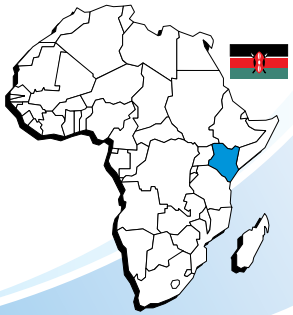
7.17 Tanzania



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Capital city	Dodoma
Population (2005 est.)	38,500,000 (2.4% growth)
GDP per capita (USD 2005 est.)	$744
Life expectancy at birth (2005 est.)	51.0 years (Male - 50.0, Female - 52.0)
Land and water area	945,087 km² (land - 886 037, water - 59 050)
Length of coastline	1 424 km
Highest point of elevation	Mt Kilimanjaro, 5 896 m
Coral reef area (2001 est.)	3 580 km²
Mangrove area (2005 est.)	125,000 ha
Marine protected areas (2007 est.)	1514 km² (39% of total territorial waters) (Nyika E. Pers Com.)
Capture fisheries prod. (2006 est.)	110,000 metric tones (Division of Fisheries, 2007)
Aquaculture fisheries prod. (2006 est.)	13 metric tones (Division of Fisheries, 2007)

Geographic Location: The United Republic of Tanzania is located in eastern Africa between longitude 29° and 41° East, Latitude 1° and 12° South. The country is bordered by Kenya to the north east, Uganda to the north west, Rwanda, Burundi and Democratic Republic of Congo to the west, Zambia south west, Malawi south and Mozambique to the south east, and the Indian Ocean to the east. The Island of Zanzibar is 2 000 km².

Rivers to the Country's Coast: The coast is strongly influenced by rivers that bring to it water, sediments, nutrients and pollutants. The Pangani, Wami, Ruvu, Rufiji, Matandu, Mbemkuru, Lukuledi and Ruvuma, flow to the Indian Ocean. These rivers influence the coastal environment through creation of productive brackish water environments in estuaries, maintenance of deltas, tidal flats and shorelines, as well as nourishment of mangroves and seagrass beds.

Coastal Climate: The climate of Tanzania can be broadly classified into four types: the hot, humid coastal plains; the hot, arid zone of the central plateau; the high, moist lake regions; and the temperate highland area. The climate is controlled by two major factors:

- Its geographical location within 1°S - 12°S latitude, which creates a truly equatorial setting, with high temperatures, high humidity (60 to 80%), low wind speeds and absence of cold season
- Its position on the eastern edge of Africa exposes Tanzania to large seasonal changes brought about by the general circulation of air over the Indian Ocean

The monsoons are the dominant influence on climate, particularly, wind direction and strength, temperature and rainfall. There are two monsoon seasons, namely the northeast monsoon (Kaskazi) which prevails from November to February and is characterized by higher air temperatures (30°C) and weaker winds, and the southeast monsoon (Kusi) which lasts from April to September and is marked by lower air temperature (approximately 23°C) as well as stronger winds. Occasionally, the southeast monsoons are associated with storms and cyclones. The months of March/April and October/November are the inter-monsoon periods and usually are the calmest. June and July are the windiest months while March, April and November experience the lowest and most variable wind speeds. January to February is generally dry, from March to May the coastal area experiences long rains, and short rains between November and December. The long rains are heavier than the short rains, while the heaviest rains are received in either April or May.

Coastal Geomorphology: Most of the country lies on the Great African Plateau with an altitude ranging between 1 000 and 2 000 m above sea level, the exception being the narrow coast belt. The coastal plains are composed of both marine and terrestrial sediments. Much of the coast is of Pleistocene and recent coral limestone. A belt inland from the coast, an area of continental and coastal deposition of cretaceous and tertiary period, includes limestone, sands and gravel. The marine rocks consist chiefly of marls, limestone and shells. The rocks of Zanzibar, Pemba and Mafia are composed of calcareous sediments with some marine clays, sandstone and coralline limestone. They range in age from the Miocene to more recent formation. The continental shelf is narrow, with 200 m depth contour approximately 4 km offshore, except at the Mafia and Zanzibar Channels where the shelf width extends to 60 km. The 200 m depth is about 2 km from the coast at the narrowest point (latitude 9°30'S) and 80 km at the widest point (latitude 6°25'S). The continental shelf is widest in the Zanzibar and Mafia Channels and off the Rufiji Delta.

