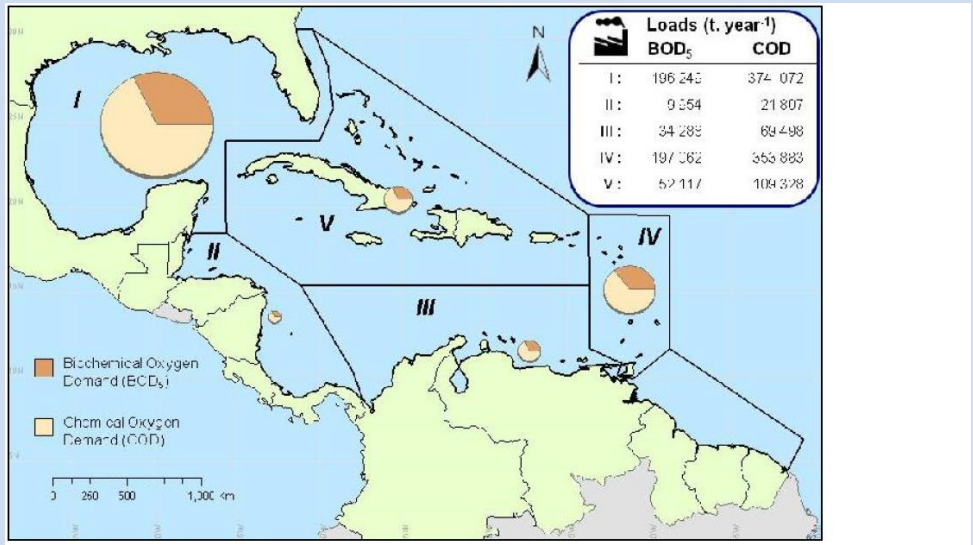


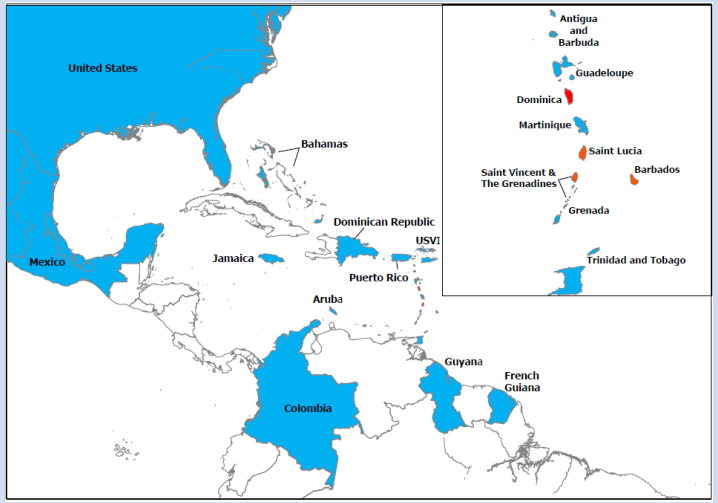
Figure 11. Organic matter (BOD_5 and COD) inflow of industrial origin by sub-region in WCR (t.yr^{-1})

3. UNEP CEP, 2019. State of the Convention Area Report (SOCAR).

- First State of the Convention Area Report (SOCAR) on land-based pollution (Data 2010-2015). To provide a quantitative baseline for monitoring and assessment of the state of the marine environment.
- **Untreated domestic wastewater/sewage and nutrient loads** are the **major anthropogenic pressures** from land-based sources and activities.
- An estimated **15 x 10^9 cubic meters of domestic** municipal wastewater was generated in the Wider Caribbean Region in 2015.
- Only **37%** reached treatment plants.
- **63%** presumably discharged in **untreated** form.

- Eight water quality indicators
  - dissolved inorganic nitrogen (DIN)
  - dissolved inorganic phosphorus (DIP)
  - chlorophyll-a
  - dissolved oxygen and pH
  - *Escherichia coli* and *Enterococcus* species

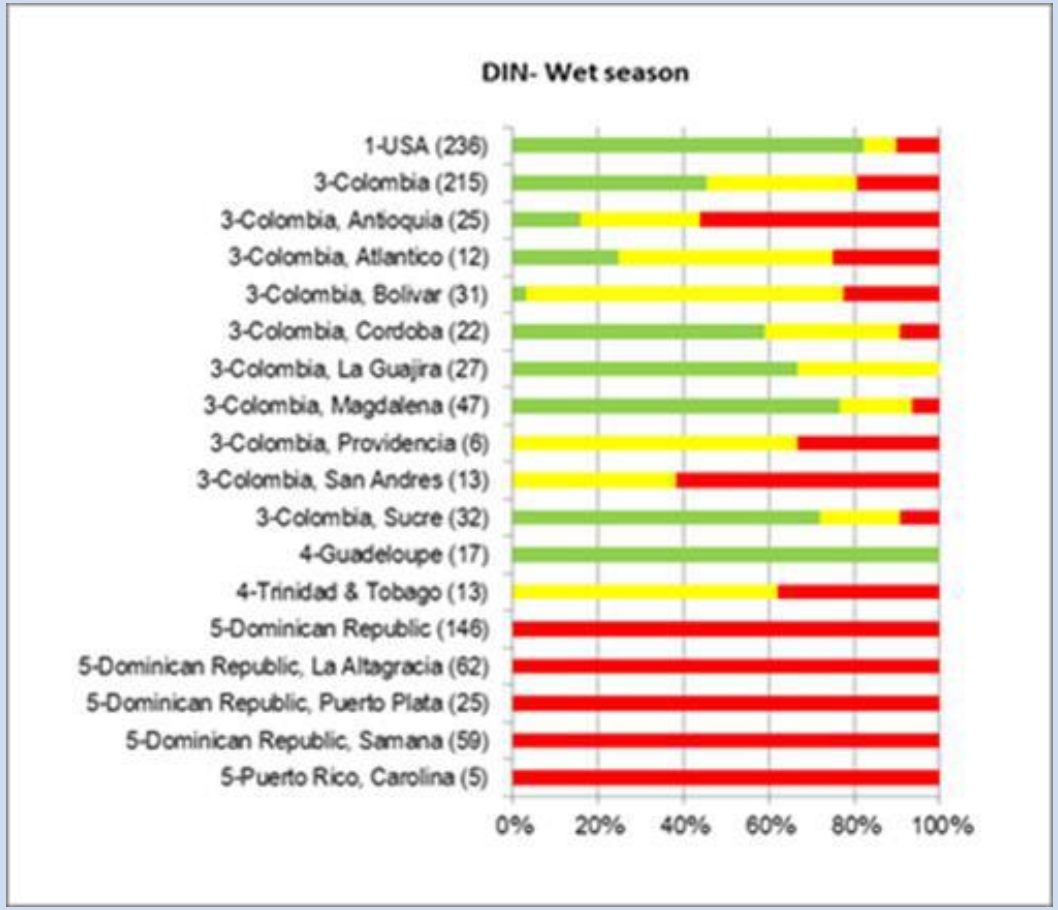
Countries submitting data indicated in blue



