MUNICIPAL WASTEWATER MANAGEMENT IN THE WESTERN INDIAN OCEAN REGION

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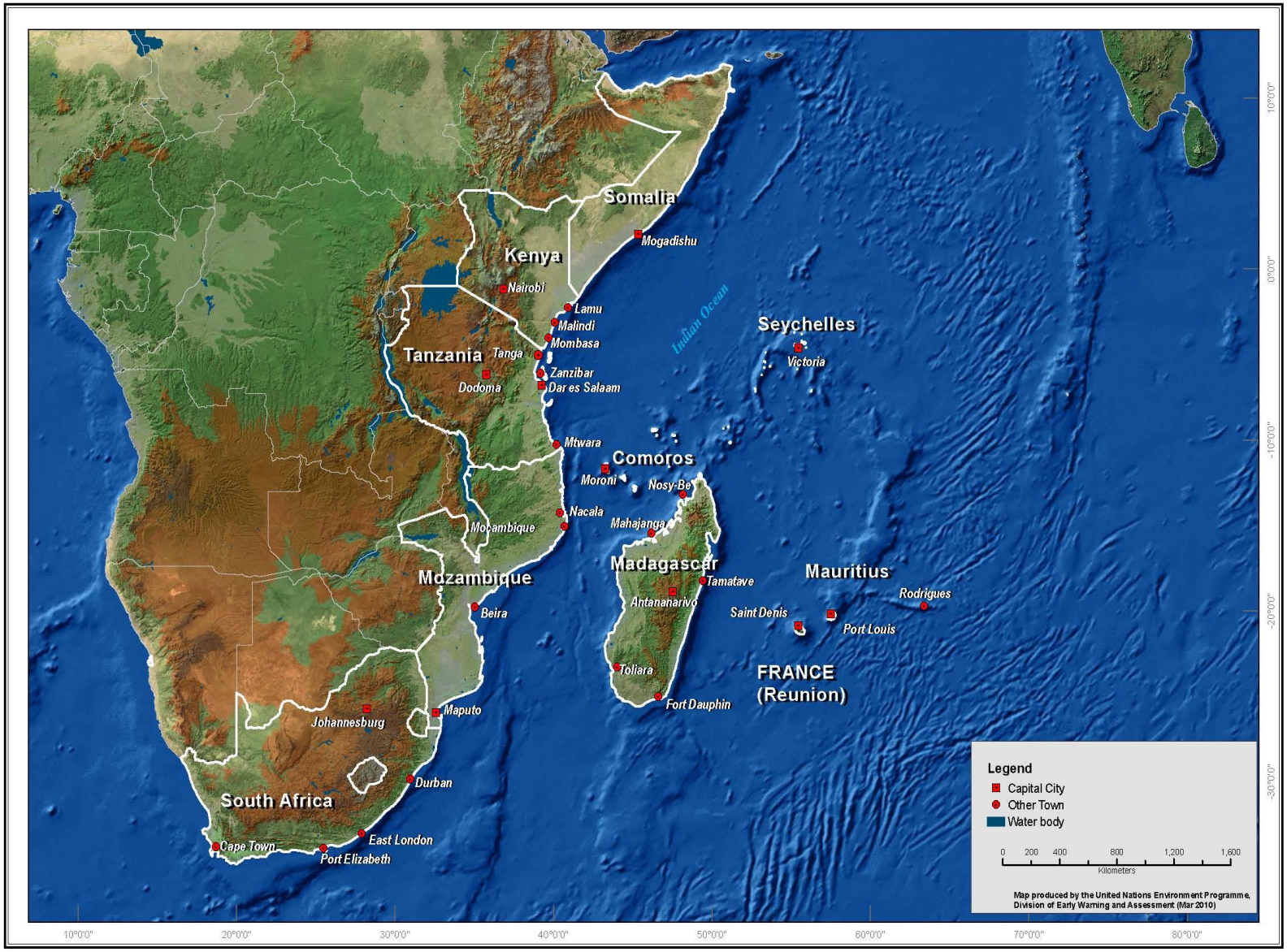

Somalia
Mogadishu
Kenya
Nairobi
Lamu
Malindi
Mombasa
Tanzania
Tanga
Zanzibar
Dodoma
Dar es Salaam
Indian Ocean
Seychelles
Victoria
Mtwara
Comoros
Moroni
Nosy-Be
Nacala
Mahajanga
Mozambique
Madagascar
Tamatave
Antananarivo
Mauritius
Rodrigues
Saint Denis
Port Louis
Beira
Toliara
FRANCE
(Reunion)
Fort Dauphin
Maputo
Johannesburg
Durban
South Africa
East London
Cape Town
Port Elizabeth
Legend
Capital City
Other Town
Water body
0 200 400 800 1,200 1,600
Kilometers
Map produced by the United Nations Environment Programme,
Division of Early Warning and Assessment (Mar 2010)
10°0'0"
0°0'0"
-10°0'0"
-20°0'0"
-30°0'0"
10°0'0"
20°0'0"
30°0'0"
40°0'0"
50°0'0"
60°0'0"
70°0'0"
80°0'0"