Coastal Habitats: The coastline of Tanzania is characterized by a mixture of beautiful sandy beaches, rocky outcrops, extensive coral reefs, and dense mangrove stands, especially around river deltas. The intertidal zone is mainly of sandy-muddy flats or rocky reef platforms, while the sublittoral zone consists of extensive seagrass beds and reefs. Among the more famous of these natural resources are the beaches of Bagamoyo, the Jozani forest reserve, the coral reefs of Mafia, Unguja and Pemba, and the Amboni caves. These coastal ecosystems support a wide variety of marine life.

Coastal Currents and tides: The dominant major currents prevailing in the coastal waters of Tanzania are the south equatorial current, which flows westwards permanently at around 12°S and the northward-flowing East African Coastal current (EACC). The EACC is strongest in the southern monsoon (April-October) with an average speed of about 2

Figure 1. Drs. Narriman Jiddawi and Aviti Mmochi with a group of pearl farmers at Bweleo, Zanzibar (photo credit: Dr. Flower Msuya, 2007).

Figure 2. Seaweed ready for harvest at a seaweed farm in Mukuchuni, Tanga (photo credit: Dr. A.J. Mmochi, 2007).

m/s and occasionally reaching 3.5 m/s and weaker during the northern monsoon (November-March), with an average speed of less than 0.5 m/s. The tides along the Tanzanian coast are of semi-diurnal type, characterized by two occurrences of both high and low waters within a day. These are the mean spring tide of about 3.5 m and mean neap tide of about 2.5 m. The age of the tide (time lag between the new or full moon and the peak of spring tide) in most of the areas ranges from one to two days.

Coastal Observations: Tide gauges are installed and operational at Zanzibar and Dar es Salaam and another one will be installed at Mtwara.

Coastal Economy: The Tanzanian economy is heavily dependent on agriculture (primarily coffee, cotton, tea, cashew nuts, sisal and tobacco) which accounts for 50% of the gross domestic product (GDP). Tourism is one of Tanzania's dynamic sectors and has shown significant growth in recent years. The five coastal regions which comprise 15% of land area of Tanzania, contributes about one third of the national GDP, with Dar es Salaam leading overall with 20% of the national GDP. Economic activities in the coastal areas include subsistence farming, fishing, trade and tourism. In addition, the coastal area's historical attractions, including old buildings, ruins, and the monuments, particularly those in Zanzibar, Kilwa and Bagamoyo, are among the finest in the region.

Ports and Harbours: The major ports on the Tanzanian coast are Dar es Salaam, Zanzibar, Tanga and Mtwara. There are also small ports on the coast, namely Pemba, Lindi, Kilwa and Mafia. With the exception of Zanzibar port which handles only Tanzania cargo, the other major ports handle Tanzanian goods as well as transit goods for neighboring landlocked countries.

Fisheries: Marine fisheries are an important source of protein for the coastal populations. The main fishery along the Tanzanian coast is artisanal. Most of the fishing is done in the creeks, on the reefs and in the shallow inshore waters. The present annual fish catch is about 350,000 metric tones. The number of fishermen who are permanently employed is about 80,000.

Mineral Resources: There are several minerals being extracted along the Tanzanian coast. These include: salt, gypsum, iron ore, lead, barite, limestone, coral stone for building, clay and apatile. The discovery of petroleum and gas deposits in Mtwara, Pemba and Songosongo will boost the coastal economy.

Agricultural Products: Most of the land in the coastal areas is of low agricultural potential. The following agricultural products are important in the coastal region: horticultural products include vegetables and tropical fruits, sisal, coconuts, cashew nuts and bixa.

Other Marine Resources: The mangrove forests along the coast provide local communities with fuel wood, timber for house construction, fences and furniture. In recent years the mangrove forests have been cleared to make way for agriculture, fish ponds, prawn farms, salt pans, residential houses, industries and dumpsites.