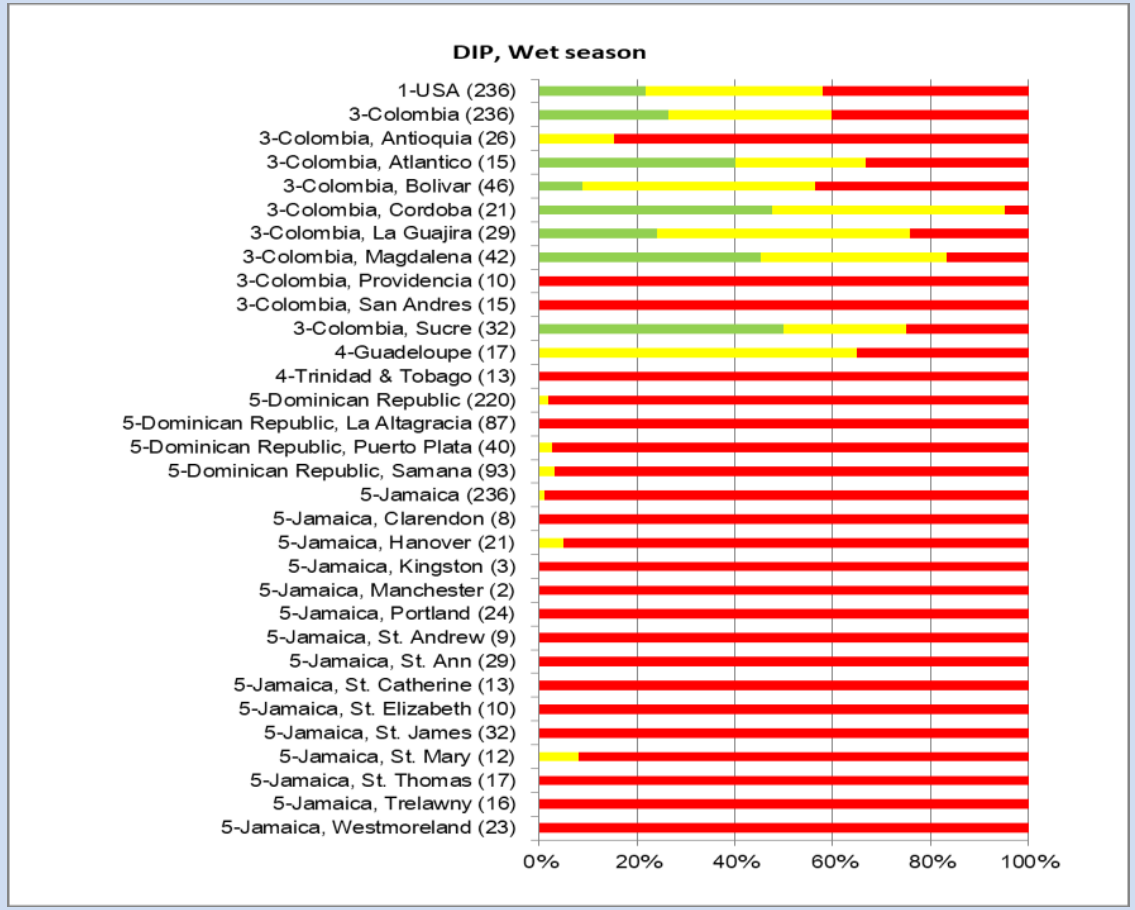
Lead author: Sherry Heileman (Consultant)
Contributing lead author: Liana Talaue-McManus (Consultant)

UNEP CEP, 2019. State of the Convention Area Report (SOCAR).