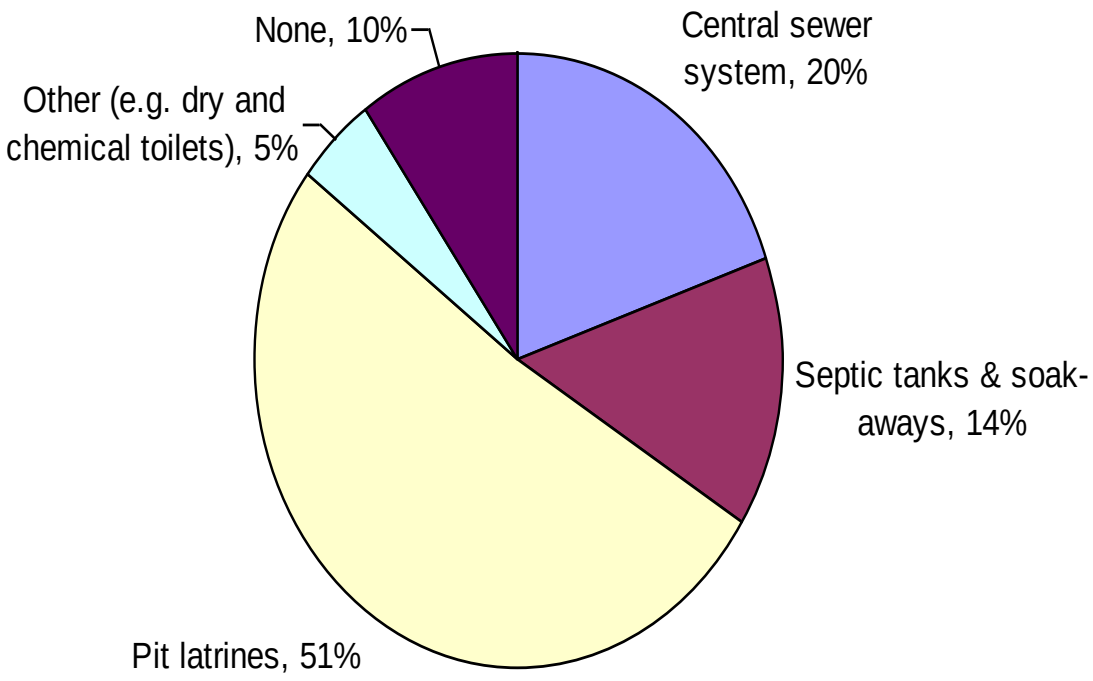
Key socio-economic characteristics of the Western Indian Ocean countries

Country	**Area** (km^2)	**Pop.** (millions) **2007**	**% Coastal pop. In 2000** **<25km**	**< 75km**	**<100km**	**GDP 2007** (US$ billions)	**GNI Per Capita 2007** (US$)	**HDI 2005**	**Pop. growth rate 2007**	**Life expectancy 2006**
Comoro	2,170	0.63	100	100	100	0.45	1,150	0.561	2.0	63
Kenya	582,650	37.53	6.1	7.5	8	29.51	1,540	0.521	2.6	53
Madagascar	587,040	19.67	23.2	45	55	7.33	920	0.533	2.6	59
Mauritius	2,040	1.26	100	100	100	6.36	11,390	0.804	0.7	73
Mozambique	801,590	21.37	32.7	52.1	59	7.75	690	0.384	1.9	42
La Réunion (France)	2,517	0.76	100	100	100	4.6	6,000	-	1.4	74
Seychelles	455	0.09	100	100	100	0.73	15,450	0.843	0.5	72
Somalia	637,657	8.70	30.5	52.7	55	-	-	-	2.9	48
South Africa	1,219,912	47.6	23.4	35.9	39	277.6	9,560	0.674	0.4	51
Tanzania	945,087	40.43	13.6	17.3	21	16.18	1200	0.467	2.4	52
TOTALS		178.04	20.1	30.4	34.3					

