

7.6 Gabon



*Dr François Edgard Faure**, *Carine Moussounda (Msc)*

National Center for Scientific and Technologic Research
(CENAREST)
National Center for Data and Information Oceanographic
(CNDIO) BP 10961 Libreville, Gabon

*Corresponding author E-mail: faured@yahoo.fr



Capital city	Libreville
Population (2005 est.)	1,300,000 (1.5% growth)
GDP per capita (USD 2005 est.)	\$6 954
Life expectancy at birth (2005 est.)	56.2 years (male - 55.6, female - 56.9)
Land and water area	267,667 km ² (Land - 257 667, water - 10 000)
Length of coastline	885 km
Highest point of Elevation	Mount Birougou 1 190 m (Mombo, 2004)
Mangrove area (2005 est.)	150,000 ha
Marine protected areas (2007 est.)	1 054.93 km ² (4.86% of total territorial waters)
Capture fisheries prod. (2006 est.)	41,521 metric tones
Aquaculture fisheries prod. (2006 est.)	126 metric tones

Rivers to the Country's Coast: The dominant river is the Ogooué, which flows for 1 200 km forming a delta at the Atlantic Ocean. 1 000 km of this is within Gabon. It drains a basin of 215,000 km², approximately 4/5 of the country. In addition to the Ogooué, there are other smaller coastal rivers. From north to south, they are: the Noya, the Mbeya, the Ntsini and the Komo (which flows into the estuary of the same name as the city), and the Nyanga.

Coastal Climate: The coastal environment is located in two distinct climatic areas: the equatorial climate of transition in the central area and the equatorial climate of transition in the south-west and central Atlantic coast.

The equatorial climate of transition in the central area has the estuarine climate, situated in the coastal area north-west of the country including the Coco beach and Libreville. This sub climate is characterized by high precipitation, varying between 2 000 and 3 800 mm per year.

The equatorial climate transition in the south-west and central Atlantic coast has the sub climate as found in the area south of Port-Gentil to the border with Congo. The area of influence extends far beyond this region of lagoons– including much of the delta of the Ogooué. The proximity to the sea means it is very rainy, with annual precipitation between 1 700 and 3 500 mm.

There are two main climatic seasons: the dry season and rainy season, with periods of both wet and dry throughout. For example, we present the temperatures and precipitation recorded for Libreville and Port-Gentil (Tables 1 - 3).

Table 1. Libreville average annual temperatures (1991-2000).

	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
Max	27,6	27,2	27,6	27,3	27,8	27,5	27,5	28,2	27,5	27,6
Min	24,9	24,7	24,9	24,8	25,2	24,8	24,6	24,8	24,6	25,1
Range	2,7	2,5	2,7	2,5	2,6	2,7	2,9	3,4	2,9	2,5

(Source: Direction of the French Central Meteorological Office)

Table 2. Annual total precipitation and days of rainfall in Libreville (1991-2000).

	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
Total volume of precipitation (ml)	2167.8	2663.3	2423.2	2330.7	2392.3	3337.1	2747.1	2669.6	2595.9	3345.5
No of days of rainfall	198	196	186	157	172	189	207	217	203	193

(Source: Direction of the French Central Meteorological Office)

Table 3. Averaged temperatures in Port-Gentil (1992-2001).

	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
Average	26	26.3	26.2	26.5	26.2	26.2	27.4	26.7	26.5	26.3

(Source: Direction of the French Central Meteorological Office)

Coastal Geomorphology: The coast of Gabon is characterized by a diversity of coastline, including: low rocky areas, sand and mud flats, cliffs, beaches, estuaries, lagoons and delta areas. The coast of Gabon has three main morphological units spread from north to south.

The first unit is a large estuarine area in the north-west, between 1°09' north on the border with the Republic of Equatorial Guinea, and the position of the geographic equator, near the village Nyon. This area comprises three main estuaries: Mouni estuary, Mondah estuary and



Figure 1. Erosion of a beach in Port-Gentil.

Komo estuary. This stretch of coastline is distinguished from the rest of the Gabonese coasts by its rocky low-lying areas dominated by sandy deposits, and mud flats covered by the mangroves.

The second unit is a complex delta in the centre of the country, formed by the mouth of the Ogooué. It lies between 0°30' and 1°30' latitude south, between the southern region of Wonga-Wongué and the mouth of the lagoon to Olende Fernan Vaz. The system is complex. The part of the delta oriented to the north is asymmetrical and large, whereas to the south the delta is smaller.