Proportion of sites showing good, fair and poor water quality



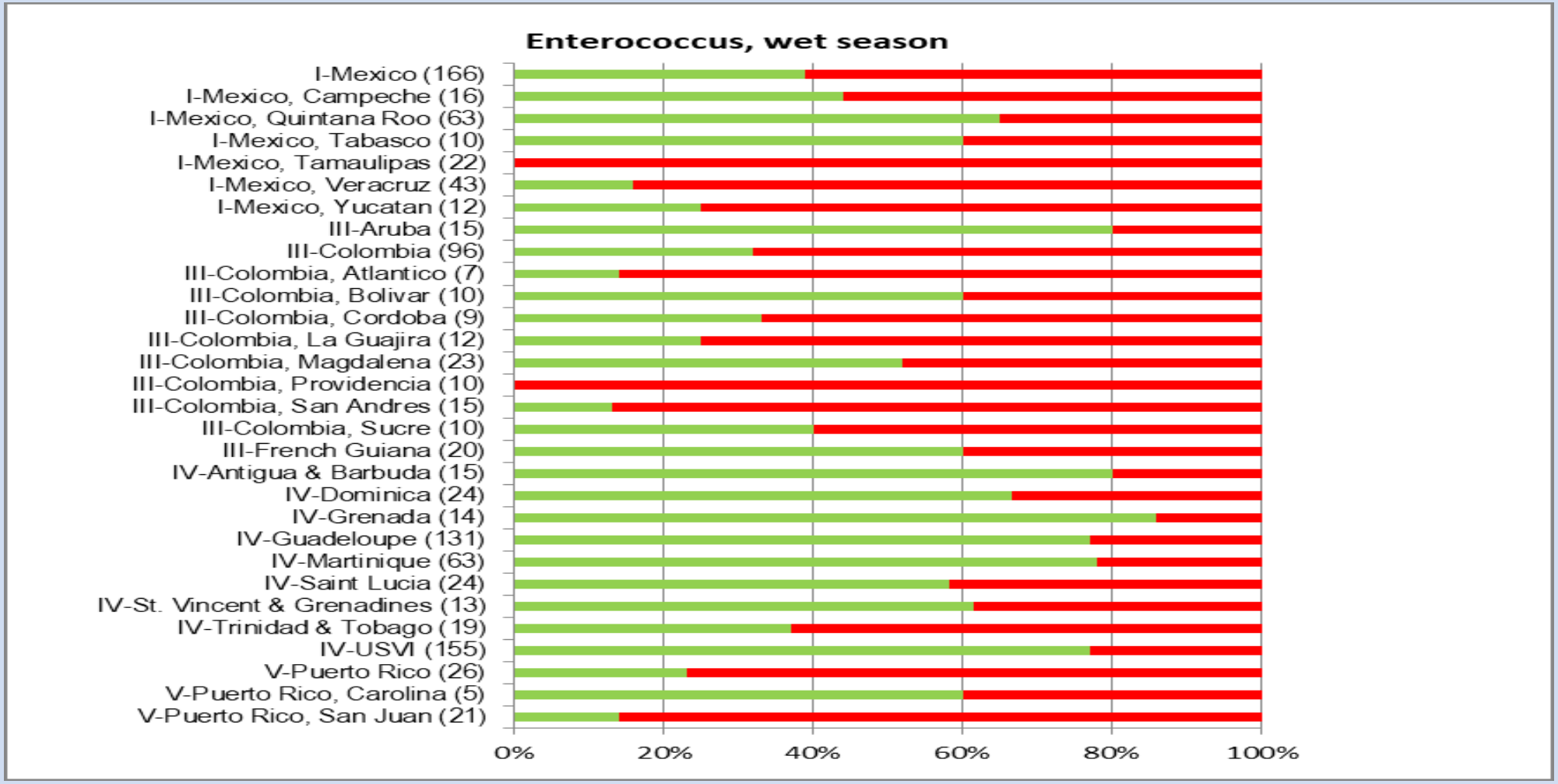
Dissolved inorganic nitrogen (DIN)



Dissolved inorganic phosphorus (DIP)

UNEP CEP, 2019. State of the Convention Area Report (SOCAR).