Abbreviations: HDI – Human Development Index

The distribution of sanitary infrastructures used as on-site in the WIO region

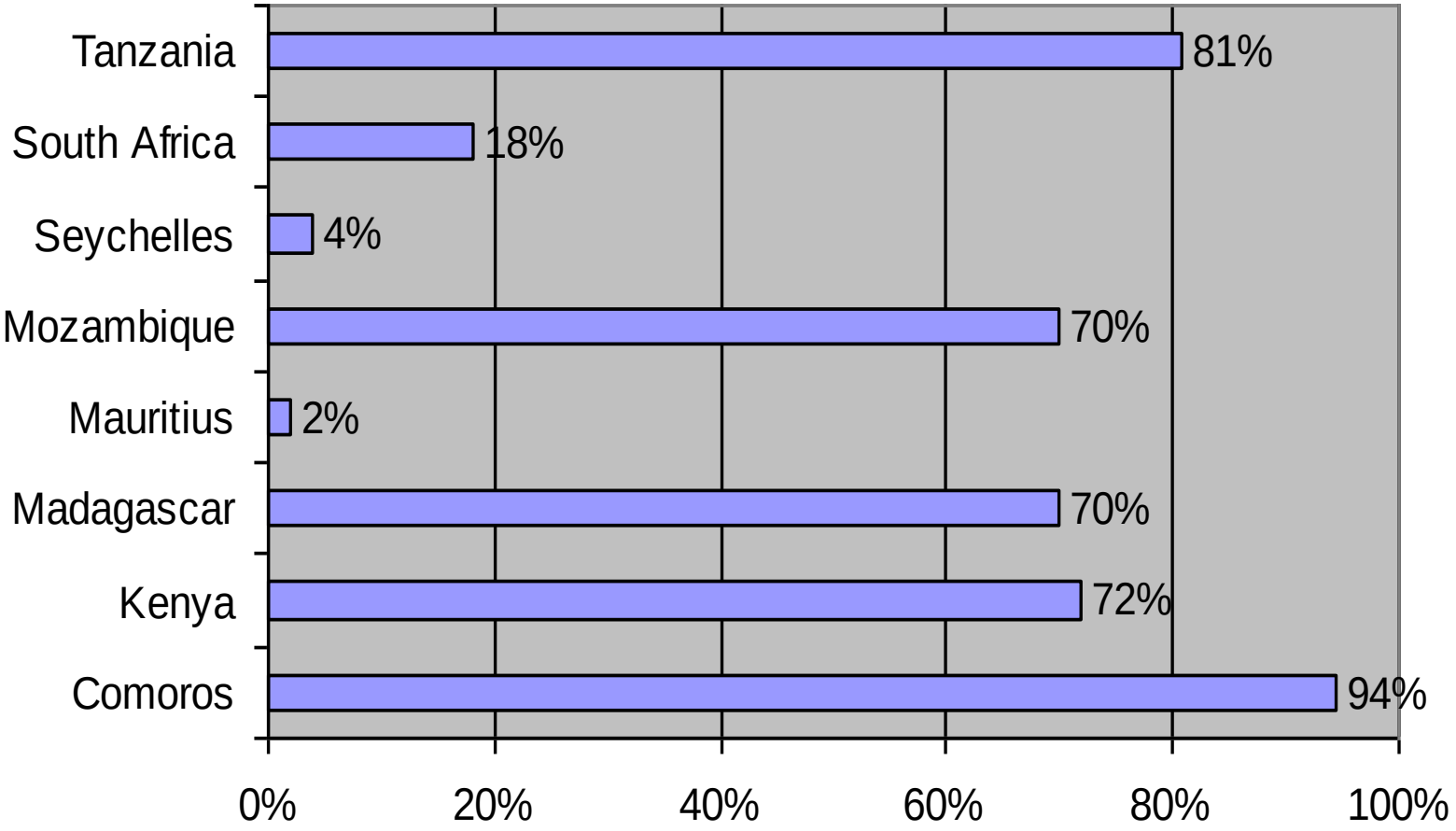
- Most commonly used sanitary facility in the region is the traditional pit latrine (62%)
- Central sewer (13%)
- Septic tank (10%)
- Sea-outfalls (4%).
- About 12% of the population in the region have no facilities and practice open defecation.


None, 10%
Central sewer system, 20%
Other (e.g. dry and chemical toilets), 5%
Septic tanks & soak-aways, 14%
Pit latrines, 51%

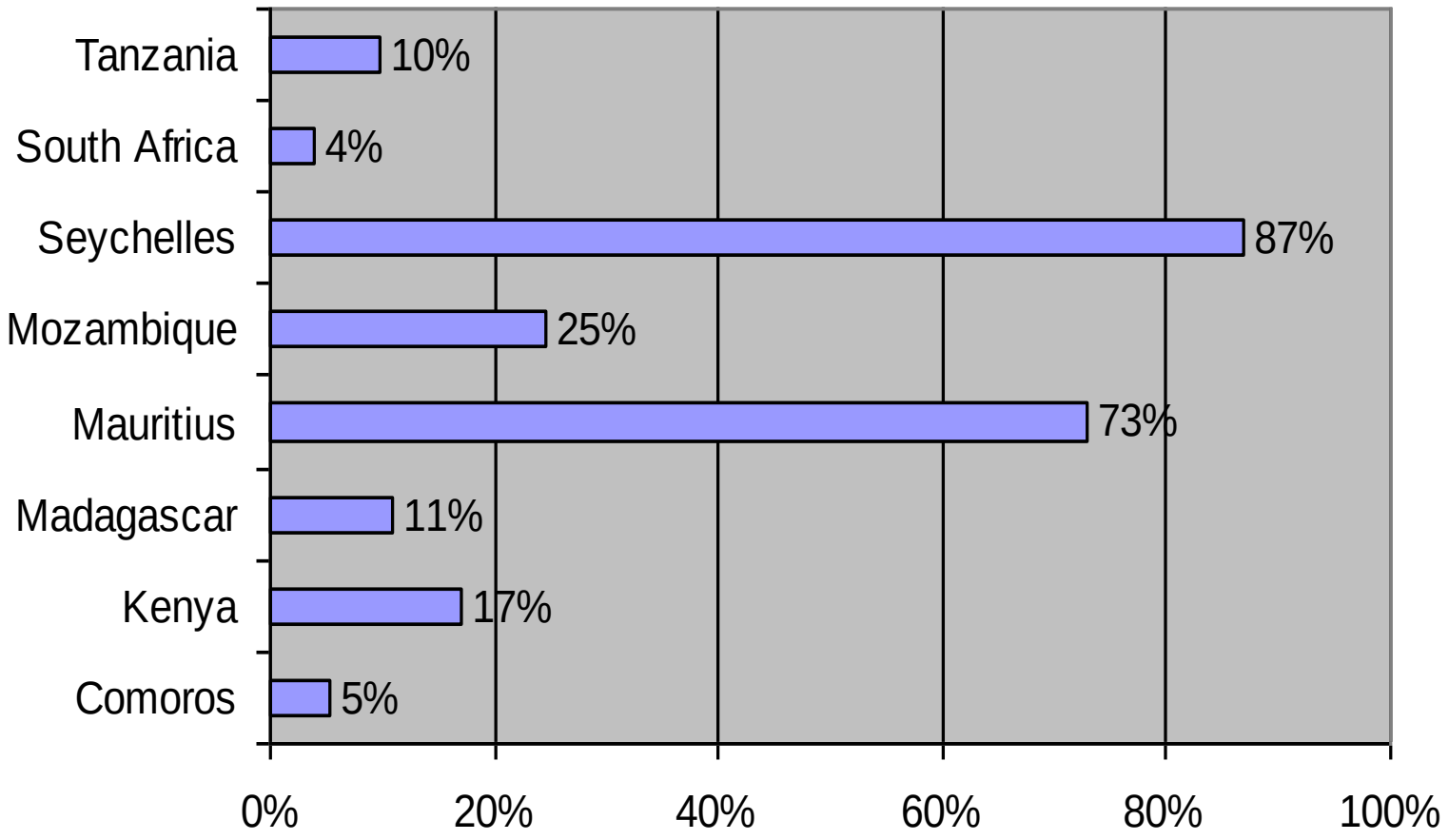
Treatment of municipal/domestic wastewater in the WIO region