ADDRESSING KEY COASTAL ISSUES

In Dar es Salaam, Tanga and Zanzibar town, and to a lesser extent, Bagamoyo, Lindi and Mtwara, there are many types of pollution, i.e., industrial, institutional, and domestic discharge; agro-chemical pollutants; and sedimentation brought about by deforestation, poor agricultural practices, and construction activities. These types of pollution affect nearby reefs. So far, there is no evidence that pollution of various types has caused loss of coral reef ecosystems in Tanzania. However, it appears that some modification of coral reefs that are near sources of pollution has occurred (Muhando 2001). Another type of pollution in Tanzania is microbial pollution. Sewage accumulation in settlements poses a serious health risk to the population leading to the spread of diseases, mortality, morbidity, increased public and private medical costs and loss of labour force productivity (Francis, 2001). The degradation of river water quality often degrades valuable water resources of downstream communities. Communities draw their water for domestic and agricultural use and the degradation undermines income opportunities and food supply. The extent and costs of the impacts is often under-estimated or has not been determined.

Natural impacts that have led to ecosystem modification or loss in Tanzania include storms and coral bleaching. Damage due to strong wave action is common on exposed fringing reefs and on the seaward side of patch reefs and islands all along the coast of Tanzania, though there is no evidence that the extent of storm impact has been any different recently than it was many decades ago. The coral bleaching event (March to May 1998) coincided with higher than normal seawater temperatures and increased rainfall (lower salinity) (Muhando, 1999). Coral bleaching was reported on all parts of the Tanzanian coast with variable severity. Bleaching was worse in shallow waters (reef flats) than in deeper waters. In Zanzibar, overall more than 60% of the scleractinian corals showed signs of bleaching, with Acropora being most affected; while a few corals such as Diploastrea and Pachyseris were seemingly unaffected (Muhando, 1999). Some species of Porites were affected, while others were not (Wilkinson, 1998). After the bleaching event, the dead corals were colonised by filamentous algae. By November 1998, these were replaced by macroalgae and coralline algae. By January 1999, some areas showed the recruitment of small corals, while others were colonised by corallimorpharians and soft corals. On the economic side, some dive operators reported a decline in tourist potential due to the bleaching event (Muhando, 1999).

Figure 3. Ms. Kulekana (TAFIRI) and fish farmers inspecting fish ponds under construction at Mkuranga (photo credit: Dr. Mmochi, 2008).

Coastal communities in Tanzania have traditionally exploited rich products of the mangrove ecosystems as well as various parts of the mangrove trees themselves. In recent years, the rate and variety of human influences on the mangroves have increased to the extent that they are threatened with destruction in some areas (Semesi, 1997). One of the most pressing issues in the mangroves forests is the loss of areas due to conversion for commercial purposes (Semesi, 1997). It may be concluded that although there is no quantification of losses arising from mangrove habitat loss or modification, there is clear evidence that coastal communities are losing in terms of income and wood for other household purposes (Muhanda, Mgaya, Daffa 2001).

Experts taking part in a national assessment of environmental and social issues and impacts identified a number of hot spots (currently

Figure 4. Fish farms at Mkuranga – These are some of the many fish ponds developed through the SUCCESS project between IMS, CRC and WIOMSA, and funded by USAID (photo credit: Dr. A.M. Mmochi, 2008).

suffering measurable degradation), sensitive areas (likely to be subjected to some degradation in the future); and major issues of concern. These are reproduced in Table 1 (ACOPS, 2002e). Pollution was identified as the major threat to hotspots, while the sensitive areas are threatened by over-exploitation; destructive fishing practices, and modification/ loss of ecosystems (Table 1).

Table 1. Results of the Integrated Problem Analysis undertaken for Tanzania (ACOPS, 2003e).

Major issue of concern overall for the country
Modification/ loss of ecosystems. Current status: increased awareness to coastal communities, government enforcement concerning misuse of coastal ecosystems; participatory projects between the government and coastal communities on coastal ecosystem management
Destructive fishing practices. Current status: eliminated due to regular enforcement patrols and effective prosecution of offenders increased awareness to fishermen.
Over-exploitation. Current status: increased awareness and enforcement to coastal communities
Microbiological pollution. Current status national strategies management of, sold waste, ground water and sewerage outlets
Hot spots
Dar es Salaam city Zanzibar municipality Tanga municipality
Sensitive areas
Rufiji-Mafia-Kilwa complex Tanga coastal area Bagamoyo

DEVELOPMENT AND ACHIEVEMENTS OF THE NODC

The Tanzania National Oceanographic Data and Information Center (TzNODC) is hosted at Institute of Marine Science of the University of Dar es Salaam (IMS), with the support of UNESCO/IOC through the Ocean Data and Information Network for Africa (ODINAFRICA). TzNODC has been in existence for 10 years.