Proportion of sites showing good and poor water quality

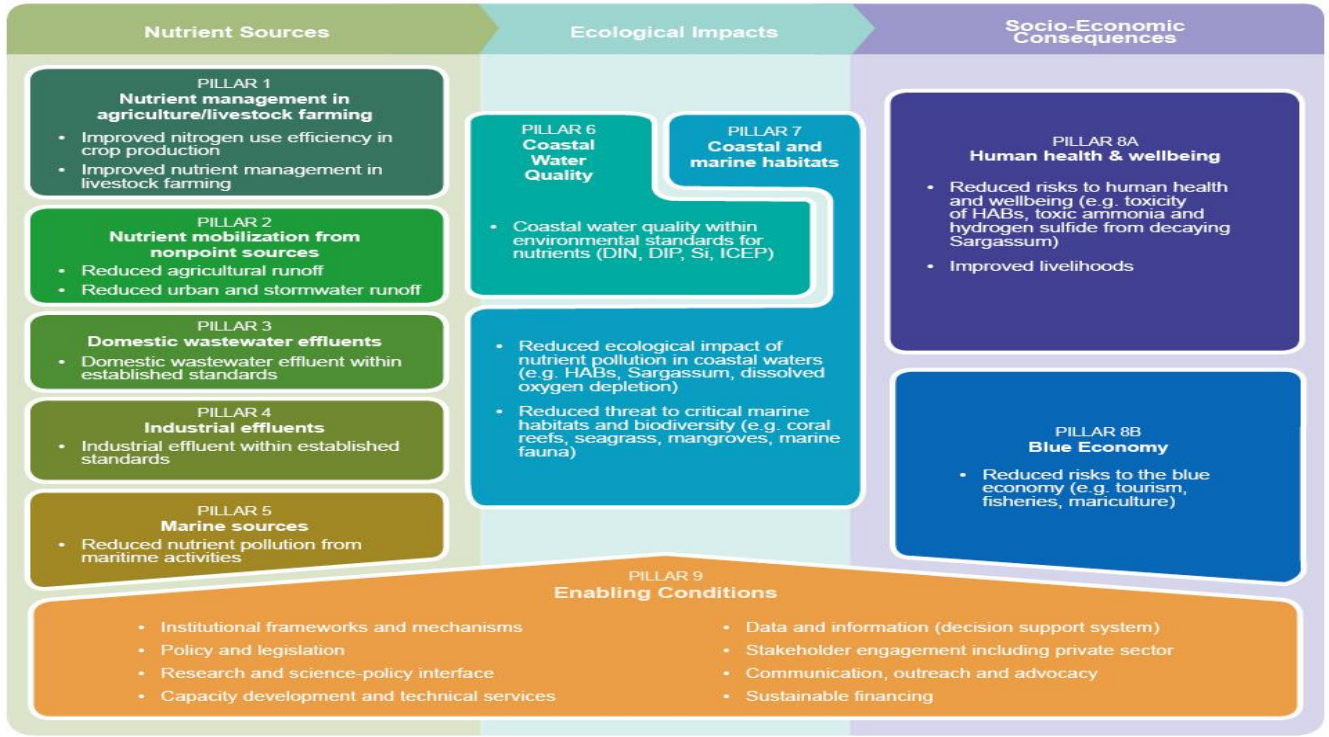


Enterococcus bacteria

4. UNEP CEP, 2021. Wider Caribbean Regional Nutrient Pollution Reduction Strategy and Action Plan (WCR-RNPRSAP).

Goal: To establish a **collaborative framework** for the **progressive reduction of impacts** from **excess nutrient loads on priority coastal and marine ecosystems** in the WCR.

Strategy was adopted by the 5th LBS Conference of Parties on 26th June 2021.



Major pollution sources

- Agriculture/Food Crop, Livestock Farming.
- Non-point sources, Agriculture, Urban.
- Domestic wastewater
- Industrial effluents.
- Marine sources.

Institutional Frame-work, Policy and Legislation, Research Science Policy Interface, Controlling Pollution at Source, Meeting Discharge Standards and Criteria..

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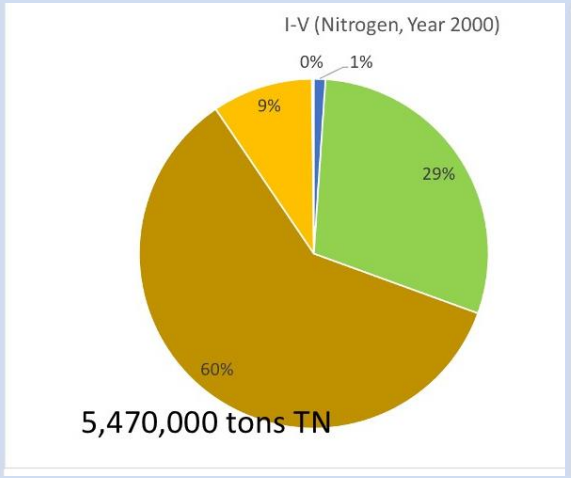
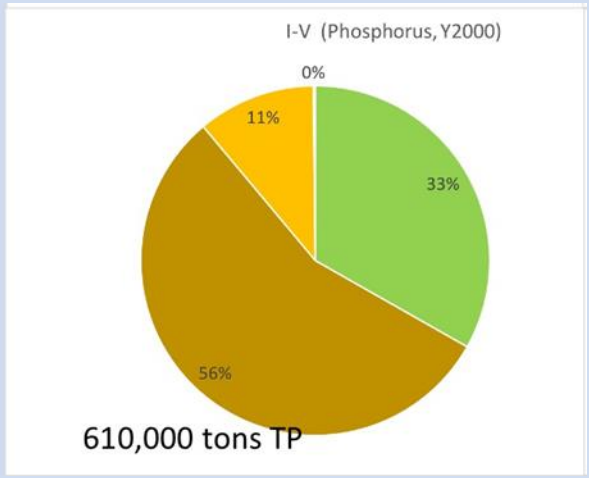
Sources of Nitrogen and Phosphorus (Beusen 2016, Model Year 2000)