	Central sewer systems	Septic tanks & soak-aways	Pit latrines	Other (e.g. dry and chemical toilets)	None
Comoros	0.3%	5.3%	94.4%		-
Kenya	11%	17%	72%		-
Madagascar	-	11%	70%		19%
Mauritius	25%	73%	2%		
Mozambique	5.4%	24.6%	70%		-
Seychelles	7.5%	86.9%	3.9%		1.7%
South Africa	47%	4%	18%	14.5%	16.5%
Tanzania	2.2%	9.8%	80.9%	0.1%	7.0%

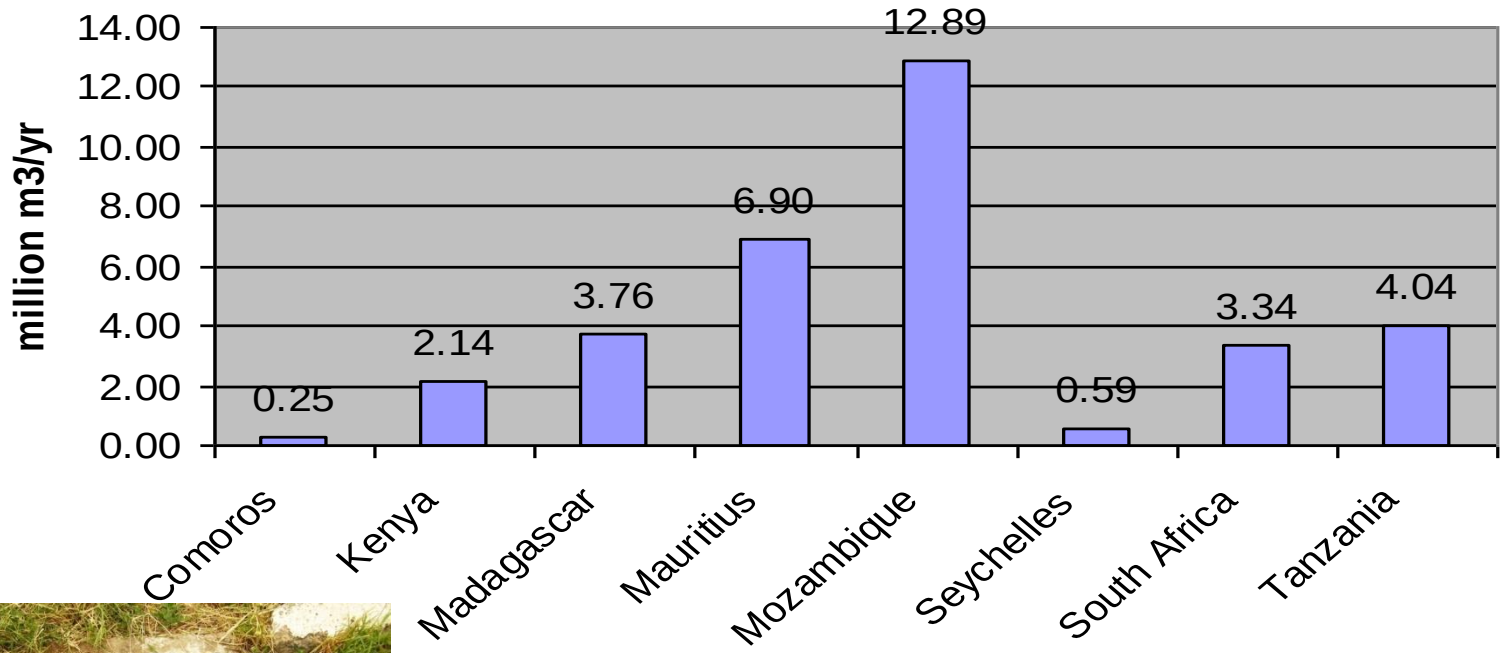
Relative coastal population (%) using traditional pit latrine in WIO Countries



