Mauritius Annex VIII. Coastal Livelihoods Assessment

GENERAL INTRODUCTION

The Agulhas and Somali Current Large Marine Ecosystems (ASCLME) project is focused on the two large marine ecosystems of the Western Indian Ocean (WIO) region, covering nine countries that are directly influenced by these current systems. It is estimated that at least fifty-six million people are reliant either directly or indirectly on the goods and services provided by these two current systems. The ASCLME project aims to support these countries in their efforts to collectively manage the marine resources on which their people and economies depend. Fisheries and other key coastal activities, including various forms of tourism, aquaculture, shipping and coastal transport, the energy sector, agriculture and forestry, are very important contributors to the economies of the countries of the WIO. In recognition of the complexity and importance of these activities, a Coastal Livelihoods Assessment (CLA) component was developed for the ASCLME project.

The CLA component had three main objectives:

- to collect as much existing information as possible about the main coastal activities in the nine participating countries as a contribution to the national Marine Ecosystem Diagnostic Analyses (MEDAs);
- to make input into ensuring that this information is stored and organised in a manner that will allow easy access and maximum utility to multiple stakeholders, both during and after the lifetime of the ASCLME Project;
- to review and sythesise the information collected in order to provide useful inputs to the TDA and SAP processes.

In order to achieve these objectives, the CLA component was separated into three distinct phases, with the first phase kicking off in May 2009. During phase one, a “desktop” review of available data was conducted by the regional project coordinators, input was made into the design of a literature management tool to facilitate the storage of information, and preparations were made for the in-country data gathering process. Planning meetings were held between the core CLA team and the in-country Data and Information (D+I) Coordinators in August 2009. The processes involved in the in-country component of recruitment and data gathering was discussed and confirmed at this stage.

Phase two involved in-country personnel having been identified and recruited through a regionally inclusive recruitment process. Nominations were invited and received from country focal points and D+I Coordinators. Twenty three consultants were recruited to assist with the project. For some sectors international experts (drawn from the region where possible) were asked to provide information for all countries in the region while in others, where good local capacity existed, in-country consultants were recruited. This group of consultants collected information from existing resources, such as published articles, government reports, regional reviews, project reports and outputs, policy documents as well as a range of other grey literature that was likely to be useful.

Phase three involved the organisation of the information into country Coastal Livelihood Reports where individual sector reports have been assessed and the key elements from each sector extracted and presented in a summarised format. These country reports will be reviewed by project representatives in each country and once accepted, will be incorporated as a separate Coastal Livelihoods chapter in the overall country MEDA documents. It is anticipated that the information collated in these reports will allow examples of best-practice to be identified for application in other parts of the region. The objective is to build on approaches that work rather than to duplicate efforts. Information gaps will be identified and addressed in subsequent phases of the ASCLME, including during a Cost/Benefit Analysis (CBA) exercise designed to weigh up the costs and benefits of various development options. Key information from these reports will feed into the CBA and hopefully provide useful guidelines for the Transboundary Diagnostic Analysis (TDA) and the development of Strategic Action Plans (SAP) for the overall ASCLME project.

The following country report begins with an overview of coastal livelihoods in Mauritius and Rodrigues, which provides a concise overview of the seven sector reports and the findings of the in-country and regional consultants. This overview ends with a conclusion which summarizes the collected information as it relates to the coastal zone in Mauritius and Rodrigues in general. This overview is followed by the more detailed sector reports, which represent the original contributions by the in-country and regional consultants. The sectors are organized in the following order: Small-scale Fisheries, Tourism, Mariculture, Agriculture and Forestry, Energy, Ports and Coastal Transport and Coastal Mining.

Each sector report has been prepared by specialists in that particular sector drawn either from the country or internationally. Sector reports have been prepared according to a pre-determined template to ensure that the relevant aspects of that sector were captured by the consultants. Reports include descriptive sections on the biophysical environment, human environment, policy and governance, planning and management, and development, trade and projects related to that sector. Each report is concluded with a SWOT analysis which provides a summary of the Strengths, Weaknesses, Opportunities and Threats facing that sector. It is the outputs of these SWOT analyses that are of particular importance to the strategic planning aspects of the overall ASCLME project. These reports were initially submitted to the regional coordinators for review and have subsequently been corrected and updated by the consultants themselves.

Finally, each sector report has a bibliography containing key references and links to relevant information. Full details of the information resources collected during compilation of each sector report, as well as electronic copies of literature (where available), are included in the overall ASCLME reference management system.

OVERVIEW OF COASTAL LIVELIHOODS IN MAURITIUS AND RODRIGUES

I. Small-Scale Fisheries

The Fisheries in Mauritius employs an estimated 11,000 people and contributes 1.5% to GDP. Artisanal fishers have an income level of around Rs300 per day, while monthly consumption expenditures for all fishers are, on average, above Rs 4,000. Total domestic production in the

sector is valued at Rs 1 billion, however, production in the artisanal sector dropped by nearly 360 tons between 2004 and 2008, which correlates to the declines in total catch during the same period. In Rodrigues, the fisheries sector employs an estimated 2,000 people, 78% of which are between the ages of twenty to forty five. The number of fishermen increased between 2005 and 2008, while production in the sector, unlike Mauritius, increased during the same period. The artisanal sub-sector supplies the majority of fish produced domestically, however, 60% of all domestic fish consumption is imported.

Many constraints have been identified in the sector, including weaknesses in capacity, a lack of finance and overall sustainability. For example, poor infrastructure and weak law enforcement both highlight the challenge of capacity in the sector. Low earnings and revenue, as well as a lack of access to capital, also highlight the extensive financial constraints prevalent in the sector. Over-exploitation of resources in the lagoon fishery, as well as the use of destructive fishing techniques, such as harpoons and seine nets, has also been highlighted as prevalent environmental issues. Catch rates and overall resources are also quite limited, which further aggravates user conflicts with recreational fishers and, potentially, the marine aquaculture sector.

There are, however, strengths and opportunities in the sector that can be utilized. For example, the provision of soft term loans, safety equipment and duty concessions by the government should incentivize production in the sector, particularly when considering the low capital investment required to harness the sector. Fisheries resources are also mainly being exploited by registered fishers, which highlights the healthy degree of management in the sector. The availability of demersal fish stocks on the shallow water banks further from the islands, as well as pelagic resources in the open ocean, also highlight the potential for catch increases, while the potential for new types of boats and new fishing techniques, such as GPS and hydraulic reels, and expansion of the programme of deploying Fish Aggregation Devices (FADs) outside of the lagoon areas make evident the scope for improvements in the sector. The potential for value addition, as well product development, is also promising for export growth. Thus, while resources, to this point, appear somewhat strained, there are clearly attainable opportunities to sustainably expand the sector.

II. Tourism

Tourism is a strong facet of the Mauritius economy, growing 9% annually between 1985 and 2005. While development has been less steady since 2005, growth is still apparent, with investment in the hotel and restaurant sector increasing from Rs 4.2 billion to Rs 12.2 billion between 2005 and 2009, and total arrivals increasing from 761,063 to 871,356 during the same period. The sector also employed 26,922 people in 2009, 19,241 of which were male and a majority of who came from large urban centers. Due to the global economic slowdown, the tourism sector did, however, contract by 6.4% in real terms in 2009. The hotel and restaurant sub-sector has also seen declines between 2007 and 2009, most evident in the sharp decline in the real growth rate from 14% to -6.4%.

Several constraints have been identified in the sector, despite the relatively strong performance over the last twenty-five years. For example, the sector is highly dependent on the European market, with 31.6% of all arrivals coming from France alone in 2009. Likewise, despite the fact that 89 out 102 hotels are located on the coast, the majority of those employed in the sector

actually come from urban areas, which further entrenches the socioeconomic disparities prevalent in some coastal areas. Numerous environmental issues have also been raised around the sector, including coastal erosion and coral reef depletion, both of which threaten the very natural base that drives the sector. Poorly regulated land development and inadequate wastewater management have also been highlighted as significant environmental issues in the sector. The country's up-market tourism brand is also being threatened by a mass-tourism image, a weakness that is further accentuated by the focus on beach tourism products. The limitation of coastal land, water scarcity, tropical diseases, as well as high population density, have also been identified as challenges.

A great number of strengths and opportunities have, however, been identified in the sector that could be utilized to mitigate some of the aforementioned challenges. For example, the country's outstanding natural landscapes, unique cultural heritage and strong up-market brand have all been highlighted as strengths in the sector. Likewise, good vocational training facilities, competitive tourism products, strong management capacity, as well as direct airline connections to source markets, could all be utilized to further grow the sector. There are also opportunities for ecotourism, which could facilitate a tourism-conservation nexus and produce greater asset protection on the coast. The government has also announced plans to both reduce the sector's dependence on the European market by tapping into markets in China and India, as well as socio-professionally empower local communities to participate in the sector. Numerous environmental programs have also been established, including reef conservation programs and projects to reduce coastal erosion, both of which should aid in the mitigation of the environmental strains highlighted in the report. Thus, if the sector can sustainably harness the growth it has seen in the past, it has the potential to continue as a dominant facet of the country's economy.

III. Mariculture

Only one mariculture farm is active in Mauritius and Rodriguez, with cage culture being utilized to produce goldlined sea bream, red drum and cobia in Mahebourg. The farm produces both for domestic consumption and export, employs 65 people and, in 2008, produced an estimated 750 tons. The sector is clearly not yet a major facet of the country's economy, however, six mariculture licenses have been granted as of 2009 and the government has identified the sector as having great potential for growth, thus, activity is likely to increase in the near future.

There are constraints prevalent in the sector, despite the support of government. For example, weak extension capacity, a lack of funding at the Albion Research Center and weak research capacity at the University of Mauritius highlight the technical weaknesses that constrain the sector. Likewise, user conflicts over marine resources, competition for coastal land with hotel developers and theft and vandalism have also been highlighted as prevalent challenges. Other constraints such as the threat of cyclones and poor access to the coast, have also been well documented in the report. The existing Aquaculture Masterplan appears to encourage only large-scale mariculture activities, which could preclude potential small-scale operators and investors from benefitting directly from mariculture activities at a local level.