WCR

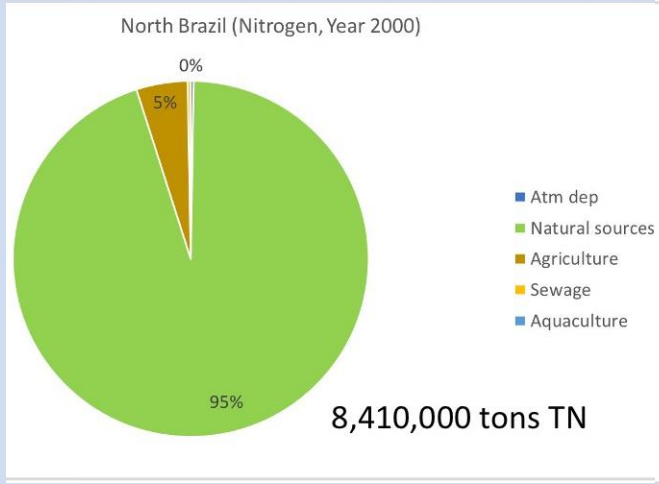


5,470,000 tons TN

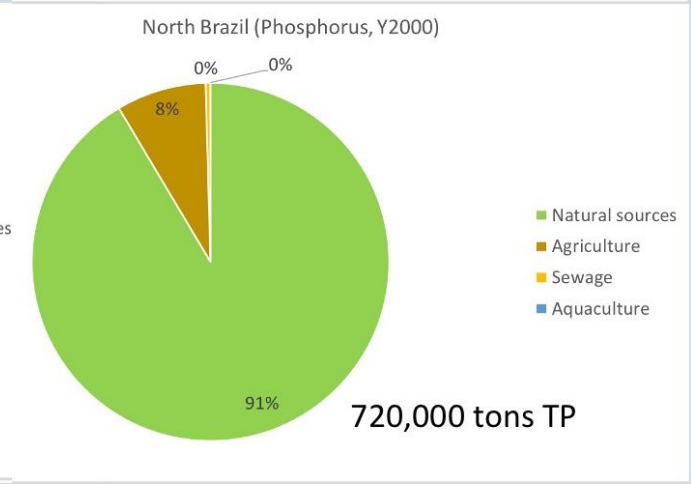


610,000 tons TP

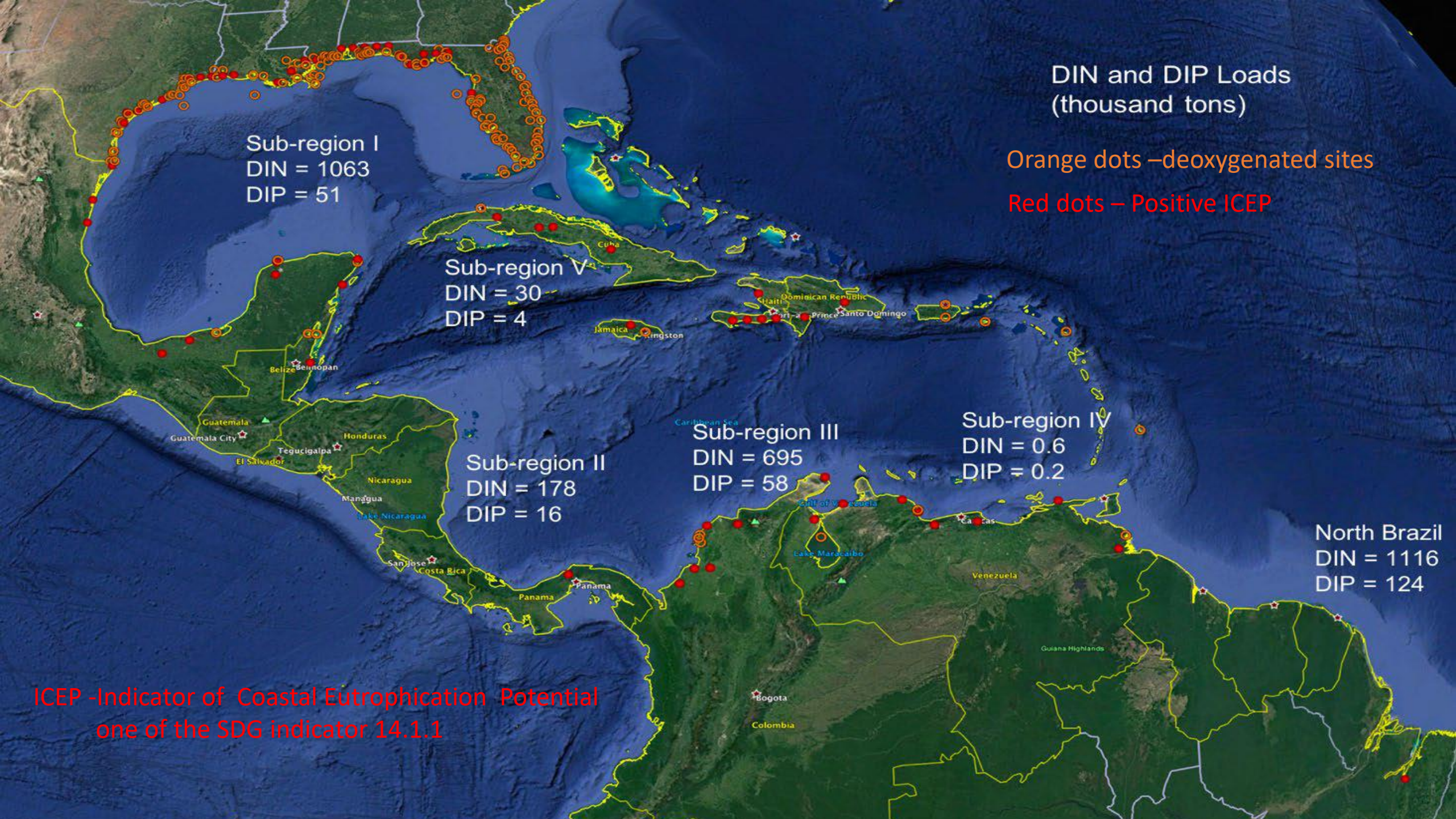
North Brazil shelf



8,410,000 tons TN



720,000 tons TP


DIN and DIP Loads
(thousand tons)
Orange dots –deoxygenated sites
Red dots – Positive ICEP
Sub-region I
DIN = 1063
DIP = 51
Sub-region V
DIN = 30
DIP = 4
Sub-region II
DIN = 178
DIP = 16
Sub-region III
DIN = 695
DIP = 58
Sub-region IV
DIN = 0.6
DIP = 0.2
North Brazil
DIN = 1116
DIP = 124
ICEP -Indicator of Coastal Eutrophication Potential
one of the SDG indicator 14.1.1
Cuba
Haiti
Dominican Republic
Santo Domingo
Jamaica
Kingston
Belize
Belmopan
Guatemala
Guatemala City
Honduras
Tegucigalpa
El Salvador
Nicaragua
Managua
Lake Nicaragua
San Jose
Costa Rica
Panama
Caribbean Sea
Gulf of Venezuela
Caracas
Lake Maracaibo
Venezuela
Guiana Highlands
Bogota
Colombia

Marine Based sources of nutrient pollution:

(Honey, 2016)