Relative coastal population (%) using Septic tank system in WIO Countries

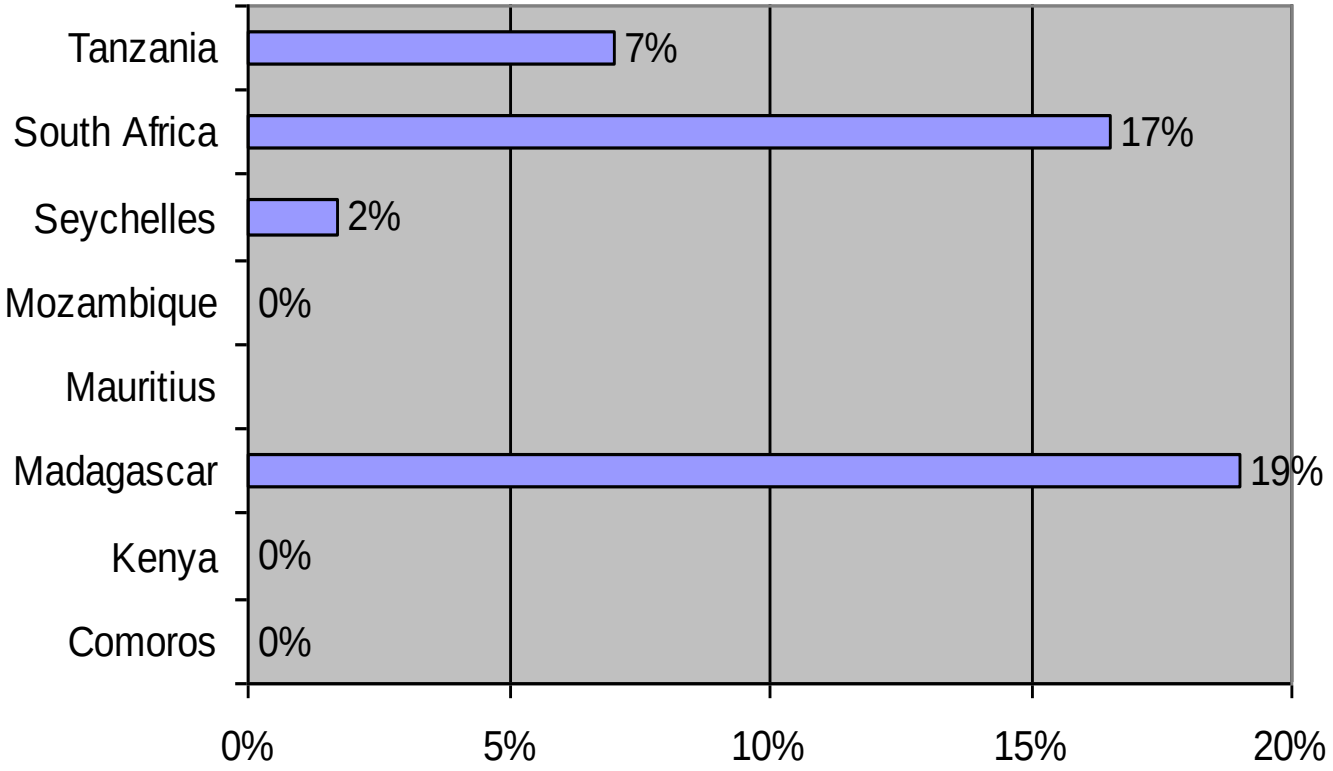


Estimated quantity of wastewater discharged through septic tanks

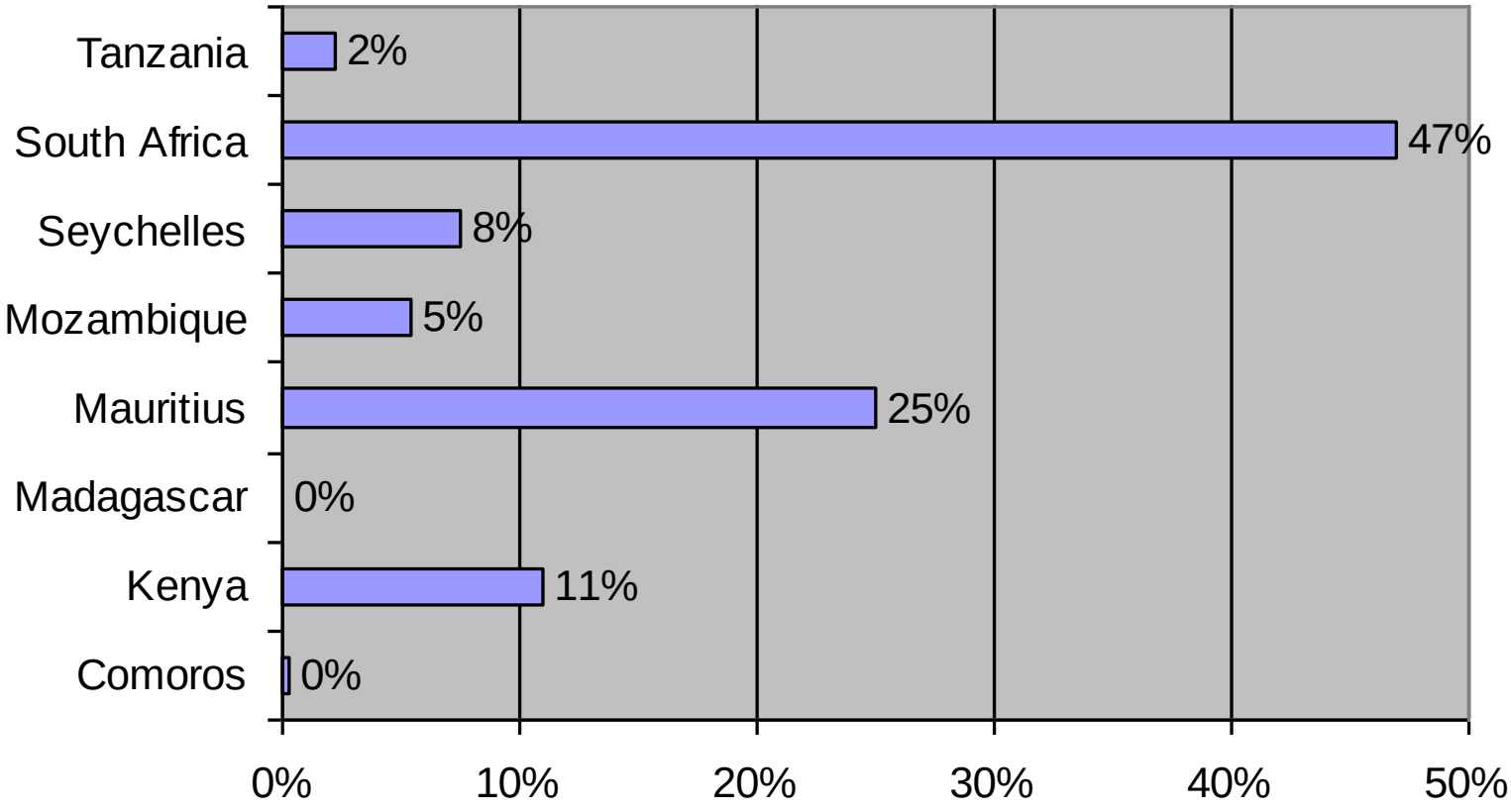


