

# 15 Caribbean Sea

## Overview

The Caribbean Sea is a semi-enclosed sea located in the Western Hemisphere between North and South America, and which is bounded by Central America to the west. It is noted for its many islands in the Eastern side, including Cuba, the Leeward and Windward Islands, Puerto Rico, Haiti, and the Commonwealth of Dominica. Many other islands such as Jamaica and the Cayman Islands are also located within the gulf.<sup>1</sup>

## Location

### Basic information<sup>10</sup>

Surface area : 2,718,200 km<sup>2</sup>

Volume : 7,195,075 km<sup>3</sup>

Average depth : 2,647 m

Maximum depth : 7,686 m

## Nature

### < Background >

The Caribbean Sea is the second largest sea in the world after the Mediterranean Sea, covering an area of 2,718,200 km<sup>2</sup>, and comprising some of the territorial waters and coastal areas of 35 bordering countries and territories.<sup>1,2,10</sup> Some of these nations have large populations and industries, while others are sparsely populated. At present, the responsibility for the region's marine resources is divided between these 35 nations.

There are numerous banks and breaking shoals in the Caribbean Sea. It is also comprised of four deep basins - the Venezuelan Basin in the east, the Colombian Basin in the west, the Cayman Trough and the Yucatan Basin in the northwest.

### Climate

Generally the area has a wet tropical climate with wet and dry seasons and a hurricane season from June to November. However, local climate depends on local variations in mountain altitude, water currents and trade winds. The Caribbean region is also influenced by the multi-year cycle El Niño/Southern Oscillation (ENSO), that causes variations in surface temperatures and salinity, due to the changes in rainfall patterns on the South American continent.<sup>1</sup> Average temperature of the waters in the region is 27 °C with a variance less than 3 °C.<sup>2</sup>

### Topography

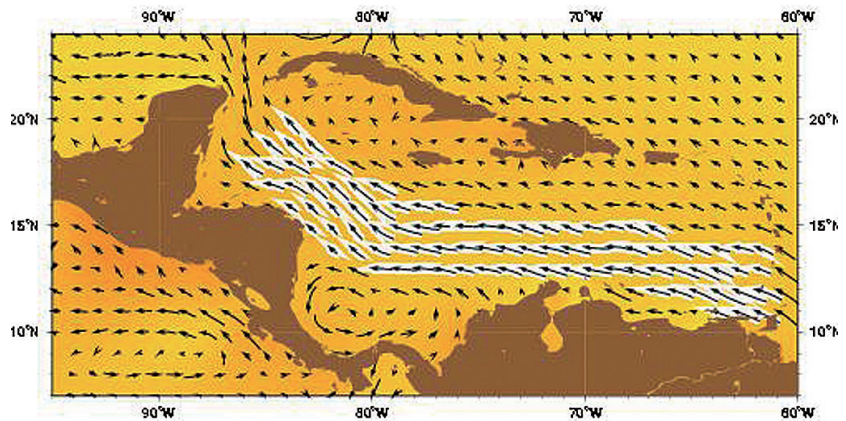
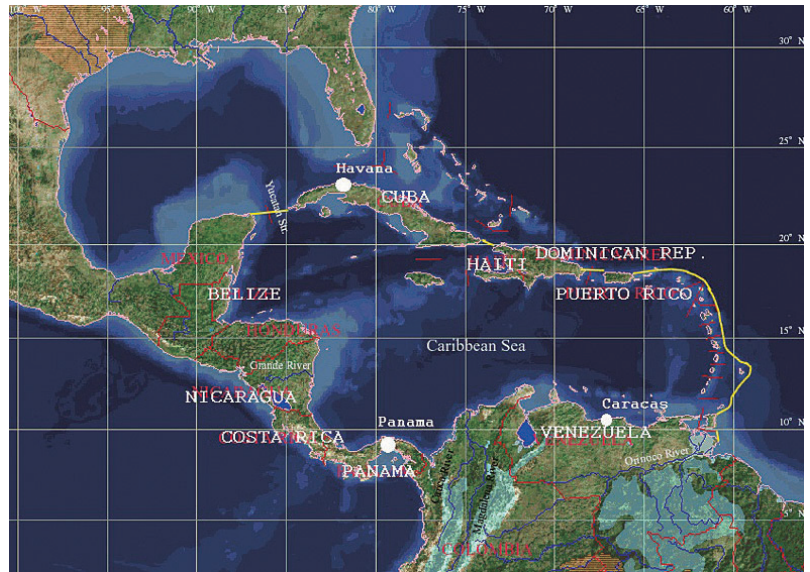
Overall, the Sea is largely enclosed by the landmasses of South and Central America and the Greater Antilles, with narrow passages between the Lesser and Greater Antilles connected with the Atlantic Ocean. Two deep troughs - the Cayman Trough and Puerto Rico Trench- exist. Coasts in areas adjacent to major stable plates are generally flat, while coasts next to mountain ranges have a wider range of elevation between steep cliffs and deep bays.<sup>1</sup>