Type of visitor	Total number of visitors	Percentage of total visitors	Avg. length of stay (days)	Average daily expenditure (US$)	Total expenditure (US$ millions)	Contribution toward overall tourism revenue
Yachting	29,114	5.2%	10.8	42.71	13.43	4.5%
Stay-Over	207,662	36.8%	7.8	169.67	274.83	92.4%
Cruise Ship	328,038	58.1%	1.0	27.95	9.17	3.1%
Total	564,814	100%	4.0	240.59	297.43	100%

Year 2020 Report Card for 18 Cruise Lines

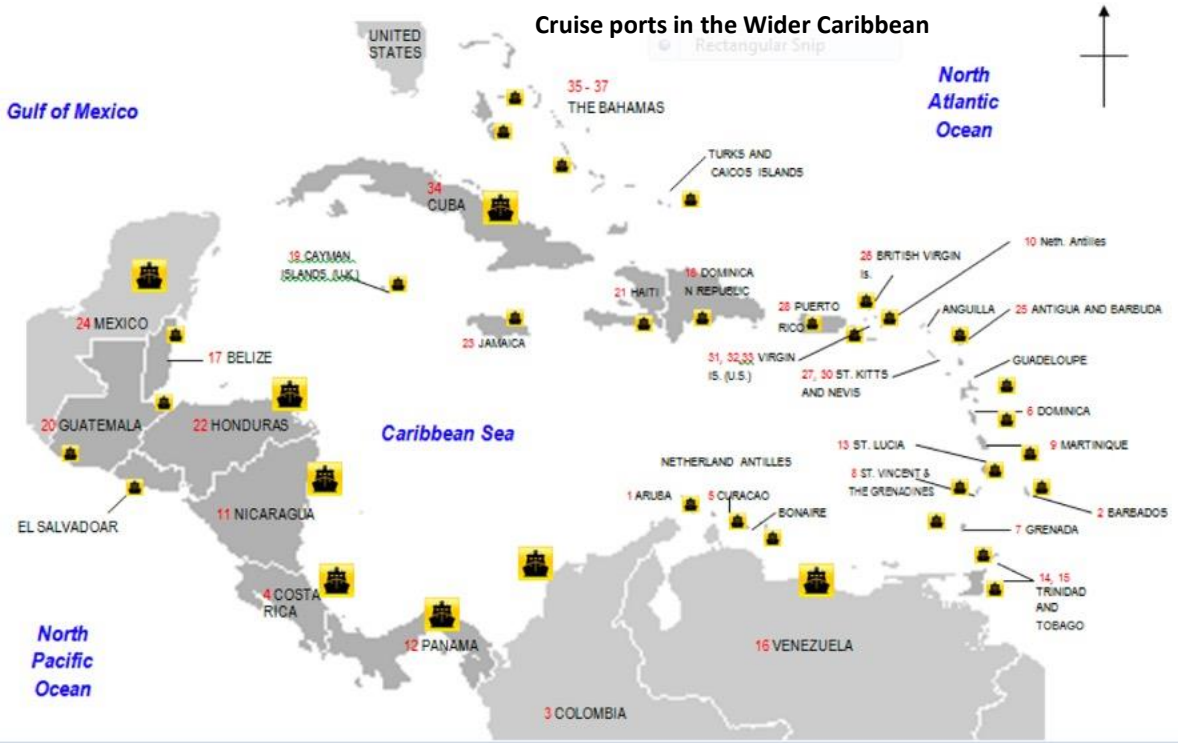
Criminal Violations: All Carnival Corporation companies committed criminal environmental violations from 2017 - 2020.

CRUISE LINE	Sewage treatment	Air pollution reduction	Water quality compliance	Transparency	Criminal Violations	2020 FINAL GRADE
Disney	C	A-	A	A		~~A-~~ B-
Silversea	D-	F	A	A		C
Celebrity	C	F	F	A		D+
Royal Caribbean	C-	F	F	A		D
Virgin Voyages	C	F	F	A		D
Regent Seven Seas	C	F	A	F		D
Princess	C-	C	D+	F	✓	~~D~~ F
Norwegian	C	D-	F	F		D-
Oceania	D	F	C+	F		D-
Seabourn Cruises	C	F	D-	F	✓	~~D~~ F
Holland America	C	F	F	F	✓	~~D~~ F
Cunard	C	F	F	F	✓	~~D~~ F
AIDA Cruises	C-	F	F	F	✓	F
P&O Cruises	D-	F	F	F	✓	F
Carnival Cruise Line	F	D	F	F	✓	F
MSC Cruises	D-	F	F	F		F
Costa	F	F	F	F	✓	F
Crystal	F	F	N/A	F		F

Royal Caribbean Group - Carnival Corporation - Norwegian Cruise Line Holdings -

(Friends of the Earth)