Cesspit emptier discharging wastewater containing sludge to waste stabilization ponds in Maputo, Mozambique

Relative populations without sanitary services in the WIO region

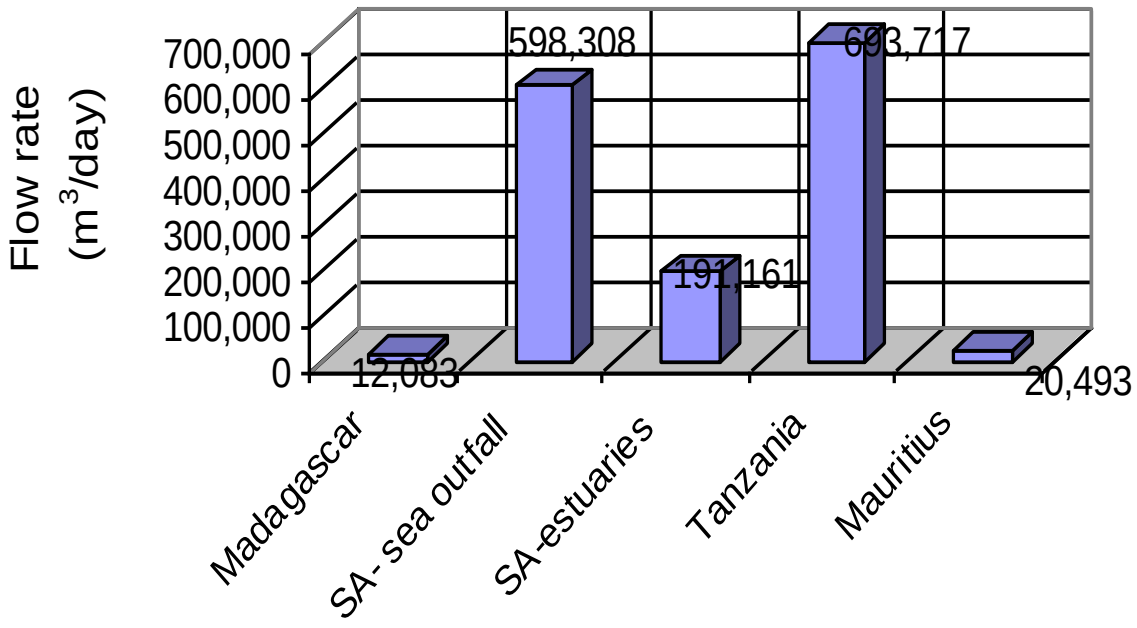


The % population served with centralized sewerage systems in the WIO region in 2007