The main objectives of the Centre are to:

- Provide marine scientists in the region with the necessary scientific information
- Enhance the use of indigenous scientific information in the region
- Promote and facilitate communication between the scientists, both intra - and inter - regionally
- Disseminate information on marine scientific research activities in the country.

The centre has provided training in data and information management to staff from collaborating institutions in the country. IMS is an input centre for the Aquatic Sciences and Fisheries Abstracts (ASFA) database.

TzNODC has accumulated a wealth of data and information, the majority of which is held in CD-ROMs which are utilized to develop a wide range of products and services in support of various communities involved in coastal management. TzNODC's collection covers oceanographic, and related terrestrial data. In the case of oceanographic data, an area of interest, bounded by the following latitudes and longitudes has been defined: 0.5°S, 6°S and 39°E, 50°E from the World Ocean Database 2005 produced by the US-NODC. Quality controlled ocean profile data for this area has been extracted from the World Ocean Database 2005 produced by the US-NODC. These depth profile data span several years and include measurements of temperature, salinity, oxygen, phosphate, nitrate, silicate, chlorophyll, alkalinity and Ph.

The centre has actively sought to present various sets of data in GIS, visualizing information on the Indian Ocean basin such as variations in chlorophyll and sea surface temperatures. The centre is set to avail more information on coastal terrestrial environment following the implementation of the Nairobi Convention Clearinghouse and Information Exchange System. This is implemented through national institutional networks with each institution acting as a node for particular categories of data.

The following are some of the products and services available at TzNODC:

- Catalogues of marine related datasets, which provide information on types, quantity, geographic coverage, sensors used, institutions/individuals holding the data and conditions for access
- Library catalogue
- Union library catalogue (holdings) of all institutions dealing with marine and aquatic sciences in Tanzania
- Directory of marine and freshwater scientists within the country
- Computer software tools available for quality control, analysis and sub-setting of data
- Provision of datasets resulting from ocean observing programmes and respective meta data
- Tide predictions from tide gauges in Zanzibar and Dar es Salaam
- Delivery of data and information in the form of maps and graphs and other services for scientists and coastal management practitioners
- Provision of bibliographic search and delivery services to the scientific community
- Provision of various information products to the local community

Figure 5. IMS Librarian introduces users to databases developed with support from ODINAFRICA.

MARINE RELATED PROGRAMMES AND ORGANIZATIONS

The following are organizations that work in collaboration with the TzNODC:

- Institute of Marine Sciences (http://www.ims.udsm.ac.tz)
- National Museum of Tanzania (http://www.museums.or.tz)
- The Tanzanian Navy
- Tanzania Fisheries Research Institute (http://www.tafiri.org)
- Division of Fisheries
- Western Indian Ocean Marine Science Association (WIOMSA) (http://www.wiomsa.org)
- National Environment Management council (http://www.nemc.gov.tz)
- Sokoine University (http://www.sua.ac.tz)
- University of Dar es Salaam (http://www.udsm.ac.tz)
- Tanzania Ports Authority (http://www.tpa.co.tz)
- Tanzania Meteorological Agency (http://www.tma.org.tz)
- Marine Parks and Reserves
- Mbegani Fisheries Development Center
- Zanzibar Department of Fisheries and Coastal Products
- Department of Fisheries and Coastal Resources Zanzibar
- Zanzibar Port Authority
- The Commission for Lands and Environment - Zanzibar
- Commission for Science and Technology (COSTECH - http://www.costech.org)
- Ministry of Livestock and Fisheries
- Ministry of Natural resources and Tourism
- Prime Ministers Office
- The Vice Presidents Office

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Figure 6. Participants at a Leadership workshop for Head's of marine institutions in Eastern Africa hosted by IMS in Zanzibar 2006.