Cruise ports in the Wider Caribbean

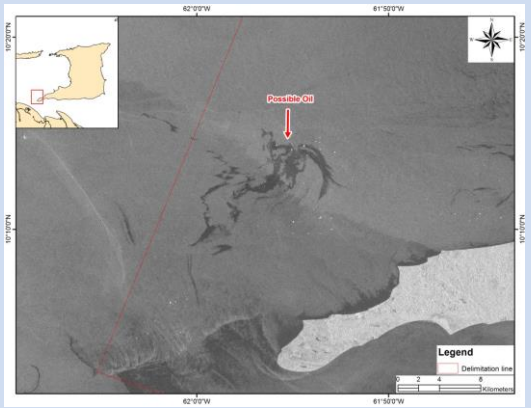


Oil Hydrocarbons and Spill Monitoring

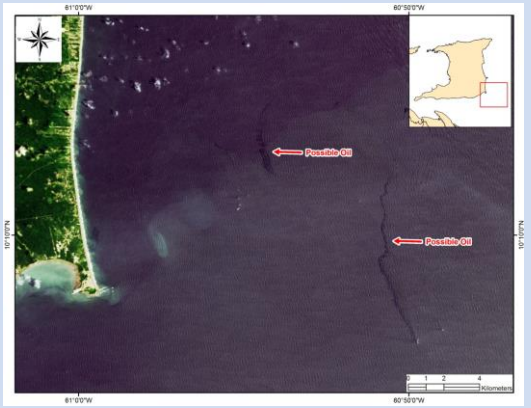
- Majors spills in regions, 2019-Brazillian coast, 2021,2017 and 2014- Trinidad.
- Oil and gas activity, exploration, oil pipeline transport, accidental releases, storage and bunkering activity, natural seeps.
- Waste oil discharges, shipping, yachting sector, poor waste oil management, collection and disposal.
- Oil spill clean-up and disposal, use of dispersants.
- 2021, Training facilitated by IOCaribe, a pilot program for T&T was organised. Training conducted by NOAA Satellite Analysis Branch on a variety of satellite platforms.
- **Need for Early warning and detection for entire Caribbean region.**

Oil Refinery and Tanker terminal

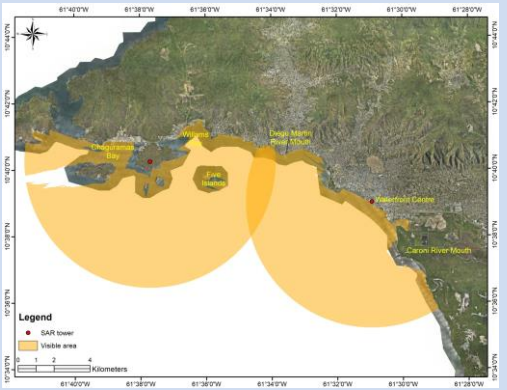
Sentile 1 SAR imagery



Landsat8 optical imagery



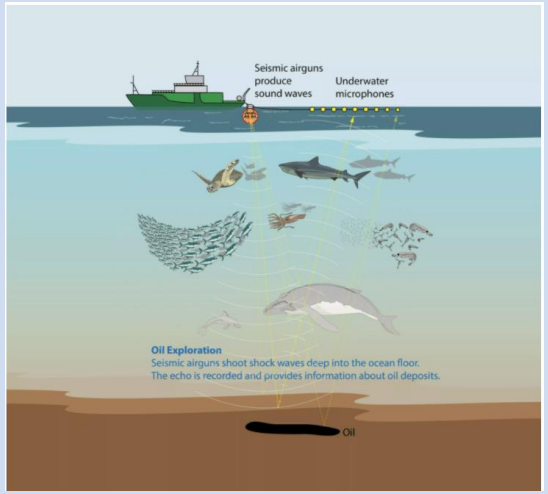
Synthetic Aperture Radar (SAR) Tower mounted



Ocean Noise

-Seismic activity from oil and gas activity
-Military sonar
-Shipping and Ocean transport

-Internal injuries and standing of marine mammals
-Affects habitat of marine organisms, reduce populations
-Reduced fish catches linked with seismic activity.



Scientific Gaps and Future Studies Required

Spatial and temporal links between some mass strandings of cetaceans — predominantly beaked whales — and the deployment of military sonar.
A military sonar experiment conducted in the Bahamas by the US Navy in 2000 was linked with17 beached whales that were all bleeding from their eyes and ears, 7 of which were already dead upon arrival.

Jepson, P., Arbelo, M., Deaville, R. *et al.* Gas-bubble lesions in stranded cetaceans. *Nature* **425,** 575–576 (2003). https://doi.org/10.1038/425575a

https://www.oceancare.org/en/our-work/ocean-conservation/underwater-noise/underwater-noise-consequences/

Weilgart, L. (2013). “A review of the impacts of seismic airgun surveys on marine life.” Submitted to the CBD Expert Workshop on Underwater Noise and its Impacts on Marine and Coastal Biodiversity, 25-27 February 2014, London, UK. Available at: http://www.cbd.int/doc/?meeting=MCBEM-2014-01

Marine Litter and Plastics

Key Messages

-The **Wider Caribbean Sea** has one of **the highest plastic concentrations in the world ocean**, and this is expected to increase.

- Over **one million tons** of plastic were introduced to coastal waters of the WCR in 2015, mainly from land-based sources.

-Solid waste generation is expected to increase in the region as human populations continue to grow, in the absence of more sustainable production and consumption patterns and adequate solid waste management.

-Plastic pollution poses significant risks to public health and marine life as well as to economic sectors such as tourism, fisheries, and shipping.

UNEP CEP, 2019. State of the Convention Area Report (SOCAR)..

Persistent Organic Pollutants, Pesticides.

Generally limited regional assessments for costal and marine environments.

GEF REPCar Final Project Report “Improving the Management of Agricultural Pesticides in Colombia, Costa Rica and Nicaragua” Experiences of the GEF- Reducing Pesticide Run-off to the Caribbean Sea Project.
In 1999 the Mesoamerican Caribbean Basin (MCB) countries **imported** more than **14,600 metric tons** (active ingredients) of pesticides, and **produced** an additional **13,300 metric tons** that were applied to 21 crops on about 3 million hectares.

Pesticide Residues Monitoring component, Colombia, Costa Rica and Nicaragua established a baseline with information on pesticide residues in coastal areas for the 2008–2010 period.