Industrial wastewater discharged in Mikocheni River, Dar es Salaam, Tanzania draining into the Indian Ocean

Volume of industrial wastewater from WIO countries

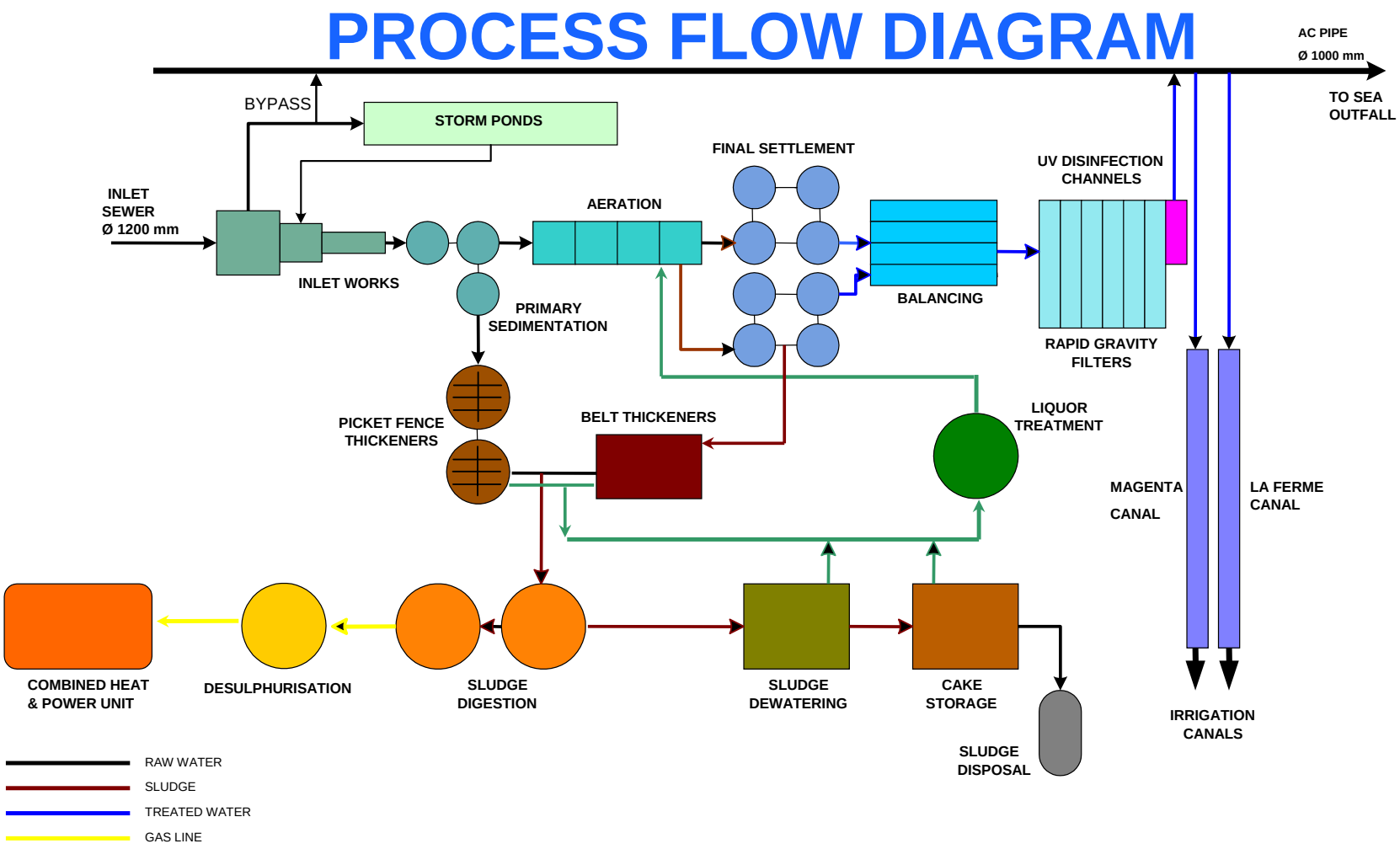


Recommendations for Improved MWW Management

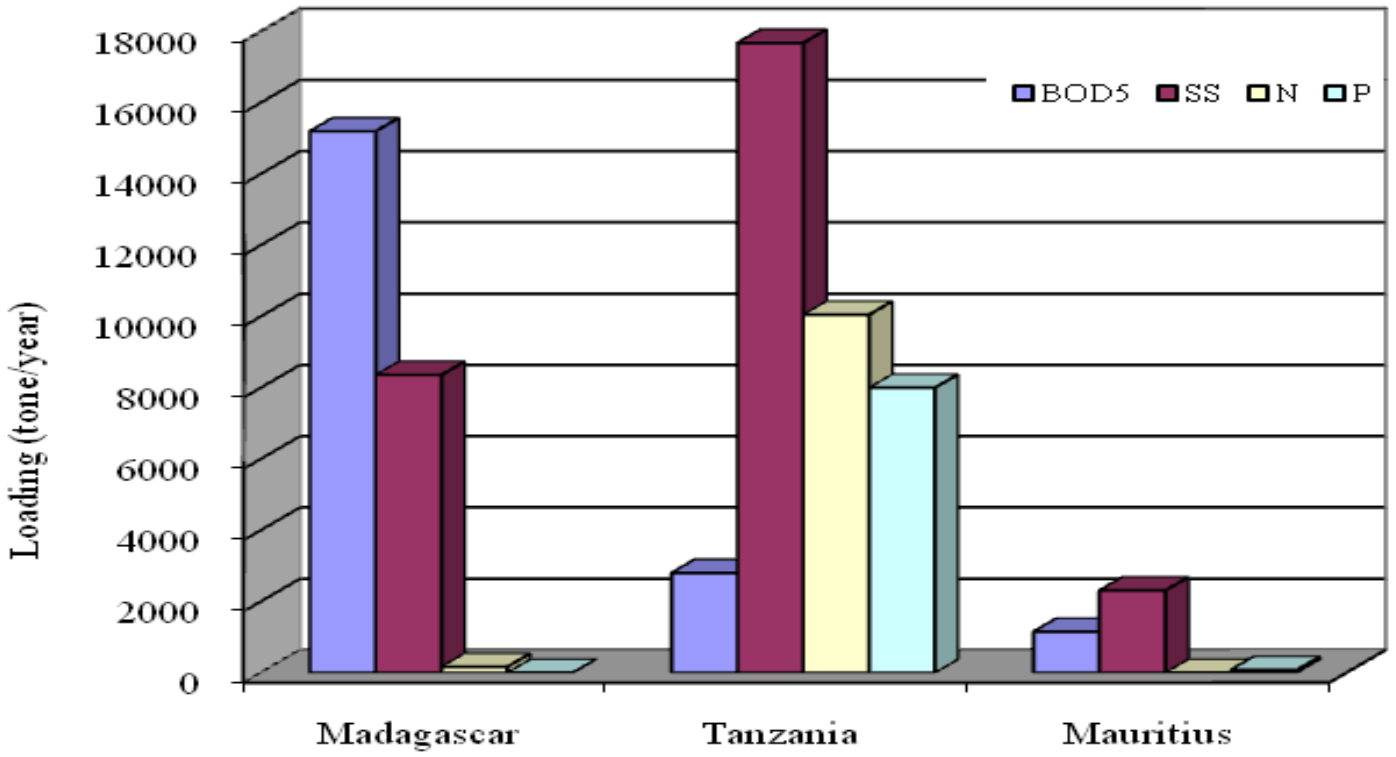
- Effective wastewater management cannot be realized through technical and regulatory frameworks alone.
- Universal wastewater management can be achieved through: true political commitment and public awareness, good working institutional arrangements and legal framework, strong financial arrangements, and appropriate technical options for wastewater treatment, disposal and reuse.

Wastewater bypassing Kipevu wastewater treatment plant in Mombasa draining directly into the Indian Ocean.

ST Martin process flow diagram of wastewater treatment plant in Mauritius.



Pollution loading from industries located in Madagascar, Tanzania and Mauritius



Challenges in managing municipal wastewater in the WIO Region

- **Inadequate Legal and Regulatory Framework**
- **Lack of Coherent Institutional Arrangements**
- **Lack of Knowledge on Selection of Appropriate Technology**
- **Low Stakeholder Involvement**
- **Lack of Financial Stability and Sustainability**

The top countries in terms of percentage of the coastal population using pit latrines

- Comoros (94%)
- Tanzania (81%)
- Kenya (72%)
- Mozambique (70%)
- Madagascar (70%).
- Mauritius (2%)
- Seychelles (4%).

- A small percentage of population along the coast of Kenya and Tanzania use Ventilated Improved Pit (VIP) latrines and ECOSAN toilets.
- Septic tanks are most common in Seychelles (87%) and Mauritius (73%) while in the remaining WIO countries they are less than 20%.

The technologies recommended for the WIO Region