A number of identified strengths and opportunities can, however, be utilized to facilitate growth in the sector. For example, the country's high quality seawater, its existing processing and aquafeed production capacity, as well as research capacity at the Albion Research Center, could

all be used to further development. Likewise, despite a lack of expertise, extensive lagoon areas in Rodrigues could potentially be harnessed for the farming of seaweed and sea cucumber, while there is a great opportunity to develop an integrated approach to value addition and exports. This is also promising when considering the support being given to the sector by both government and the Bureau of Investments. Thus, by capitalizing on the opportunities for greater NGO involvement and the development of support services, mariculture has the potential to develop into a significant component of the country's economy.

IV. Agriculture and Forestry

Agriculture represents 5.5% of total GDP, with 43% of land being used for agricultural purposes. 90% of this land-use is utilized for sugar, which makes up 70% of agriculture's total contribution to GDP. In terms of production, sugar, tea and tobacco contribute 52% to overall output, food crops and others 19%, livestock and poultry 14% and fishing 4%. Despite the importance of agriculture to the overall economy, the sector has been in perpetual decline in terms of GDP, decreasing from 30% of GDP in the 1970's to 5.5% in the present. Agricultural land has also decreased by 5,500 ha over the past ten years.

There are numerous constraints prevalent in the sector, despite the importance of agricultural production for the entire economy. For example, much development in the coastal zone has been undertaken without adequate planning, which has led to significant coastal erosion and pollution, while degradation of lagoon water quality has become highly problematic in Grand Bay. Increased mass tourist activity is also expected to place further strains on coastal land, which could be deleterious to coastal management plans. The over-dependence on sugar production has also been highlighted as a weakness, particularly in terms of obstructing sustainable diversification in the sector over the long-term. Poverty is also very high in the coastal zone, which not only reduces employment options for coastal populations, but encourages harmful agriculture practices that are detrimental to coastal resources.

A significant number of strengths and opportunities have, however, been identified in the sector. For example, a majority of the coastal population is involved in agriculture to some degree, thus, there is an incentive for Government to strengthen and support the sector. The Ministry of Environment also completed a study on coastal erosion in 2002 with the aim to design techniques to monitor coastal systems, implement a lagoon reef restoration project and establish more marine protected areas, all of which are important with regard to the sustainable use of coastal resources. Similarly, a Mangrove Propagation Program was initiated in 1995, which has been highly effective in countering previous mangrove depletion, evident in the estimated 78% survival rate in the mangrove seedlings propagated. The potential for eco-tourism has also been highlighted, particularly as a means to develop alternative livelihood opportunities amongst coastal farmers. Thus, while rapid coastal development and an over-dependence on sugar production could become problematic, there are clearly strengths and opportunities through which the sector could sustainably develop in the future.

V. Energy

Mauritius has no proven oil and gas reserves, thus, there is currently no upstream activities in the country. However, the country does have a significant amount of renewable energy resources, including hydroelectricity, bagasse from the sugarcane industry, as well as woody

biomass and solar energy. The development of biofuels, including bagasse and ethanol production, is, thus, a central pillar of the country's energy plan for the future, and while only 8 million litres of hydrous ethanol was produced between 2004 and 2008, the country is aiming to produce 30 million litres annually in the future. Currently, Independent Power Producers produce 42% of electricity used in Mauritius, mainly using bagasse and imported coal, while the parastatal Central Electricity Board produces 58%, using imported fuel oil and imported coal. In 2009, the electricity, gas and water sector accounted for only 3,100 jobs, while sugarcane activities accounted for nearly 17,300 jobs during the same period.

Constraints have been identified in the sector, many of which are interrelated. For example, there is clearly an over-dependence on sugar production, as 90% of agricultural land is planted with sugarcane, while the sub-sector represents 70% of GDP generated by agriculture. This not only makes it difficult to diversify the country's economy, but it also places limits on the sustainable livelihoods diversification process. Utilizing sugarcane to meet growing energy demand is also problematic, as it could have a negative impact on food security in the country, while a reliance on coal as a source of energy has also been identified as a weakness in the sector. Thus, while biofuels development is a positive attribute of the energy sector moving forward, its ability to reduce the country's dependence on fuel oil and coal imports should not overshadow the potential negative impacts it could have.

Numerous strengths and opportunities have, however, been identified in the sector. For example, the government has made numerous commitments to the development of clean energy, evident in the 2005 National Development Strategy and the 2006 Multi Annual Adaptation Strategy, both of which have the potential to make Mauritius a regional leader in green energy. The country also has strong coastal protection regulations, as well as strong environmental regulations, which should not only ensure that any development in the sector is conducted in a sustainable manner, but should also facilitate and sustain growth in sectors, such as tourism, where success is directly dependent on the country's natural environment. The government also continues to encourage competiveness in the energy sector, which should facilitate efficiency in the sector moving forward. A memorandum of understanding for cooperation was also signed with India in relation to oil and gas exploration, which could be fruitful in terms of development in the future. Thus, while Mauritius is clearly dependent on sugarcane, the commitment to the biofuels and other green energy development should allow the country to realize its clean energy strategy and subsequently reduce its reliance on imported coal and fuel oil as primary sources of energy.

VI. Ports and Coastal Transport

There are four identified ports in Mauritius, with Souillac handling leisure vessels, Grand Bay accommodating leisure vessels and fishing fleets and Port Mathurin handling services between Rodrigues and Mauritius. The only commercial port in the country is located in Port Louis, which is the second largest container-handling facility in the Indian Ocean. In 2008, the port received 2000 vessel calls and handled 6.3 million tons of cargo, comprised of 5.1 million tons of imports and 1.2 million tons of exports. The port is owned and operated by the Mauritius Ports Authority, while the Mauritius Freeport Authority is responsible for promoting distribution, warehousing, marketing and logistics for the port.

Numerous strengths and opportunities have been identified in the sector, all of which could be utilized to facilitate growth. For example, not only is Port Louis Africa's second largest financial center , but the country is politically and financially stable, all strengths which are highly conducive to private-sector confidence. The government's promotion of economic development has also been highly positive, which, in conjunction with an established agriculture sector and a growing manufacturing sector, could be very beneficial in terms of port activity. There are also new opportunities in the sector, particularly for port expansion, as well as increased investments in well-designed tourist facilities, coastal property and manufacturing. Manufacturing and agriculture, in particular, are important as both stimulate port activity through exports and international trade and strengthen the link between the Small Island State and the global economy. Thus, any increased activity in manufacturing and agriculture will not only benefit the port, but it will also be very positive for coastal communities.

There are, however, several unavoidable constraints exist in the sector which need to be recognized when planning for the future. For example, high transport costs, as well as cyclone activity, already negatively impact on the shipping sector, while competition in manufacturing, particularly from Asia, is a potential threat to economic development in Port Louis. Regional competition in both tourism and port activities from Madagascar also needs to be taken into account and strategies designed to make the ports and shipping sector more competitive. In general, the country's strong investment climate, along with the potential for increased investment in supporting sectors, highlights the opportunities for development not only in the country's ports, but also in the connected coastal communities.

VII. Coastal Mining

There is little mining activity in Mauritius; for example, only 1 million tons of stone, 300,000 tons of sand, 7,000 tons of lime and 6,000 tons of salt was produced in 2000. Coral sand mining was traditionally practiced in lagoon areas in the coastal region, however, due to the destruction of adjacent marine habitats, as well as coastal erosion, the government placed a moratorium on lagoon sand mining in 2001. As a result, substitute technologies are now being used for crushing rock, which is subsequently utilized for construction purposes.

The moratorium on lagoon sand mining is an example of the strong environmental regulations in Mauritius. Strong coastal zone protection regulations are also prevalent in the Integrated Coastal Zone Management (ICZM) division, which highlights the government's commitment to protecting the country's coastal environment. ICZM committees have been established in Flic-en-Flac and La Morne / La Gaulette, while a plan for Rodrigues is currently being prepared. All ICZM projects are largely aimed at addressing beach erosion, the creation of marine protected areas and the protection of wetlands, all of which is very promising in terms of the sustainable management of coastal resources. The EU and UNEP are also currently operating programs aimed at sustainable coastal resource management, which should support the current projects being implemented by the government.

Overall, with little potential for future mineral production and special regulations for coastal mining already in place, the sector will not likely play an important role in coastal livelihoods in Mauritius in the future. And given the aforementioned dedication to sustainable development in the coastal zone, environmental problems should not arise from the sector in the future.

Conclusion

There are clearly numerous opportunities for sustainable development in the Mauritius coastal zone, many of which could be utilized to reduce the environmental challenges highlighted across the sectors. There are, at the same time, numerous constraints prevalent in the country, many of which require immediate action if development is to be sustained.

One clear challenge highlighted in all sectors is the pressures being placed on the country's coastal resources. In the small-scale fishery, the over-exploitation of lagoon resources, as well as the use of deleterious fishing techniques, have been highlighted as substantial environmental concerns in the sector. In agriculture and forestry, poverty has been highlighted as a motivating factor in perpetuating the use of poor farming practices, which places further strain on the limited land resources on the coast. Coastal erosion, coral reef destruction and poor wastewater management have also been highlighted in the tourism sector. These cases of environmental degradation undoubtedly require immediate attention, as much of the socioeconomic activity outlined in the report, particularly in the small-scale fishery, tourism, and agriculture sectors, relies heavily on the goods and services provided by sea and coast. Environmental degradation is also a particularly serious problem for tourism, as most activity in the sector is directly dependent on the country's natural landscape, which means any significant deterioration in the country's natural habitat will likely result in negative spin-offs in one of the most important sectors in the country's economy.