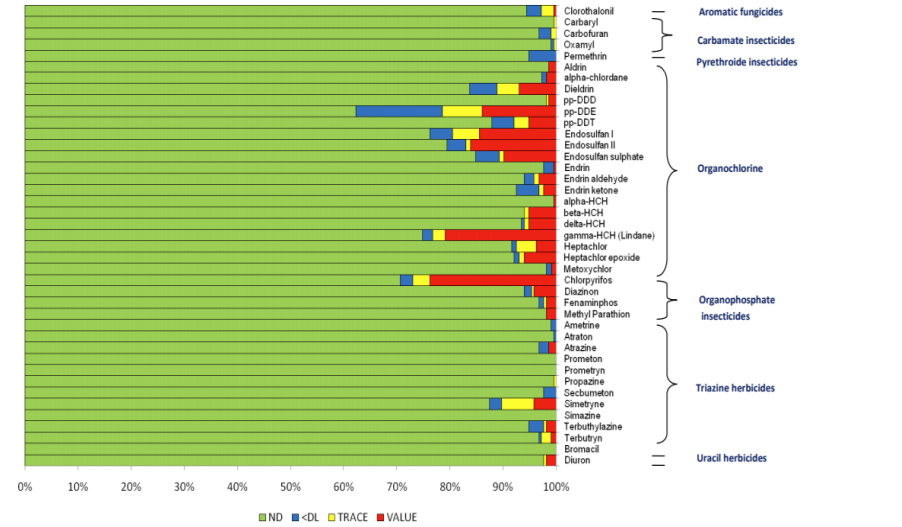


Figure 5. Distribution of analytical results according to detection level for pesticide compounds in sediment samples collected at all sampling stations in Colombia, Costa Rica and Nicaragua. Quantifiable levels (VALUE), not quantifiable above the limit of detection and less than the limit of quantification (TRACE), below the limit of detection (<LD), not detected (ND).

To identify and quantify the presence of traces of pesticides in the Caribbean coastal waters of Colombia, Costa Rica and Nicaragua, a coastal monitoring programme was developed and 7 sampling campaigns were scheduled for the 2008-2010 period with samples coming from 64 locations (Figure 2). The campaigns included the rainy and dry seasons.

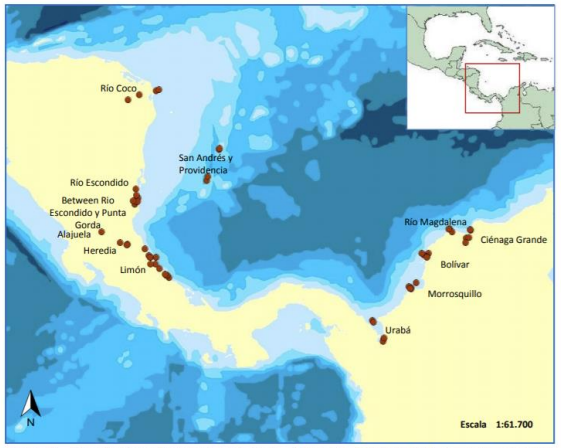


Figure 2. Distribution of sampling stations of the coastal monitoring programme for 2008-2010

The distribution of analytical results from water and sediment samples collected showed **largely non detects**.
Values reported were **low and below environmental criteria** to suggest concern.
DDTs found although these were banned in countries in 1980’s.

Persistent Toxic Substances

- GEF funded project Minamata Initial Assessments (MIAs) for **Mercury** coordinated by Basel Convention Regional Centre **(BCRC)** for Training and Technology Transfer for the Region.
- **MIA projects -Jamaica, Saint Kitts and Nevis, Saint Lucia and Trinidad and Tobago (completed 2018), Antigua and Barbuda, Dominica, Grenada, Saint Vincent and the Grenadines, Belize (ongoing),**
- Major source of **mercury** releases globally is due to the use of mercury in most **artisanal and small-scale gold mining processes**. In the Caribbean region, this occurs in countries like **Guyana and Suriname.**
- **60,000 kilograms of mercury imported into Guyana** (MIA, 2016 Country report).
- **Limited data is available for mercury in the marine environment.**
- Other sources of mercury dental laboratories and hospitals; fish canning; municipal waste; mercury lamps, batteries and electrical components (de la Cruz, 2002). Organic mercury compounds were imported by paint companies in Haiti (Carré, 2002).

- Limited data on **organotin** compounds in the marine environment, these compounds being used as **anti fouling agents in marine paints in Mariner, Boat yards.**

https://www.bcrc-caribbean.org/our-projects/mercury-management/#

UNEP Chemicals- Regionally Based Assessment of Persistent Toxic Substances. Central America and the Caribbean Regional Report. December 2002. Global Environment Facility.

Contaminants of Emerging Concern (CECs) Pharmaceuticals

- Synthetic or naturally occurring chemicals that are not commonly monitored in the environment but which have the potential to enter the environment and cause known or suspected adverse ecological and (or) human health effects (Geissen 2015).
- Chemicals found in a range of products (personal care products, pesticides, industrial and household products, flame retardants, plasticiers, microplastics, metals, surfactants, industrial additives, and solvents).
- Monitoring of CECs is **challenging since no established standardized analytical method may be available.** Uncertainties in the detection, identification, and quantification of EPs stem from low detection limits required and little or no knowledge on their transformation products when exposed to the environment.
- A study in Barbados, detected in **watersheds** artificial sweeteners (AS), acesulfame, cyclamate, saccharin, and sucralose, prescription pharmaceuticals and the steroid hormones, estrone and androstenedione and fungicide[1].
- **Need for further studies on marine environment and impact on ecosystem**.

Geissen, V. *et al* . (2015) Emerging pollutants in the environment: a challenge for water resource management. *Int. Soil Water Conserv. Res.* **3**, 57–65.
[1]Edwards et al. (2017). Contaminants of emerging concern in surface waters in Barbados, West Indies. Environ Monit Assess, 2017 14;189(12):636. doi: 10.1007/s10661-017-6341-4.

Thank You very much for you attention

http://www.ima.gov.tt/home/

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