- Off-site treatment using artificial wetland may be the best low-cost technology for coastal areas to treat wastewater from sewerage systems.
- In water shortage area, disposal of excreta and other household wastewaters could opt for VIP latrines or composting latrines.
- Simplified sewerage system, conventional sewerage system or settled sewerage system (wetlands/lagoons) are recommended where there is adequate water supply.
- Constructed wetlands and waste stabilization ponds are potentially good, low-cost, appropriate technological systems for domestic wastewater for household, institutional and communal levels.
- Conventional systems of wastewater treatment should be adopted if mechanical energy is reliable.

Constructed wetland Technology for wastewater treatment

The technologies recommended for the WIO Region

- For industrial wastewater, an application of combined technologies may be used to maximize the treatment efficiency.

- For organic loaded industrial wastewater, combination of constructed wetlands with other systems that can reduce the organic content of the waste before entering a wetland can be used.

- Instead of using a series of waste stabilization ponds, only anaerobic pond may be used, coupled with subsurface flow constructed wetland for biological treatment of wastewater.

- Usage of separate flows in the households is another alternative technology that minimizes generation of a large volume of wastewater. This may be achieved by separating grey water from black water. The grey-water may be used for irrigation of non-sensitive crops.

- Where possible effluent reuse should be integrated in all wastewater treatment systems. This offers an advantage of treating wastewater as an economic good.

Thank You