Volcanic activity and earthquakes are common in the Caribbean, as are destructive hurricanes that originate over the sea or in the Atlantic.<sup>1</sup>

### Hydrology

In the Caribbean Sea part of the South Equatorial Current enters the Sea through the Lesser Antilles, is warmed and flows toward the east, exiting via the Yucatan Channel into the Gulf of Mexico.

Water quality and ecology of the Caribbean Sea is greatly affected by the large volume of fresh water and sediments that inflow from the Amazon, Orinco, and Magdalena river basins. Fresh water from the Amazon and Orinoco create large plumes of buoyant fresh water in the Eastern Caribbean, and from the Magdalena in the Western part of the sea.<sup>1</sup>



The Caribbean current as represented by the Mariano Global Surface Velocity Analysis<sup>1</sup>

## < Surrounding environment >

### Habitat

The Caribbean coastal zone contains many productive and biologically complex ecosystems. Nearshore marine habitats include coral reefs, seagrass beds, mangroves, coastal lagoons, and beaches.

Coral reefs are among the most important coastal resources in the Caribbean, and are also among the most productive. 7% of the world's coral reefs exist in this location, providing multiple ecosystem services such as food, shoreline protection, recreational value, and medicinal products.<sup>1</sup>

The Caribbean Sea ecosystem is showing signs of stress, particularly in the shallow waters containing coral reef systems. Much of the reef has already been greatly degraded, due to a combination of hurricane damage, disease, bleaching, pollution, coastal development and agriculture, overfishing, etc.

### Biota

The Caribbean region contains a rich variety of complex ecosystems with a great abundance of plant and animal species, some of them endemic to the region. Half of the plant species are endemic to the area. As of 2008, 1,697 species fall under the threatened category in the region.<sup>3</sup>

The Caribbean region contains diverse and productive coastal and marine habitats. The region represents the greatest concentration of biodiversity in the Atlantic Ocean Basin. Because the nations in this region depend heavily on the health and beauty of the natural world to generate income, the conservation of the region's biodiversity is not only linked to social, cultural and political conditions, but also to the economic realities of the region. Coral reefs, seagrass beds and mangroves are among the best known marine and coastal ecosystems in the Caribbean region, and are large contributors to the biodiversity of the region. The Caribbean islands as a whole have been classified as a biodiversity hot spot.<sup>1</sup>



Caribbean reef shark (endangered species)<sup>9</sup>

## History and Culture

### < History >

The Caribbean Sea got its name from the original inhabitants of the Caribbean - the Carib people. These indigenous Indians inhabited the region at the time of arrival of the first Spanish explorers.