The government has, however, taken steps to reduce some of this damage. For example, the promotion of mariculture not only has the potential to create an alternative form of income generation for coastal communities, but, in doing so, has the potential to reduce the strain being placed on the country's natural resources. Similarly, numerous projects and programs have been designed by the government to deal with some of the environmental issues raised in the report. For example, the Mangrove Propagation Program has been highly successful in offsetting past mangrove depletion, while the moratorium on lagoon sand mining has largely prevented the coastal erosion that was facilitated by deleterious mining activity. Reef conservation projects were also identified in the tourism sector, which again highlights the government's awareness of both the environmental and socioeconomic importance of sustaining the country's coastal resources. There is also potential for the development of eco-friendly products and services in the tourism sector, which could also be helpful in mitigating some of the aforementioned environmental problems.

Weak capacity has also been highlighted as a constraint across sectors. For example, weak law enforcement has been highlighted as a challenge in the small-scale fishery, while poor extension and research capacity has been highlighted as a technical constraint in mariculture development. In tourism, poorly regulated land development has been identified as a problem, particularly in terms of its environmental impact, while similar problems in planning capacity have been documented in agriculture. Thus, it is likely that increases in capacity will be required, particularly if enforcement in the small-scale fishery is to be improved, and mariculture is to meet its full potential.

Opportunities highlighted in the report include potential for further development in exports, evident in mariculture, where there is a great opportunity to develop an integrated approach to value addition and exports, as well as the small-scale fishery, where value addition and product

development has the potential to facilitate further export growth. Growth in exports could also be beneficial for the ports and coastal transport sector, as it could not only stimulate activity, but it could further strengthen the country's links to the global economy.

There are also opportunities for further expansion, particularly in mariculture, the small-scale fishery and biofuels. For example, extensive lagoon areas in Rodrigues could potentially be harnessed for the farming of seaweed and sea cucumber, while the availability of demersal fish stocks on the shallow water banks further from the islands, as well as pelagic resources in the open ocean, also highlight the potential for catch increases in the small-scale fishery. The government has also been highly proactive in both sectors, particularly evident in the small-scale fishery where duty concessions and the provision of soft-terms loans have been utilized to support the sector. A commitment to biofuels expansion also has the potential to not only decrease the country's reliance on coal imports, but it could also allow Mauritius to become a regional leader in clean energy.

Overall, the country's strong investment climate and its political stability are both attributes that could be conducive to realizing the above opportunities. The country's outstanding natural landscape and bountiful coastal resources are also attributes that, in conjunction with this stability, could continue to perpetuate the development that has been seen to date. It is also promising to note that there is a clear recognition of the importance of facilitating development in a sustainable manner, which could be fruitful not only in terms of sustaining coastal resources for generations to come, but in terms of allowing sectors, such as tourism and mariculture, to provide employment and livelihood opportunities into the future. Thus, while environmental degradation does remain problematic in the present, the push to create alternative streams of income and provide coastal communities with employment opportunities highlights the potential for sustainable and inclusive socioeconomic development in the Mauritius coastal zone.

DETAILED SECTOR REPORTS

I. Small-Scale Fisheries – Prepared by Mr. Sreenivasan Soondron,

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1. Introduction

The Republic of Mauritius is located in the Indian Ocean at about 800 km east of Madagascar. It consists of two main islands, Mauritus and Rodrigues and its outer islands, namely the St Brandon group of islands, Agalega, Chagos Archipelagos and Tromelin. The Exclusive Economic Zone of the Republic of Mauritius extends over an area of 1.9 million km^2. Figure 1 shows the map of the EEZ of the Republic of Mauritius.

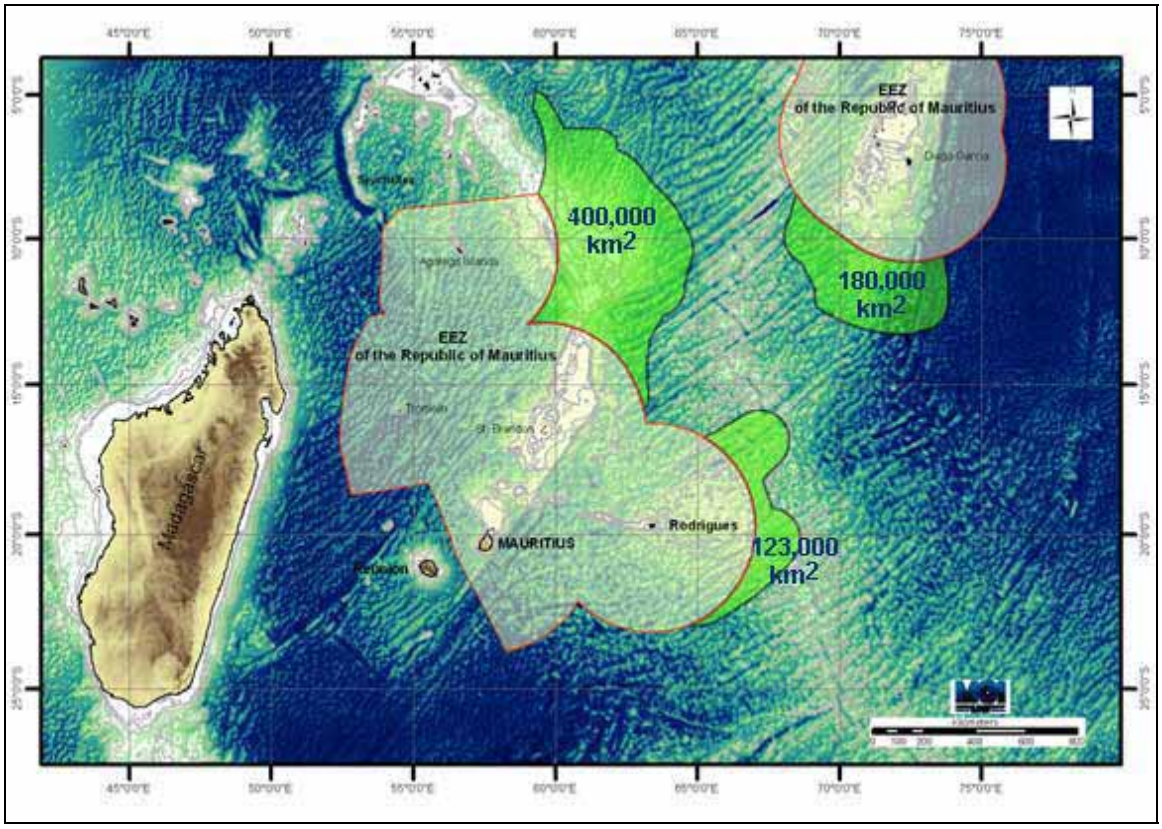


Figure 1. Map showing the EEZ of the Republic of Mauritius (Source: http://moi.gov.mu).

The Island of Mauritius[1] has a total area of 1865 km^2 with a 322 km long coastline, almost entirely surrounded by a fringing coral reef enclosing a lagoon area of 244 km^2. Strictly speaking, the fishery activities fall into three main categories namely coastal fisheries, banks fisheries and

[1] Location of Mauritius is $19^0 45^0$ S and 57^0 30'E

tuna fisheries. In 2008, approximately 9,000 tonnes of fish were landed as a result of these activities (Ministry of Fisheries Annual Report 2008)

About 11 000 people are engaged in the fisheries sector which accounts for 1.5% of the GDP. Fisheries is thus an important sector at the socio-economic level. Local fish production amounts to about Rs 1 billion[2] and Government also generates revenue in terms of foreign licence fees and export of fish products. However, fisheries have inter-linkages with other sectors of the economy and such contributions to the GDP are reflected either in the manufacturing or in the seafood processing sector. A classification of the Fisheries sector of Mauritius is provided in Annex 1.

1.1 Government Policy for the Fisheries Sector

The policy of the Government for the fisheries sector is based on sustainable resource use and protection of the marine environment. It is aimed at safeguarding employment and economic benefits. Additionally, it ensures food security and increase in fish production. The mission of the Ministry of Fisheries and Rodrigues is to be the driving force for the sustainable development and management of fisheries resources, conservation and protection of living aquatic resources and the marine environment in the waters of and of interest to Mauritius for continued socio-economic benefits to stakeholders.

1.2 Artisanal Fishery Sector

1.2.1 Lagoon fishing

Fishing in the lagoon is a tradition which dates back from the early days of French occupation. About 2020 fishermen are presently involved in the artisanal fishery and they operate in the shallow water lagoons and outer lagoons of Mauritius and in some locations up to depths of 300m (Samboo *et al*.1987). A total of 820 tonnes of fresh fish was landed along the coast of Mauritius at 61 fish landing stations in 2008 (Ministry of Fisheries Annual Report 2008; see Annex 2). All the fish caught are consumed locally, except for about 50 tonnes of high-valued fish (snappers) which are exported to Reunion Island. The gears used are basket traps, hooks and lines, harpoons, large nets and gill nets. In 2009, there were 1591 boats which are mainly propelled by outboard motors; however, some still use oars and sails or wooden poles. The most popular type of fishing is carried out by large seine net fishermen. This type of fishing which is carried out between the months of March to September is operated by teams of 15 to 20 fishermen. Table 1 shows the number of fishermen according to gear used:

Table 1: Number of fishermen by gear type

Year	BT	L/H/OF	BT/L	LN	GN	Total
2004	445	896	736	159	20	**2 256**
2005	493	789	689	189	14	**2 174**

[2] 1US$=Rs 31.00 (approx.)