The third morphological unit runs in roughly a straight line from the north-west to south-east. It is characterized by barrier beaches delineating the vast lagoons from the coast. The coast is linked to a series of lagoon systems, stretching from the lagoon Fernan Vaz, in Gabon and beyond the border with Congo. The lagoons within the system vary in size. Among the most important there are the lagoons of Fernan Vaz Nkomi, Ngove, Ndogo and Banio.

The continental shelf width varies between 15 and 40 km in the north of Cape Lopez, and rarely beyond 80 km wide south of this point. Usually at the shelf limits there is a strong drop in depth corresponding to isobaths of 120/130 metres. This was the extent of the former shoreline of the coastal environment during the Palaeolithic era.

Coastal Habitats: The land area of Gabon is 267,667 km² of which 2/3 are covered with forests. Many rivers flow to the coastline with an area of 10,000 km² that flow into estuaries (north), the delta (centre) and lagoons (south) of Gabon. Several ecosystems are found along the coast of Gabon. The dominant systems are mangrove, coastal savannah, and coastal forests. These ecosystems are diverse in terms of flora. The fauna of the mangrove forests of Gabon are also quite diverse, though little is documented. Gabon has nearly 395,000 ha of mangrove (Rabenkogo, 1995), divided among the following: the estuary of the Muni, the Bay of Mondah, the Komo estuary, the delta of the Ogooué and the southern coastal lagoons. Mangrove forests provide coastal communities of Gabon with needed resources, including firewood and wood for construction.

Coastal Observations: A tide gauge has been installed and operational at the port of Owendo since August 2008. A tide gauge is proposed to be installed in Port-Gentil. In addition, the Gabonese Government has been discussing the possibility with the Intergovernmental Oceanographic Commission (IOC) to deploy three buoy profilers that will contribute towards the ARGO programme. The development of this programme in Gabon will strengthen its system of coastal observation. Weather stations exist in Libreville and Port-Gentil, and one rain gauge exists at Gambia.

Ports and Harbours: After petroleum, the second greatest economic resource of the coast of Gabon is trade through the ports Owendo-Libreville and Port Gentil. Indeed, maritime transport is of particular importance to Gabon. Approximately 90% of the country's foreign trade is carried by sea. Imports include food and manufactured goods. Exports are based primarily on timber, manganese and oil. In terms of traffic, results of operations of the port of Libreville-Owendo during the years 2004 and 2005 have been rising sharply. Thus, the total volume of goods handled at Owendo rose from 4,548,722 tones in 2004 to

5,720,252 tones in 2005, an increase of 25.8%. Conversely, activity in Port-Gentil has deteriorated, partly because of lower volumes of oil and forest products exported. Its traffic is therefore decreased from 14,222,204 tones in 2004, to 14,034,058 tones in 2005, a decrease of 1.3% (EPA, 2007).

Coastal Economy: The largest coastal economic activities are offshore petroleum extraction activities, port activities, fishing, forestry, mining and tourism. Tourism and fisheries are described in the following sections.

Coastal Tourism: Coastal tourism contributes more than 80% to the national tourism industry, and the coastline offers great opportunity for tourism. This includes bathing, sight seeing and sports, particularly sport fishing. Tourists, residents and foreign visitors, tend to benefit from the quality of beaches with gentle slopes and relatively moderate swell. The most famous are in the provinces are 1) Estuaire (la Sablière, Cap- Estérias, la pointe- Denis, Pongara, Ekwata, Nyonié), 2) Ogooué-Maritime (Cap Lopez, Ozouri, Olendé, Iguéla, Sétte-Cama), and the 3) Nyanga (Mougagara, Panga, Mayumba).

Tourism sight seeing is predominantly based on the observation of marine animals such as turtles, dolphins, whales and orcas that frequent Gabonese waters.

On 30 August 2002, Gabon created 13 national parks, 4 of which are located along the coast of Gabon: Akanda, Pongara, Loango and Mayumba. The network of thirteen national parks covering a total of 2,837,000 hectares, more than 10.6% of the total land area (Vande Weghe, 2007).

In addition, there is also the presidential reserve of Wonga-Wongué bordering the Ogooué northern delta.

Fisheries: In Gabon, the biodiversity of the marine environment is considerable. Covering an area of nearly 265,000 km², Gabonese waters contain a wide variety of fish and crustaceans, and support larger organisms such as whales. Port-Gentil was in fact a whaling port until the late 1940s.