After the Caribbean was visited by Christopher Columbus in 1493, Spain claimed the area, and its ships searched for treasure. With the Spanish discovery of the Pacific Ocean in 1513, the Caribbean became the main route of their expeditions and, later, of convoys. Pirates and warships of rival powers preyed on Spanish ships in the Caribbean. Although Spain controlled most of the sea, Britain, France, the Netherlands and Denmark established colonies on the islands along the eastern fringe. The 1800s brought United States ships into the Caribbean, especially after 1848, when many gold-seekers crossed the sea to reach California via Panama.<sup>4</sup>

After unsuccessful French attempts in the late 1800s to build a canal across Panama, the U.S. assumed control of the project in 1903. The 1914 opening of the Panama Canal paved the way for increased U.S. interest and involvement in this strategic sea, sometimes called the 'American Mediterranean'. Several Caribbean islands have U.S. military bases, many of which were established during World War II as support bases to protect the Panama Canal. The naval base at Guantanamo Bay, Cuba (est. 1899) is the oldest U.S. Caribbean base.<sup>4</sup>

U.S. policy since the Monroe Doctrine of 1823 has been to exclude foreign powers from the Caribbean. However, in 1959, Cuba became the first country to come under strong Soviet influence. U.S. intervention in the affairs of Caribbean countries, such as the Cuban missile crisis of 1962, the landing of U.S. marines at Santo Domingo in 1965 and at Grenada in 1983, and the U.S. invasion of Panama in 1989, reflects the region's importance to the United States.<sup>4</sup>

## Social Environment

### < Population >

The total population of the Caribbean Region was approximately 43.1 million in 2015, an overall increase of about 4.7 million since 2000. Annual population growth rate in the region was 0.88 during 2000-2005, and decreased to 0.70 in the past five years. Urban population also increased to make up 76% of the total population, with some nations such as Anguilla and Puerto Rico having more than 90% inhabiting urban areas. Among the most populated Caribbean countries are Cuba, the Dominican Republic and Haiti, whilst those with the smallest populations include Anguilla, Montserrat and the Caribbean Netherlands (the islands of Bonaire, Sint Eustatius, and Saba).<sup>5</sup>

### < Land use >

In the Caribbean, land used for arable or permanent crops amounts to about 7.1 million ha total. Forest cover has steadily increased from about 5.35 million ha in 1990 to 6.08 million ha in 2007. Most of the island nations have preserved or restored their forests most likely because of their economic value directly linked to ecotourism, as well as the countries' low population pressures. Agricultural land is being converted to urban areas, while marginal-soil areas are being converted to farming land to increase food supply sufficiency in some countries.<sup>5</sup>

### < Industry >

According to the Caribbean Development Bank, the region's economy continued its recovery in 2014, with 16 out of its 19 members experiencing growth, driven mainly by tourism and construction services. Much

of the increase in construction activity was due to the private sector, relating to tourism and other commercial development.<sup>6</sup>

Tourism is one of the principal industries in the wider Caribbean region. In 2013, an estimated 25.1 million tourists visited, which was only a slight increase from the 24.5 million in 2012. Visitors spent a total of about 28.1 billion US Dollars per year. Cruise activity is also a large part of the tourism industry, and the Caribbean is the leading cruise destination globally, accounting for 45.3% of global ship deployments.<sup>7</sup>

Trinidad and Tobago accounts for over 60% of the region's manufacturing industry. An increase in non-petroleum products occurred due to economic recovery in the region. Haiti and Guyana experienced growth in their manufacturing sectors due to expansion in apparel exports and sugar production, respectively.<sup>6</sup>

For agriculture, Jamaica accounts for over a quarter, Haiti nearly a third, and Guyana over a tenth of the regional production. Guyana's rice and sugarcane output increased, while Haiti's decreased moderately due to impacts from drought in 2014.<sup>6</sup>

Mining and quarrying output slowed down among the main producing countries such as petroleum extraction in Belize, Suriname and Trinidad and Tobago. Lower commodity prices globally led to the decrease in bauxite production in Guyana and Suriname and alumina in Jamaica.<sup>6</sup>



The Caribbean Sea Large Marine Ecosystem.