2006	275	764	1 111	149	13	**2 312**
2007	283	770	876	137	12	**2 078**
2008	275	795	807	138	13	**2 028**

BT = basket trap; L/H/OF= line, harpoon, on foot; BT/L = basket trap and line, LN = large net; GN = gill net (Source: Ministry of Fisheries Annual Report 2008)

1.2.2 Outer-lagoon fishing

Outside the reefs, fishing is done mostly by hand lines and basket traps. There are 825 fishermen involved in such activities and those fishermen operate at distances up to 20 kms off the coast and remain at sea for long periods of time. They catch the choicest species of fish such as sacréchien (*Etelis sp*.), vacoas (*Aprion virescens*), dame berri (*Lethrinus sp*.) and other red snappers . Night fishing is a common feature for line fishermen who ply in crafts measuring between 8-15 metres and equipped with inboard or outboard engines. Some crafts are now equipped with echo-sounders and VHF radio and are thus able to remain longer at sea. Making use of bathymetric charts which are on sale at the Albion Fisheries Research Centre, offshore fishermen are better equipped to locate the fishing banks in the coastal waters. Table 2 shows the catch from the artisanal sector during the past 5 years.

Table 2: Annual catch (in kg) by gear

Year	Line	BT	BT/L	LN	GN	H/OF	Total
2004	285 832	425 327	54 874	168 069	11 300	97 402	**1 042 804**
2005	288 818	433 832	16 786	121 521	8 196	78 165	**947 318**
2006	303 675	343 794	19 608	201 122	11 298	70 501	**949 998**
2007	169 963	251 233	16 227	132 656	7 565	62 426	**640 070**
2008	178 656	270 923	13 920	143 644	6 669	68 171	**681 983**

BT = basket trap; BT/L = basket trap and line; LN = large net; GN = gill net; H = harpoon, OF= on foot (Source: Ministry of Fisheries Annual Report 2008)

With the poor productivity[3] of the lagoon, Government has been promoting both off-lagoon and fishing around Fish Aggregating Devices (FADs). The fishers leave early in the morning to come back after seven or eight hours. The fishers prefer to use wooden boats as the latter provide more stability during drifting. None of the fishers carry ice boxes but they have uncovered ordinary hold which is protected by gunny bags. The return trip lasts for approximately three hours if they proceed to the islets in the North (Round Island) but can be longer if they fish around more distant FADs. This means that the high valued fish caught at depth of 50 to 100m at eight to ten nautical miles away are exposed for at least four hours to solar radiation. The fishers are either boat owners or are employed by fishmongers who own the boats. The landed catch is sometimes sold outside the fish landing stations on rudimentary wooden tables exposed to the sun; or are taken by fishmongers on motor cycles or vehicles, for distribution in district markets or at other sale points.

Semi-industrial boats as defined in the Fisheries and Marine Resources Act 2007 do not exceed 24 meters in length overall. In accordance with Section 42 of the Fisheries and Marine Resources Act 2007, any person who owns a boat should register it with the Ministry of Fisheries and Rodrigues. A register is maintained for fishing boats whether used by professional fishermen or not. The register contains the particulars of every such boat. Additionally any person who is a party to any sale or transfer of a fishing boat is required to notify same to the Ministry within 14 days from the loss, destruction or sale of the boat.

1.2.3 Fish Aggregating Device (FAD) Fishery

The lagoon fishery is heavily exploited and with a view to reducing fishing pressure in the lagoon, sine 1985 Government has initiated a programme for the setting of Fish Aggregating Devices (FADs)[4] around the island (Roullot et al. 1988). The categories of boats operating around FAD in Mauritius are artisanal, semi industrial boats and game fishing crafts. In Mauritius, the dories are generally 6 to 8m wooden planked boats with outboard motors. Semi industrial vessels are well equipped fishing vessels generally 10 to 15m long and three metre wide with central engines. Game fishing craft of 4-17m are also well equipped, propelled by either central or outboard engines. The game fishing craft operate principally on the south west, north and eastern coast of the island. The sports fishery catch is estimated at 600 tonnes with majority of catch being the marlin and tunas. Reliable data are lacking as the landed catch is beyond the control of the Fisheries Protection Service (FPS); moreover, as they are registered with the Ministry of Tourism, they are not bound by law to report landed catch. The main species caught around FADs are yellow-fin tuna, albacore, skipjack, dolphin and wahoo. The big-eye tunas are most abundant at depth greater than 200m depth. Surface catches consist of small yellow tuna, alabacore, bonito,wahoo and dolphin. The annual fish catch around FADs is estimated to be around 400 tonnes.

1.2.4 Offshore banks

[3] The shallow lagoon area has witnessed over-fishing in the last two decades.

[4] A Fish Aggregating Device is a floating structure made up of a row of highly resistant floats mounted on a nylon rope and anchored in the open sea using polypropylene ropes and scrap irons as anchors.

The banks are fishing areas located along the Mauritius-Seychelles ridge. They are known as Saya de Malha, Nazareth, Soudan, Albatross and St Brandon groups of islands. The banks can be considered as coralline sea mounts with reef slopes along the Mascarene Ridge and the Chagos Archipelago. The upper surface is found at 50-60 meter depth, and is surrounded by a shallow rim sloping to around 150m and a steep outer slope. Primary productivity is low (0.15 mg Carbon per m^2 per day) except for a few upwelling areas. In 2009, there were 7 fishing vessels and around 400 fishermen operating in the banks fishery. The total catch amounted to 2230 tonnes of fish comprising mainly of lethrinids while the MSY for the banks fisheries is estimated at around 4 200 tonnes (Soondron, 2009). Table 3 highlights the landings from the various fisheries in Mauritius (overleaf).

Table 3: Total fish production (in tonnes)

Sector	2004	2005	2006	2007	2008
Artisanal fishery					
Mauritius	1 043	947	950	640	682
Rodrigues	1 204	1 040	1 067	1 067	1 758
Agalega	30	30	30	30	30
Sports fishery	650	650	650	650	650
Amateur fishery	300	300	300	300	300
Barachois	4	5	4	2	2
Ponds (prawn & fish)	32	23	20	17	62
Marine aquaculture (cage)	325	367	447	550	181
FAD Fishery	-	-	214	164	167
Sub-total	**3 588**	**3 362**	**3 682**	**3 420**	**3 832**
					Offshore demersal fishery
Shallow water banks	3 216	2 178	3 112	2 848	2 428

Banks deep water snappers	7	--	0	0	285
St Brandon inshore	204	414	235	*54	*173
Semi-industrial chilled fish	284	223	311	171	173
Tuna fishery	1 640	1 402	1 380	803	475
Semi-industrial pelagic fish	97	177	247	184	41
Demersal trawlers	1 595	2 584	1 112	0	0
Sub-total	**7 043**	**6 978**	**6 397**	**4 060**	**3 402**
Grand Total	**10 631**	**10 340**	**10 079**	**7 480**	**7 234**
*=only chilled and salted					

(Source: Ministry of Fisheries Annual Report 2008)

2. Human Environment

2.1 Socio-economics

Two socio-economic surveys of the artisanal fisheries have been conducted in 2007 and 2008 respectively. Sobhee (2007) found that many fishers have an income level which is below Rs300 per day and very few of them do perform an additional job. In addition, most fishers have children who are students and whose wives are non-working citizens. Thus, the household income would be more or less equivalent to that of the head of the household. Many fishermen do save part of their income for use during non-fishing days. The expenditure of fishers is mostly absorbed in the purchase of food items and rarely does this community spends on education of their children; the limited income does not allow for it. Also, not much is spent on rent, as would be the case with low income households, because most of the fishers own a house or at least live in one for which they do not have to pay any rent. Most of the fishers have an average monthly consumption expenditure of at least Rs 4,000.

It is a fact that several fishers are indebted. However, in spite of their low collateral, some of them have been able to contract a loan from the Development Bank of Mauritius (DBM) or an alternative source to purchase a boat or its engine. Their limited income, the lack of formal arrangements and limited education make them indepted to money-lenders or fishmongers.

However some fishers prefer to borrow from the DBM, as the latter is rather flexible in providing loans for the purchase of boats and equipment under several schemes to assist fishermen.

Fishers claim that there is a decrease in their fish catch due to pollution and coastal development, in particular hotel development. They also want to receive some compensation against the pollution caused by hotels along the coastline. They argue that this waste water released by hotels contains chemicals which are harmful for the corals in the vicinity of the hotel and the juvenile fish in the lagoon. The community acknowledges that hotel development generates income in the regional economy through linkage effects but may not necessarily provide direct benefits for the fishing community. It is argued that jobs which are created are mostly occupied by more educated people from elsewhere, essentially from the urban areas.

Fishermen are willing to stop fishing for some time as long as they would receive a compensation[5]. It is to be noted that very few would be willing to change jobs immediately or be trained for another job. With this precarious situation, they would also discourage their wards to choose fishing to earn a living because of the constantly declining income and the risks involved.

New strategies would have to be devised to attract youngsters to replace the present generation and fish around off-shore FADs and in semi-industrial fishing.

Appavoo (2008) observed that artisanal fishers have a poor life style both in Mauritius and Rodrigues. Those who are not boat owners often have to look for a secondary occupation to make ends meet. For boat owners, particularly those involved in lagoon fishing, they find it hard to repay their loan at the Development Bank or to relatives. When sand extraction[6] was permitted, several fishers in a year were carrying sand as the business was more lucrative. Presently, all fishers have reverted to fishing, thus causing overfishing capacity in the lagoon. Sand extraction is still permitted in Rodrigues.

2.2 Fishermen Associations

One of the characteristics of the Mauritian artisanal fishing industry is that only a minority of fishermen are grouped in associations in order to best protect their interest. This phenomenon which is the result of the absence of the spirit of self help, self reliance and mutual aid characteristic of certain societies, has resulted in the lack of interest for group action in order to improve the standard of living and quality of life, and is the root cause of the state of exploitation which has for long been prevalent in the fishermen's milieu. The lack of education, particularly among the older generation in the coastal areas aggravates their situation as they tend to depend exclusively on intermediaries (banians) and other traders to carry out their activities.

[5] Fishermen in Mauritius and Rodrigues are paid a bad weather allowance during bad weather days when they do not venture at sea. They also receive an allowance during the closed season in the net fishery.
[6] Sand extraction was banned in Mauritius in 2005 because of its adverse effect on the marine environment.