The demersal species fisheries are estimated at a potential 312,480 tones per year. Small pelagic fisheries (such as sardines and mackerel), are estimated at 153,000 tones per year. The estimated potential of large pelagic fisheries is around 250,000 tones per year for the entire region of the Gulf of Guinea (EPA, 2007). Large pelagic (tuna and other species) as well as the deep shrimp and cephalopods are operated on a seasonal basis within the framework of fisheries agreements with the European Union, Japan and China.

A decree of 1994, regulating fishing in Gabon, divides the waters under national jurisdiction in fisheries as follows:

- *Zone 1*: including inland waters (rivers, lakes, lagoons) and extends to the mouth, and is strictly reserved for the fishing activities of nationals
- *Zone 2*: extends from the mouth to 3 nautical miles, and is reserved for artisanal fisheries
- *Zone 3*: which cover 3 to 6 nautical miles, are reserved for activities of the local fishing industry
- *Zone 4*: which runs from 6 to 12 miles, is only authorized to non-national vessels.

The division of the Gabonese coast Effectives Fishing Areas (PTA) has five main sections. The fishing sector employs about 21,000 people. It generates an annual turnover of 41.5 billion CFA francs, and contributes to gross domestic product (GDP) up 1.5%. The industrial fishing fleet in 2003 was 87 vessels. Shrimp is the dominant and lucrative catch, with 9 500 tones taken in 2005. Artisanal fisheries (marine and continental) include a wide variety of fish species, with a production of 32,240 tones in 2005 (EPA, 2007).

Mineral Resources: Oil is the principal mineral resource on the Gabonese coast, with exploitation beginning in the mid 1950's. Since the late 1980's, oil production seems to have slowed. Indeed, between 2003 and 2005, production has stabilized at around 13 million tones. The extraction of sand for industrial purposes, particularly in the area of Libreville and Port-Gentil, is one of the major mineral resources of the coast. Limestone quarries are also located in the province of Estuaire (Ministère de l'Environnement et de la Protection de la Nature et de la Ville, in Gabon: Profil Environnemental de la Zone Côtière, 2007).

Agricultural Products: Agricultural production in coastal areas is very low and soils are of low agricultural potential. The main food crops include plantain, cassava, taro yam, sweet potato, maize, and groundnuts. Urban and peri-urban agriculture takes place especially in the coastal zone. Produce includes tomatoes, amaranth, eggplant, okra, peppers, onions, and coconuts.

Other Marine Resources: Gabon is rich in marine and coastal biological resources, particularly mangroves, and fisheries which are exploited by the Gabonese population. From the perspective of the biological potential, marine primary productivity of Gabonese marine waters is high- around $1704 \text{ mg C m}^{-2} \text{ day}^{-1}$ (Ministère de l'Environnement et de la Protection de la Nature et de la Ville, in Gabon: Profil Environnemental de la Zone Côtière, 2007). This productivity is higher in the south and around Cape Lopez (Port-Gentil). This environment is the limit of cold water and rich marine life from the Benguela Current, including an abundance of small pelagic species. The Guinea Current, with warmer waters, produces large pelagic fish such as tuna. The point of contact with these bodies of water in Gabon provides diverse and abundant living marine resources.

Figure 2. Mangroves in the bay of Mondah.



Marine animals are also present and appreciated by many tourists every year. The leatherback turtle (*Dermochelys coriacea*), and three other species of marine turtles visit Gabonese beaches. There are Green turtle *Chelonia mydas* and the Hawksbill turtle *Eretmochelys imbricate* abundant in the Bay of Mondah. The Olive Ridley *Lepidochelys olivacea* is the only turtle seen fairly regularly south of Port-Gentil and is more common.

ADDRESSING COASTAL KEY ISSUES AND HOT SPOTS

Gabon has a large maritime area estimated at about 265,000 km², which includes a territorial sea of 12 nautical miles (expandable to 24 miles) of exclusive economic zone Better Term Needed. The large coast and marine waters are rich in mineral and biological resources. Navigation, port activities, exploitation of marine resources, tourism, and coastal development all play important roles in the development of the country. Paradoxically, the country lacks data for managing these resources and activities, particularly in the area of oceanography.

The coast of Gabon is characterized by diverse ecosystems and coastline. These are threatened by rising sea levels, coastal erosion, pollution, and over exploitation. In fact, in certain coastal areas there have been 100 to 250 metre advancements of the shoreline inland since 1950, for example Cape-Lopez to the north of Port-Gentil (Rabenkogo, 2007).

In the south of Libreville, in the Owendo area, a rate of 3 metres per annum advancement of the shoreline has been recorded since 1980 (NTOLE, 2008).