## **Environmental Problems**

### < Current status >

#### Water Quality

One of the greatest sources of pollution and coastal degradation in the Caribbean is from land-based sources. Sewage is one of the most significant pollutants affecting the coastal environments of the wider Caribbean region. Most Caribbean territories lack proper treatment facilities, and discharge untreated sewage directly to the environment. This negatively affects the marine ecosystems in the region, as well as creating a threat to human health. One of the possible effects is eutrophication, which leads to degradation of seagrass and coral reefs, and decreased fisheries production. Over 70% of the region's reefs are affected by discharges of untreated sewage.<sup>8</sup>

Persistent Organic Pollutants (POPs) are produced from the agriculture, energy, and industrial sectors, as well as the incineration of waste. POPs from the application of large quantities of pesticides reach the coastal environment, and have been found in sediments in Jamaica, Cuba, and St. Lucia.<sup>8</sup>

Organic and nutrient pollution is possibly the most serious marine pollution problem in the Caribbean. The main nutrients are nitrogen and phosphorus compounds, and they enter coastal waters from point and non-point sources. Solid waste such as disposal of non-biodegradable man-made materials is another concern. Some of the waste such as plastics can release toxic chemicals and heavy metals.

Offshore oil and gas exploitation can be sources of pollution, either in the form of accidental oil spills or from the release of 'produced water' from the oil-bearing strata during oil and gas production. The 'produced water' is discharged into the marine environment, together with waste drilling chemicals and mud. The 'produced water' may contain substances that exert high oxygen demand, together with toxic poly-aromatic hydrocarbons (PAHs), benzene, ethylbenzene, xylene and heavy metals, such as lead, copper, nickel and mercury.<sup>8</sup>

#### Sediment Quality

Most land in the Caribbean region, especially on the small islands, is relatively near the ocean, making the coastal and marine environments especially vulnerable to the sedimentation caused by human activities. In addition, the coastal areas are under increasing development pressure, while the shortage of land on small islands forces development activities onto steeper, erosion-prone terrain.<sup>8</sup>

### Other Environmental Issues

Some of the main threats to biodiversity in the wider Caribbean region are: habitat destruction due to coastal development, population growth, tourism, sedimentation and pollution; overexploitation of living resources, including fisheries; and predation by introduced species. As a result, coral reefs, seagrasses and mangroves, among other coastal ecosystems, are under intense pressure, threatening the biodiversity in the region.

The Caribbean Sea ecosystem is showing signs of stress, particularly in the shallow waters of coral reef systems. In some areas, up to 80% of shallow-water reefs have been destroyed. Since the 1970s, black ring disease and white band disease afflicted coral reefs, with other diseases being reported with increasing frequency. Moreover, elevated sea surface temperatures cause coral bleaching, and widespread damage.

Severe loss of mangroves has also occurred in many Caribbean nations, including loss in Cuba from agricultural expansion, shrimp farms in the Dominican Republic, and removal for tourism development. This leads to an increase in sediment quantity, which hinders coral growth.

### < Environmental Protection Measures >

The Cartagena Convention and its protocols constitute an important legal instrument for regional cooperation in the wider Caribbean. The Cartagena Convention entered into force in 1986 for the purposes of the protection and management of the marine and coastal areas of the wider Caribbean region. Currently, 25 states are Contracting Parties, which means they have legally committed to the convention's provisions. Under the Convention, three protocols exist which are as follows:

- Protocol Concerning Cooperation in Combating Oil Spills in the Wider Caribbean Region (Oil Spills) provides for regional cooperation when an oil spill threatens the coast of a participating state, and for the preparation and updating of contingency plans.
- Protocol Concerning Specially Protected Areas and Wildlife in the Wider Caribbean Region (SPAW) provides for the protection and management of marine areas and associated terrestrial areas, as well as wildlife. This protocol is supported by a special subprogram of the Caribbean Environment Programme called the SPAW Programme.
- Protocol Concerning Pollution from Land-based Sources and Activities (LBS), is an instrument for dealing with environmental pollution that reaches the marine environment from land-based sources.