In the early seventies a Federation of Fishermen Co-operatives was created to care for the interest of such fishermen. To enhance the activities of the Federation and to pave the way for the marketing of fish direct to consumers by Co-operatives, facilities for the reception, storage and dispatching of fish were put up at Cap Malheureux, Tamarin and Port Mathurin (Rodrigues) where in the early eighties, three 'Maison des Pecheurs' were put up equipped with cold and refrigeration modules, ice-making machines and transportation infrastructure by way of isothermic trucks.

There are presently 18 societies affiliated to the Mauritius Fishermen's Co-operative Federation, which also sells by-catch landed by foreign fishing vessels calling in the port area. It is observed that many Fishermen's Co-operatives deal directly with middlemen for the marketing of their catches due to inability of their members to realize the benefits of group action, a situation sometimes resulting from their lack of education.

Fishmongers behave more than just intermediaries between the fisher and the retailer. They own boats, hire fishers and lend them money in case of hardship. They seem to have a special working relationship, and play a crucial role both in the production and supply of fish in the chain. Fishmongers carry the catch in baskets on motor cycles or in carton boxes in vehicles to district markets or other sale points. None of them use ice during transport and distribution. A training programme for fishmongers has recently been set up with a view to sensitizing them on safety and hygienic aspects.

3. Management of the Fisheries Resources in the Lagoon

The lagoon and outer-lagoon fishery in Mauritius is an open-access fishery. The fishery resources inside the lagoon and nearby outer-reef areas are thus heavily exploited and need careful protection and management for sustained production. The Fisheries and Marine Resources Act 2007, (FMRA) provides for the necessary legal framework for fisheries and marine living resources management. It makes provision for registration of fishermen, collection of fisheries information, setting up of marine protected areas (fishing reserves and marine parks) and fish farming; prohibition of fishing by use of poisonous substances, spears or explosives; close periods for net fishing and fishing of oysters; prohibition of fishing of undersized fish, crabs or lobsters in the berried state, turtles and marine mammals; prohibition of sale of toxic fish and fish products unfit for human consumption; import of fish and fish products and import of fishing vessels and licensing of nets and fishing implements. Provisions are also made for licensing of local and foreign boats and vessels. A local boat needs a fishing licence to fish within Mauritian waters or on the continental shelf, in any fishery on the high seas and in the fishing zone of a foreign state. The Fisheries Protection Service of the Ministry and the National Coast Guard enforce provisions of the FMRA. Catch quotas for the banks fisheries have been imposed as from 1994 and the number of vessels operating on the smaller banks limited through a licensing system. Management plans for the lagoon and off-lagoon fisheries are presently being drafted and the appropriate legislation would be prescribed.

4. Ownership in the Fishing Industry

In 2008, the Government of Mauritius has set up a Fishermen Investment Trust to enable fishers to participate in fishing around St. Brandon and the associated banks. The philosophy behind this is the democratization of access to the fishery resources of Mauritius to the fisher's

community at large. It is anticipated that such policy will lead to increased access to capital and support services in favour of fishers and at the same time assist in the expansion of small scale fishing operations in fishing zones not previously accessible to them. In the short term, the effect will be to maintain the existing level of employment in the fishing sector, whereas in the long term it will sustain the economic activity of coastal fishermen and small scale operators.

Fishermen and small scale operators would be given access to commercial fishing licences to meet both economic development and social objectives including employment and self-determination. Presently, commercial fishing is one of the few opportunities available for the artisanal fishers provided that the resource sustainability is maintained. Commercial access in the fishing sector for artisanal fishers represents a tangible recognition of ownership of the sea-resources. Hence, the setting up of a Fisherman Investment Trust for fisher's integration into the development of the fishing sector through access to resources is considered as the way forward to putting fishers at the centre of development.

The role of the Fisheries Division is vital in the process as it has the responsibility to manage the fisheries in an environmentally sustainable way that benefits the whole fishing community. A key component for success will be the skills and ability of the fishers to manage fishing businesses. The Fisheries Training and Extension Centre (FiTEC) of the Fisheries Division has the responsibility to provide the necessary technical expertise and training.

5. Assistance to Fishermen

With a view to assisting the artisanal fishermen, the Government of Mauritius provides the following incentives to registered fishers:

- Duty concessions for purchase of inboard and outboard motors;
- Soft term loans (Rs 200,000 at 3% interest within a period of 8 years comprising of a moratorium of 1 year) in support to the artisanal fishers. All loans granted are insured by the Development Bank in favour of fishers.
- A loan guarantee fund for assistance to artisanal fishers willing to move to the outer reef FAD fishery.
- Safety equipments (life jackets, life saving buoys, radar reflectors and tarpaulins) are provided free of cost to artisanal fishers.
- Training is provided to artisanal fishers with a view to re-orienting fishers in new viable operations (FAD, chilled fish, semi-industrial).
- A Bad Weather Allowance (Rs 200/day) and a Close Season Allowance for net fishers are in place with a view to supporting artisanal fishers during bad weather days and closed seasons for specific gears.
- Registered fishermen who are admitted to hospital in account of sickness are paid an allowance (Social Security Allowance) for a period of two weeks as from the date of admission.
- A non-contributory insurance of Rs 200,000 for loss of life at sea is in place under the aegis of the Fishermen Welfare Fund.
- Artisanal fishers are being encouraged to join the National Pension Scheme to be eligible for retirement benefits

6. SWOT Analysis

Coastal fisheries in Mauritius include the multi-species, multi-gear lagoon fishery exploited at a relatively artisanal level by fishermen and women, and the more technologically advanced fisheries that occur outside the fringing reef. The latter have been developed in response to the policy of Government to promote the diversion of fishing effort from the over-exploited lagoon towards the exploitation of off-lagoon resources. With the exception of Fish Aggregating Devices (FADs) deployed close to the shore, there is little potential for the direct involvement of the artisanal fishermen in the sector. The other fisheries require greater capitalization and may be termed Semi-Industrial. A SWOT Analysis is provided in Annex 3.

7. The Way Forward

The following strategies are proposed for the modernization of the artisanal fisheries sector, thus creating more opportunities for the fishermen to uplift their socio-economic conditions:

- Reduction of fishing effort in lagoons ;
- The transfer of fishing effort to other fisheries outside the lagoons, and to other sectors of the economy, and the provision of adequate training to achieve this;
- The rehabilitation of the lagoon environments;
- Development of a management plan for the lagoon and off-lagoon fisheries;
- Better utilization of fish resources through value addition and further development of the export oriented processing industry;
- Provision of appropriate fiscal and monetary incentives to promote the fisheries;
- Introduce more effective resource assessments for management.
- Where possible, the involvement of the local community in management decisions and monitoring of closed areas should be encouraged.
- Direct involvement of artisanal fishermen in the near-shore (within 10 miles) FAD fishery and provide appropriate training;
- Recognising the success of the FAD fishery in Mauritius, investment should now focus on upgrading the fishing boats to enable them to fish far away from shore;
- Direct involvement of artisanal fishers in the semi-industrial fisheries through the development and strengthening of the Fishermen Investment Trust. It should also require that fishermen be appropriately trained in the new technologies required;
- Investment in shore based activities must occur in parallel with those aimed at increasing production from the new fisheries;
- Review the infrastructure requirements at landing sites used by artisanal and semi-artisanal fishermen in Mauritius. Such facilities should include as appropriate to each location: provision of ice machines, cold storage, storage facilities for fishing gear, retail provision of fishing equipment, maintenance and servicing facilities, fish retail facilities;
- Continue the monitoring of existing and new fisheries, including the collection of social, economic, biological and catch-effort data;
- Introduction of a fisheries information management system which is central to the strengthening of fisheries management capabilities;
- Training programmes to address the help the fishermen community and dignify the profession;
- Maintain and further develop the mangrove planting projects in Mauritius. Mangroves are an important habitat for juveniles of many reef and lagoon fish. They also help to trap sediments arising from soil erosion and thus prevent the smothering of corals.

8. Overview of the Fisheries Sector in Rodrigues

Rodrigues is a small basaltic island and is the second largest in the Republic of Mauritius situated at about 650 km to the north-east of Mauritius, at nearly 900 km to the east of Reunion Island, and at 1540 km to the east of Madagascar, in latitude 19^0 South and Longitude 63^0 East. As at December 2000, the population[7] of Rodrigues stood at around 35,000 and they depend largely on crafting type agriculture, with livestock and maize being the main products (Central Statistical Office Census, 2002).

Fishing is a major activity in Rodrigues and is of a strategic nutritional importance for individual households, with annual per capita consumption estimated at about 50 kg. Most of the fishing is done within the reef, which extends around the island, forming a shallow lagoon with an area of 240 km^2. Fishing is also carried out beyond the reef. The banks beyond the reef vary in depth between 20 m and 80m, and cover an area of 800 km^2.

The Fisheries sector in Rodrigues is presently dominated by the artisanal lagoon fisheries exploitation, which is presently at its turning point. The exploitation rate has exceeded the maximum sustainable level and the stocks of the lagoon commercial species are under excessive pressure. There is also the problem associated with the degradation of fish habitats. As the lagoon has been silted and overexploited, revenue from exploitation of such resources as octopus is decreasing. There are presently some 2000 registered fishers in Rodrigues. Most of these fishermen and fisherwomen are forced, on a seasonal basis, to look for supplementary sources of income but have difficulties to identify good opportunities.

Rodrigues has a relatively vast expanse of lagoon and outer reef fishery grounds. Efforts have been made to tap fishery resources other than the artisanal fisheries sub-sector. The latter produces 1800 tonnes of fresh fish annually for the island's population. About 1,200 tonnes of frozen octopus are sold on the Mauritian market. The fisheries sector in Rodrigues, if developed rationally and exploited sustainably could become an important source of fish supply to the Mauritian market. Mauritius presently imports 60% of its local fish and fish product consumption.