At Nkomi the lagoon mouth has undergone considerable modification since the 1980's. Compared to the situation of 1957, the sand bank of the Ozouri mouth had moved back 2.5 km by 2000, and the mouth of Olendé (Bar of Arabic) has moved back 4 km (Rabenkogo, 2007).

Mangrove systems have disappeared at a rate of 50 hectares per year between 1960 and 1990 (Rabenkogo, 1998). Oil pollution and industrial and household waste are also present. The urbanization and development of Libreville and Port Gentil (which accounts for nearly 60% of the population) without prior impact assessment has

significantly deteriorated these important coastal areas. In the Bay of Mondah, for example, ecosystems are threatened by the uncontrolled use of the mangroves as firewood by growing population of the city of Libreville and surrounding populations.

Gabon also contains many rare marine creatures, and associated habitats, that face management challenges. Beaches National Park and the Pongara Mayumba are two nesting sites for leatherback turtles (*Dermochelys coriacea*). At sea, the leatherback turtles are often victims of trawlers, and some die asphyxiated by plastic bags that they mistake for jellyfish.

The problems faced in Gabon are compounded by the absence of policy and adequate conservation of coastal ecosystems, as well as unplanned development. The legislative and regulatory institutional frameworks are inadequate, and often the public is not informed of the ecological, social and economic values of the coastal areas at stake.

DEVELOPMENT AND ACHIEVEMENTS OF CNDIO

The National Ocean Data Center of Gabon (CNDIO) was created with the support of the Intergovernmental Oceanographic Commission of UNESCO and ODINAFRICA on the 16th June 2003.

The General Directorate of the Law of the Sea (DGDM) of the Ministry of Foreign Affairs, coordinates the centre, housed and administered by the Research Institute in Social Sciences (IRSH) of National Center of Scientific and Technological Research (CENAREST). In addition, the Department of Marine Sciences of CENAREST was established in December 2005 to develop research in the fields of oceanography and geography of the seas

The main objectives of the CNDIO are:

- Disseminate information on research in marine science to scientists of the country
- To use scientific information for oceanography and coastal management

- To promote exchanges and communication between various actors involved in the ocean
- To promote institutional and human capacity building in the field of oceanography, through promoting inter-state and inter-agency research
- Sensitize stakeholders, the public, and government to issues of conservation and development in the marine and coastal environment

In addition, the CNDIO has reached an agreement with the Ministry of Fishing for the compilation of statistics (already completed 60%) and the management of national marine fisheries. CNDIO is preparing to develop a partnership agreement with the Port Authority (Office of Transportation and Roads, Gabon) and the manager of the commercial ports (Gabon Port Management) to manage tide gauge data collected at Owendo/Libreville port.

Products and services include:

- Creation of atlases, such as a fisheries atlas
- Provision of marine weather observations
- Provision of data and products on oceanography and fisheries
- The recipients of these products and services include some of the organizations and programmes listed in the following section.

MARINE RELATED PROGRAMMES AND ORGANIZATIONS

The following are organizations that work in collaboration with the Gabon NODC:

- Institut de Recherche en Sciences Humaines (CENAREST), Libreville
- Institut de Recherche en Ecologie Tropicale (CENAREST), Libreville
- Institut de Recherche Agricole et Forestière (CENAREST), Libreville

- Institut National de Recherche sur l'Océan et le Climat (en création), Libreville
- Archives Nationales du Gabon (ANG), Libreville
- Union des Pétroliers du Gabon (UPEGA), Libreville (E-mail: upeg@inet.ga)
- Direction Générale des Pêches et de l'Aquaculture
- Comité des Pêches pour l'Atlantique Centre Est (COPACE).
- Commission Intérimaire du Courant de Guinée (CICG)
- Commission du Courant de Benguela
- Comité Régional des Pêches du Golfe de Guinée (COREP)
- Direction de la Météorologie Nationale
- Gabon Sea Turtle Conservation Partnership
- Direction Générale du Droit de la Mer, Libreville (E-mail: dgdm@internetgabon.com)
- Direction Générale de l'Environnement, Libreville
- Ministère des Mines et des Hydrocarbures, Libreville
- Ministère de la Marine Marchande et des Equipements Portuaires, Libreville; (website: <http://marine-marchande-gabon.net>).
- Université Omar Bongo de Libreville, Libreville
- Université des Sciences Techniques de Masuku, Franceville
- Gabon Ports Authority
- Gabon Ports Management

Contacts:

Dr François Edgard Faure
National Center for Data and Information Oceanographic (CNDIO)
National Center for Scientific and Technologic Research (CENAREST)
BP 10961 Libreville, Gabon
E-mail: faured@yahoo.fr