The main regional framework is the Caribbean Action Plan and the Caribbean Environment Programme (CEP), facilitated by the UNEP Caribbean Regional Coordinating Unit (CAR/RCU), which falls under the UNEP Regional Seas Programme. A sub-programme of the CEP called the Assessment and Management of Environment Pollution (AMEP) is responsible for regional coordination for implementation of the LBS and Oil Spills Protocols.<sup>8</sup>

### Monitoring program

The Caribbean Coastal Marine Productivity (CARICOMP) Programme is a regional scientific effort to study land-sea interaction processes, to monitor for change and to provide appropriate scientific information for management. Data collected includes percentage coral cover, sea urchin density, gorgonian density, seagrass (growth, biomass and leaf area), mangrove forest structure and productivity, sea water temperature, salinity and clarity as well as daily maximum and minimum air temperature and rainfall.<sup>8</sup>

### Related organizations and NGOs

- Caribbean Environment Programme (CEP) <<http://www.cep.unep.org/>>
- United Nations Environmental Programme, Global Programme of Action for the Protection of the marine Environment from Land-based Activities <<http://unep.org/gpa/>>
- Caribbean Regional Fund for Wastewater Management
- The Caribbean Natural Resource Institute (CANARI) <<http://www.canari.org/>>
- Caribbean Regional Fund for Wastewater Management <<http://www.gefcrew.org/>>

### References

1. Agard, J.B.R.; Cropper, A. et al. Caribbean Sea Ecosystem Assessment (CARSEA): A contribution to the Millennium Ecosystem Assessment prepared by the Caribbean Sea Ecosystem Assessment Team, 2007. UNEP The Caribbean Environment Programme Web site.  
<http://www.cep.unep.org/publications-and-resources/databases/document-database/other/caribbean-sea-assessment-report-2007.pdf/view> (accessed March 28, 2015).
2. World Wide Fund for Nature. The Caribbean Sea. WWF Web site, date unknown.  
[http://wwf.panda.org/what\\_we\\_do/endangered\\_species/marine\\_turtles/lac\\_marine\\_turtle\\_programme/projects/hawksbill\\_caribbean\\_english/caribbean\\_sea/](http://wwf.panda.org/what_we_do/endangered_species/marine_turtles/lac_marine_turtle_programme/projects/hawksbill_caribbean_english/caribbean_sea/) (accessed March 28, 2015).
3. Economic Commission for Latin America and the Caribbean (ECLAC), ECLAC, Statistical Yearbook for Latin America and the Caribbean, 2014. ECLAC Website.

- [http://interwp.cepal.org/anuario\\_estadistico/anuario\\_2014/PDF/AnuarioEstadisticoALC-2014.pdf](http://interwp.cepal.org/anuario_estadistico/anuario_2014/PDF/AnuarioEstadisticoALC-2014.pdf) (accessed March 29, 2015).
4. Caribbean Sea. The Columbia Encyclopedia, 6th ed. 2014. Encyclopedia.com website.  
<http://www.encyclopedia.com/doc/1E1-Caribbea.html> (accessed March 29, 2015).
  5. United Nations Environment Programme (UNEP). Latin America and the Caribbean: Environment Outlook, 2010. UNEP Website.  
[http://www.unep.org/pdf/GEOLAC\\_3\\_ENGLISH.pdf](http://www.unep.org/pdf/GEOLAC_3_ENGLISH.pdf) (accessed March 29, 2015).
  6. Caribbean Development Bank. 2014 Caribbean Economic Review & Outlook for 2015.  
<http://www.caribank.org/uploads/2015/02/CDB-2014-Caribbean-Economic-Review-and-Outlook-for-2015.pdf> (accessed March 29, 2015).
  7. Caribbean Tourism Organization (CTO). Caribbean Tourism Review 2014. CTO Website.  
<http://www.onecaribbean.org/statistics/annual-reviews-prospects/> (accessed March 29, 2015).
  8. Centre for Marine Sciences, The University of the West Indies. Research Activities, 2015.  
<http://www.mona.uwi.edu/cms/ccdc/projects.html> (accessed March 29, 2015).
  9. NOAA, [http://www8.nos.noaa.gov/onms/Park/images/Creature\\_Images/1103.jpg](http://www8.nos.noaa.gov/onms/Park/images/Creature_Images/1103.jpg)  
(accessed March 29, 2015)
  10. Hutchinson, S.; Hawkins, L.E., 2007. Oceans: A Visual Guide. Shinjusha Co., Ltd.: China, 2007.  
Japanese translation