The marine resources exploited in Rodrigues are found both in lagoon and off-lagoon areas of the island. The area of potential fishing grounds in Rodrigues amounts to 1,688 km^2, an area greater than that in Mauritius. No classification has been established yet but about 600 species of fish have been encountered and more than a hundred mollusc species. Open sea fishes are usually migratory. The setting up of Fish Aggregating Devices (FADs) enables the fishers to spend more time at a particular point.

The main fishery is artisanal fishery in the lagoon while off-lagoon fishing has not developed at a steady rate because the investment required for acquisition of appropriate offshore fishing vessels and the absence of entrepreneurship willing to take risk in this sector.

The artisanal fishery provides most of the fish supply on the local market in Rodrigues. The main fishing gear used comprises fishing net, basket trap, spears, harpoons and line fishing. Six FADs

[7] Central Statistics Office Census (2002)

have been placed outside the lagoon for fishermen to move from the heavily over-exploited lagoon.

The main organisations directly involved with the conservation and sustainable use of aquatic resources are:

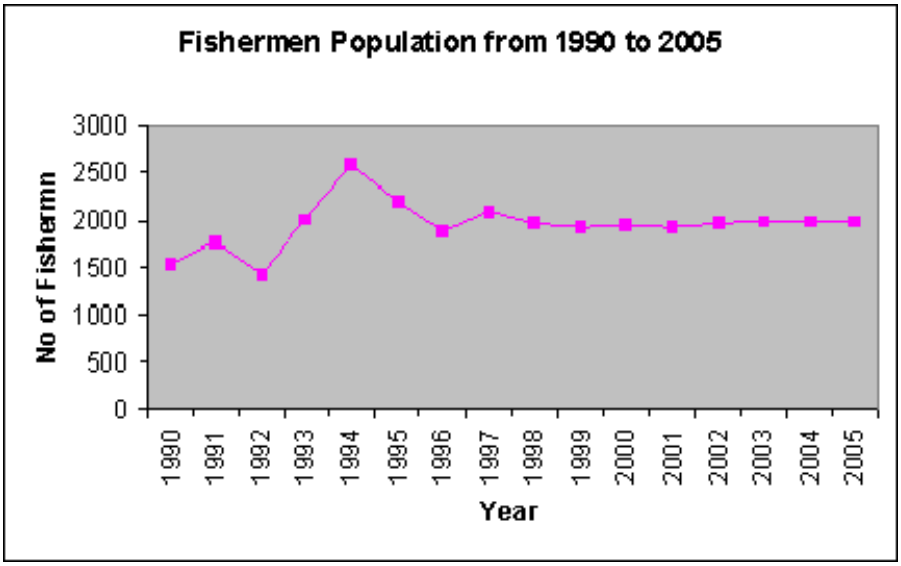
- Commission for Fisheries (Fisheries Monitoring and Enforcement Service and Fisheries Research and Training Unit (FRTU))
- Commission for Public Infrastructure and Environmental Issues
- Police Department - National Coast Guard
- Forestry Department
- Shoals of Rodrigues and other NGOs, including Rodrigues Underwater Group)

In 1995, the FAO Investment Centre outlined strategies especially for the artisanal fisheries sector of Rodrigues. These were aimed at decreasing fishing effort in the lagoon fisheries and transferring some of that effort to agriculture, to off lagoon FAD fishing and to the semi-industrial fisheries

Appavoo et al. (2007) made the following observations on the small-scale fisheries sector in Rodrigues:

- The lagoon fisheries have experienced an increasing exploitation rate that nowadays the catch may have exceeded the maximum sustainable level.
- The number of fishermen has been increasing slightly from 1998 to 2005 while the trend in the number of fisherwomen has been cyclical during the same period (Figure 2a and b overleaf)
- One of the reasons contributing to such increase in the number of fishermen is the introduction of Bad Weather Allowance in 1984.
- 78% of the Fisherman fall under the age group of 20-45 years old (Figure 3 overleaf)
- The fisheries sector of Rodrigues is mainly traditional (artisanal). The octopus fishery with harpoons is the most common fishing method in the lagoon of Rodrigues. Other methods in use are seine nets, hand lines and baskets (traps).

(a.)



(b.)

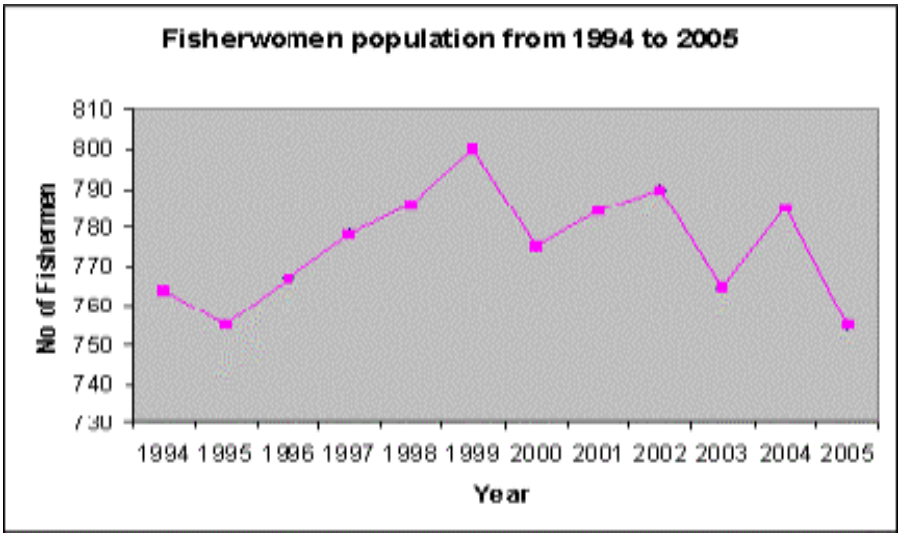


Figure 2. (a) Fishermen population 1990 – 2005 Figure 2. (b) Fisherwomen population 1994 – 2005

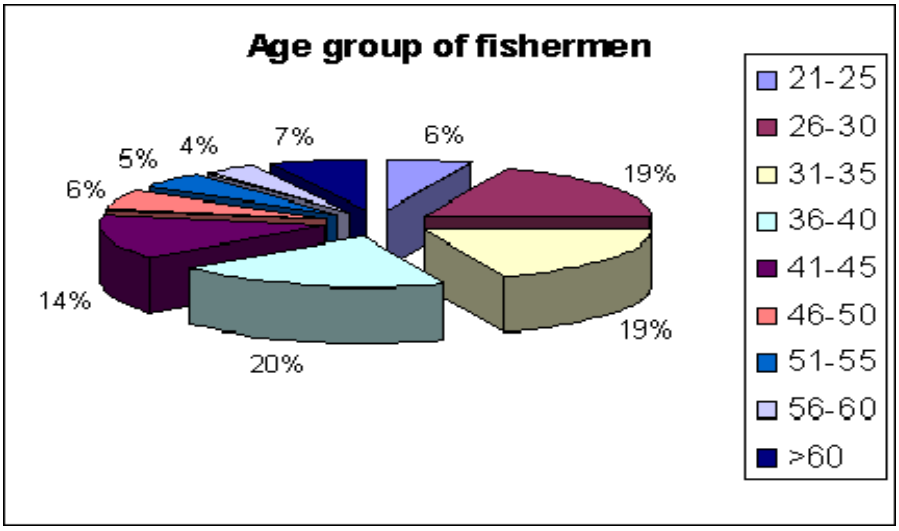


Figure 3. Age group of Fishermen in Rodrigues.

- Some 2000 fishermen and women are registered with the Fisheries Protection Service in Rodrigues out of which approximately 780 are fisherwomen who are concerned mainly

with octopus fishing. There were some 1000 pirogues (small open sailing canoes) and 146 fishermen were involved in off-lagoon fishing in the year 2006.

- Yearly catches of octopus are on the decline (Figure 4 below).

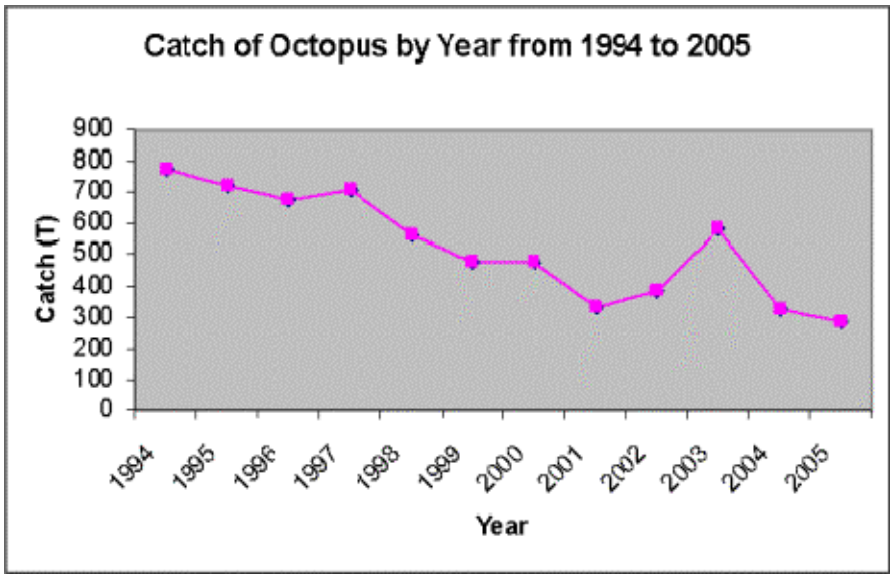


Figure 4. Rodrigues annual catch of octopus

- The development of the off-lagoon fishing has been slow in Rodrigues due to lack of entrepreneurs and that off-lagoon fishermen do not have appropriate boats and other equipment to venture in the off-lagoon.
- The fishers are having difficulties in attracting finance to construct or purchase larger boats required for off-lagoon
- Both the harpoon and seine net octopus fishery are considered to be disastrous for the sustainability of the ecology of the reef as well as being responsible for depletion of existing stocks. There are now only 8 official permits for large seine nets in Rodrigues, 22 holders of a bait net permit, and 13 holders of a shrimp net permit.
- There is also some sports fishing outside of the lagoon near the FAD located in the north of Rodrigues.

8.1. Strategies for developing the artisanal fishery in Rodrigues

One of the alternatives is off-lagoon fishing, which is in line with the government policy to protect and manage the lagoons. However, fishermen are not used to off-lagoon fishing such that they need specific training.

Infrastructure is necessary to support the shift from lagoon to off-lagoon fishing and includes landing sites, the dredging of deeper port access channels, safety bouys etc.

Other priorities relate to the restructuring of the fishing sector on Rodrigues with new initiatives for a well implemented marine and fisheries research programme that will monitor fish stock trends and inform policy makers of targets and limits of exploitation and areas of needed investment.

Further, it is recognized that the sector needs to be properly structured with appropriate institutional and legal framework in place.

Marketing and branding strategies need to be developed so as to expose the Rodriguan products on the international market thereby increasing revenue for the benefit of the Fisheries sector and hence the overall economy.

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ANNEX 1

A classification of the Fisheries of Mauritius, indicating the potential for further exploitation

Ecosystem	**Depth**	**Area***	**Fishery type**	**Fishery**	**Potential**
Lagoon/barrier	0-10m	Mauritius, 300 km^2 Rodrigues, 270 km^2	Artisanal	Multi-species, multi-gear, small scale	Over-exploited

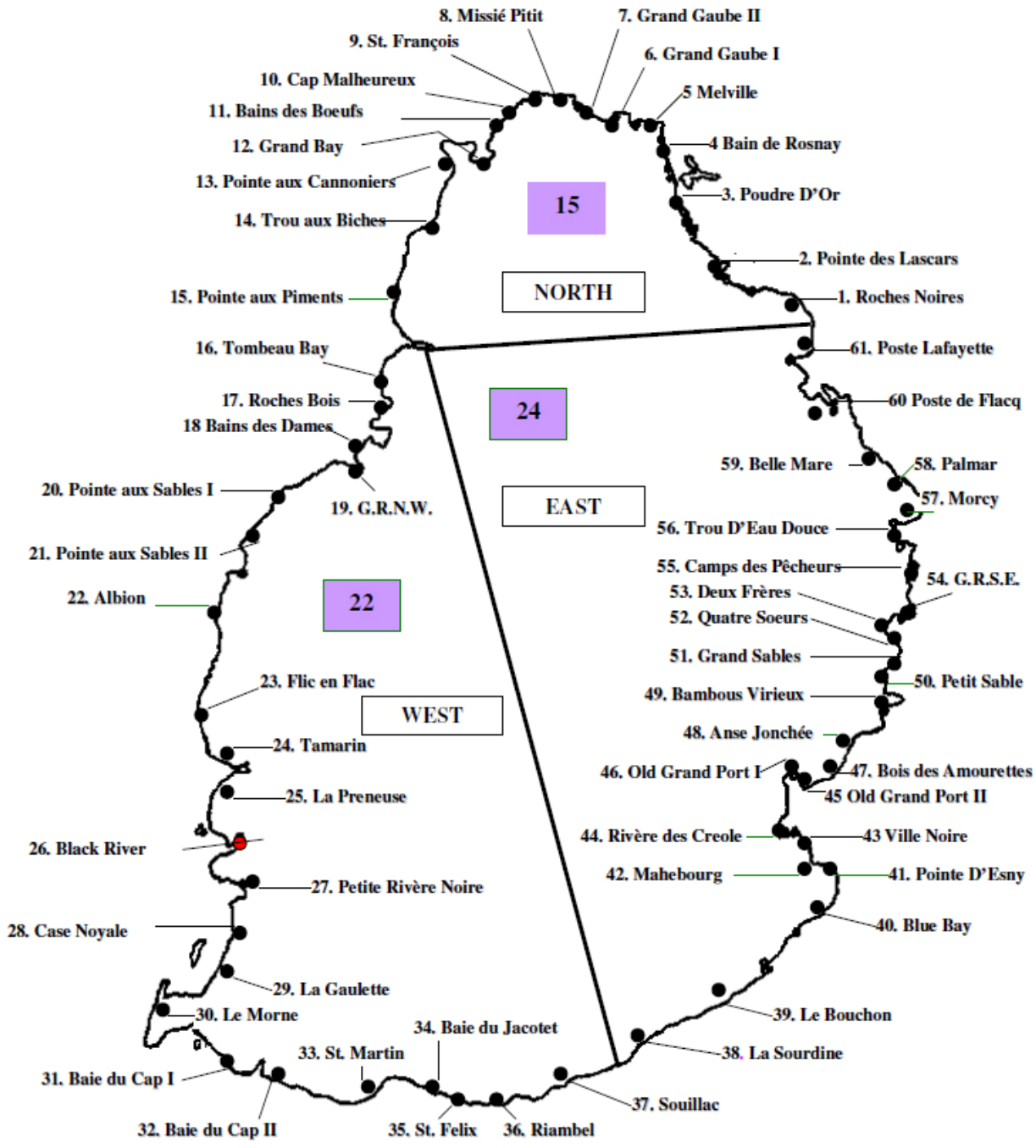
			Commercial/diving	Aquarium fish	Moderately exploited
Off lagoon	10-300m	Surface area to 18km from shore: Mauritius 4000 km^2; Rodrigues 3,500 km^2	Artisanal, demersal	Demersal fishery, principally hand-line	Over-exploited;
			Artisanal, pelagic, Semi-industrial	FAD fishery for pelagic species	Uncertain potential
			Sports, amateur	Open water trolling (some demersal species)	Moderately exploited
Continental mid-slopes around Mauritius, Rodrigues and the oceanic banks	300-1000m	Total, 75,000 km^2; Mauritius, 9,000 km^2, Rodrigues 3,500 km^2	Semi-industrial	Deep water shrimp	Unexploited potential 200 t pa
Bank and sea-mount fisheries: - Within 360 km of Mauritius and Rodrigues; - Remote banks, >360 km of Mauritius and Rodrigues	Shallow banks surface to 50 m; deep reef slopes	8000 km^2 150,000 km^2	Semi-industrial	Shallow and deep water demersal fish marketed chilled;	Unexploited potential Mauritius and Rodrigues

			Semi-industrial	Miscellaneous species	Unknown
			Industrial mother-vessel and dories	Shallow water demersal fishery;	Fully- exploited
			Industrial – electric reels, others	Deep water demersal fishery	Unexploited
			Industrial –pelagic trawls	Small pelagic species	Unexploited, 13,000–26,000Mt
			Industrial	Miscellaneous species	Unknown
Oceanic waters	1000-5000m	1,6m km^2	Semi Industrial, within 360 km of Mauritius and Rodrigues	Domestic sword-fish fishery	Moderately exploited
			Industrial tuna fisheries	Domestic purse seine; Foreign purse seine and long line	Potential for long-line vessels

*Habitat area sourced from FAO Rep. 110/95 IFAD-MAR 9, 1995

ANNEX 2

Map of Fishing Landing Sites



Albion Fisheries Research Centre

ANNEX 3

SWOT Analysis

Strengths	**Weaknesses**
• Coastal fishery resources exploited mainly by registered fishermen; resources well managed. • Marine protected areas and fishing reserves exist. • Low capital investment needed to harness the fishery resource in the sector; simple fishing techniques such as nets, traps and lines. • Minimum expenses in terms of costs of operation (short distance to fishing ground). • Relatively good catch from net and trap fishing. • Ready market for fresh fish caught. • Good knowledge of the fishing grounds.	• Resource limitation. Catch rates low. • Access to open sea is limited to certain areas with reef passes. • Recreational fishermen conflicts with artisanal fisheries resource use. • Enforcement is difficult. • Low earnings in the artisanal fishery. Revenue relatively low. • Few young people are willing to join the fishery. • Due to a lack of collateral, fishermen cannot get access to loans. • Safety equipment is expensive. • Lack of infrastructure facilities including supplies of fresh water, ice and electricity at some landing stations.
Opportunities	**Threats**
• Good pelagic fishery resources exist in the open ocean. • Relocating fishing effort to offshore areas; such as fishing around FADs and the semi-industrial fishery. • Training of Fisheries Protection Officers to better control fishing activities. • Availability of demersal fish stocks on the shallow-water banks and on the deep slopes. • Use of new fishing techniques along with echo-sounders, GPS and hydraulic reels. • New types of boats. • Value addition to catch. • Product development for export markets. • Registration of amateur and	• Conflicts among multiple users; namely fishers, amateur and tourists. • Marine aquaculture may create conflict. • Pollution from land based activities. • Impact of certain fishing activities on the marine environment.

recreational fishermen	

II. Tourism – Prepared by Dr. David Picard,

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The Republic of Mauritius (RoM) comprises the islands of Mauritius, Rodrigues, Agalega, Saint Brandon and other islands. It has a total land area of 2040 km2 and a coastal line of 322 km. The main Island Mauritius, located 1000 km east of Madagascar, has an area of 1865 km2 and an estimated population of 1.24 million of inhabitants in 2010 and one of the highest population densities of the world (with nearly 600 inhabitants per km2). Rodrigues, the second largest island of the RoM, located some 650 km2 north-east of Mauritius Island, is much smaller with an area of 108 km2 and has a population of around 38 000 people in 2010. Since 2002, Rodrigues has been granted with the status of an Autonomous Region enabling the island to manage locally a considerable array of affairs.

Since the early 1980s, the RoM has been experiencing accelerated economic growth, mainly due to the successful diversification of its economic activities from a mono-crop sugar economy. This economic growth has resulted in a considerable improvement of the quality of life of its population. However, pockets of poverty persist in various places in the country, partly as the result of institutional constrains which do not allow the whole population to benefit fully from the economic development. High school dropout levels together with high land prices are major causes of poverty. Moreover, due to their relative isolation, the islands of Rodrigues and Agalega have only marginally been involved in the economic growth process of the main island and therefore face context-specific development issues, in particular high unemployment. Both islands have seen major migration flows to the main island Mauritius.

Mauritius and Rodrigues are volcanic islands endowed with exceptional marine and land ecosystems with high level of endemicity. They are almost completely surrounded by coral reef that provide for lagoons and long stretches of coral white sand beaches, which represent significant resources for tourism development. The sustainable management of these fragile environmental assets, currently threatened by various forms of degradation, is a major challenge for the sustainable development of the tourism industry.

1. Coastal Tourism Overview

Mauritius is predominantly a beach-holiday tourism destination. According to the *Survey of Outgoing Tourist 2006*[i], 74% of the tourists who visited Mauritius were on leisure holiday, 14% of them on honeymoon, 7% on business and 3% visiting friends or relatives. The remaining came for shopping, sports or medical treatment. According to this same survey, 82% of the visitors stayed in hotels, 6% in bungalows, 4% in boarding houses and 8% with friends. The number of tourist arrivals in Mauritius was 761, 063 in 2005 (Table 1). Arrivals from Europe (579,509) accounted for 66.5% of total tourist arrivals in 2009. In 2009, the room occupancy rate for all hotels averaged 61% for a total room capacity of 11,456 with 23,235 bed places. There is a high dependency on the European market. France is the leading emitting market with 31.6% of total tourist arrivals in 2009.

Tourism development took off in Mauritius in the early 1970s. It has since then undergone a continuous growth and succeeded in achieving a distinctive form of relatively high yield tourism. It has contributed significantly to the diversification of the mono-crop sugar cane economy and has been a major factor in the overall development of the island. It is considered as one of the "four pillars" of the Mauritian economy – alongside sugar cane, textile and financial sectors. With the end of the GATT in the early 2000s, the sugar and textile industries no longer benefited from preferential access to the European markets. Subsequently, Mauritius faced a transition from dependence on preferential trade to open competition in the global economy. In this context, the tourism sector was called upon to be a major engine of economic growth. Tourism development and growth are predominantly driven by macroeconomic needs owing to its important contributions in terms of employment, foreign exchange and local revenue.

Table 1: Contribution of the 'Hotel and Restaurant' sector to the economy during the past five years (2005-2009)

	Unit	2005	2006	2007	2008	2009
Value added	Rs Bn	12.4	15.5	19.5	20.0	18.2
Value added/GDP	%	7.7	8.5	9.4	8.6	7.4
Real Growth rate	%	+5.6	+3.5	+14.0	+2.7	-6.4
Tourist arrivals	No.	761,063	788,276	906,971	930,456	871,356
Gross earnings	Rs Bn	25.7	31.9	40.7	41.2	35.7
Employment	No.	21,035	21,341	22,245	24,565	22,840
Investment	Rs Bn	4.2	6.6	10.1	11.9	12.7
As a % of total investment	%	10.6	14.8	17.9	18.3	18.1
Real Growth rate	%	-24.5	+46.8	+39.2	+8.0	+5.5
Number of hotels	No.	99	98	97	102	102
Number of rooms	No.	10,497	10,666	10,857	11,488	11,456
Room occupancy rate	%	63	66	76	68	61

Source: Bank of Mauritius, 2009 Annual Report[ii] (1 US$ = approximately 30 MUR)

Table 2: Employment in the tourist industry by gender (2009)

Establishments	Male	Female	TOTAL
Restaurants	1,558	751	2,309
Hotels	15,217	5,314	20,531
Travel and Tourism	2,466	1,616	4,082
Total	19,241	7,681	26,922

Source: Ministry of Tourism[iii]

In August 2010, the Minister of Tourism and Leisure, Nanda Bodha, announced plans to reverse what he called the euro-centered strategy of the tourism sector and to focus on India and China which were both growing rapidly but still under-exploited by Mauritius[iv]. The Government has

also established a New Tourism Intelligence Unit, a recommendation of the National Tourism Sector Strategic Plan (2008-2015), to provide regular data and analysis covering overseas tourist markets, especially the new target markets in Asia. The Minister also announced a major new orientation of making Mauritius a major shopping destination thus allowing a diversification of the tourism product currently based mainly on beach leisure activities. Two major luxury shopping malls are under construction.

2. Biophysical Environment

Mauritius is of volcanic origin and forms part of the Mascareignes Archipelago which also comprises Réunion and Rodrigues. If the origin of Rodrigues is not well elucidated, it is known that Mauritius and Réunion have emerged from the same volcanic hotspot between 8 and 3 million years ago. Mauritius has a coastline of 322 km of which 243 km consist of beaches.

There are three main coastal zones where tourist activities are concentrated. Theses zones are as follows[v]:

- North Zone from Pointe aux Piment to Grand Gaube with 42 km of coastline;
- East Zone from Roches Noires to Trou d'eau Douce with 39 km of coastline; and,
- South West Zone from Le Morne to Flic en Flac with 37 kilometres of coastline.

The first big hotel resort clusters were implanted in areas characterised by long stretches of white sands (>0.5 km) and good access to the sea. Beaches adapted for bathing activities represent about 20% of all beaches, in total a stretch of around 10km. In 2009, 89 out of the 102 hotels in operation were located on the coast. Most of the coastline, about 250 kilometres, has been assigned the status of state ownership since 1795, commonly known as *Pas Géometriques*, under the French administration of the island.


Mauboussol
Islands Found in the North of Mauritius
Afrique
Madagascar
Ile Maurice
Ile de La Réunion

The *Pas Géométriques* are constituted by a strip of coastal land of 80,21 metres wide from the high water mark. The vast majority of the internationally renowned upscale beach resorts are located on these *Pas Géométriques*, which are temporarily leased to hotel developers.

From the 1960s, the state started to lease the *Pas Geometriques* as *campment sites*, sites of 0.5 hectares or more for the construction of private bungalows. The vast majority of these *Campments* were initially secondary houses on the beach developed by city dwellers. Later, some of these started to be used as primary residences or were rented to tourists or wealthy expatriates. The growth of the tourism industry and the overall increased purchasing power by the local populations gave rise to an increased demand for land in the coastal zone. For many people, investment in non-hotel accommodation and informal rental of holiday flats to tourists represented a new livelihood opportunity. Moreover, the emerging Mauritian middle classes adopted seaside fashions brought in from abroad; many choose to live on the coast or to have a secondary house. This double dynamic led to important land developments especially in the North and South Western Tourism Zones (for instance in the coastal village of Flic en Flac[vi] in the South West Zone).

These fragmented and often informal land developments provoked a series of adverse impacts on the environment:

- Some of theses development took place on natural drains and reclaimed wetlands thereby undermining their ecological functions of absorbing, regulating and filtering run-off;
- Due to a lack of law enforcement developments frequently ignored planning guidelines defined within public planning documents (National Physical Development Plan, National Development Strategy, Outline Schemes,…) creating significant “eye sores” in the natural landscape; for instance, the construction of two or three storey bungalows on very small land plots;
- Some areas have been developed without proper sewage system. The wastewater used to be discharged in individual pits or septic tanks giving rise to superficial or subterranean drainage of effluents or of inadequately filtered water in the lagoon.

The environmental degradation resulting from theses impacts represents a threat to the local economy as it undermines the very resource base of tourism activities. Furthermore, the backfilling of wetland areas for property development and high density development are major causes of flooding. Run-off and pollution into the lagoon are major sources of degradation of lagoon ecosystems leading to the acceleration of beach erosion and upsetting the coastal equilibrium.

Besides these important informal or at least poorly planned developments, a formal hotel sector has developed within a number of tourism development clusters. Here exists a range of quality hotels run by international hotel groups (some based in Mauritius) (e.g. Prince Maurice, Touessrok, St Géran, Royal Palm, etc.) and also more modest budget hotels. The *Tourism Development Plan* of 2002[vii] conducted a quality analysis of hotels and proposed the following classification:

- 25% of hotels were considered as Luxury Hotels (5*, 5* deluxe & 6*) many of which are world famous;
- 48% as Quality Hotels (4*&5*) which include first class hotels just below the level of luxury hotels;

- 17% as Value Hotels (2 to 4*) which are good quality hotels aiming at value;
- 10% as Budget Hotels which were in some cases of very good standard yet lack direct access to the beach or offer relatively few facilities.

The hotels, especially the high quality and luxury ones, are mainly low-density developments, adopting style elements of Creole architecture, and are usually well integrated into their natural surroundings. The major ones with more than 80 rooms are required to have their own wastewater treatment plants. Unfortunately, this obligation does not apply to smaller hotels. On the whole, the formal sector of the tourism industry can be considered to be a positive force for environmental enhancement and a leader in bringing about environmental improvements. The hotels run by the major international hotel groups play here a role of mainstreaming environmental management principles within the wider tourism economy.

Beach erosion is the major environmental problem threatening the tourism industry in Mauritius. Besides the haphazard development and inadequacy of the sewage system, beach and water recreational activities as well as bad fishing practices are considered as major causes for this problem. Moreover, disturbances to the stability of beach by vehicles and trampling have been contributing to beach degradation and erosion. The impact is noticeably more important on public beaches which are frequented by high number of visitors. To ensure an integrated management of public beaches, a Beach Authority has been created in 2002[viii]. It has been very active in zoning public beaches and encouraged the creation of parking areas to prevent vehicles from circulating on any part of the beach. The Beach Authority also provides facilities to the public, plants trees and landscapes the back areas of beaches thereby contributing to the stabilization of the beaches.

Additional tourism-related pressures on the marine environment include leisure activities such as snorkeling and diving, and the use of pleasure crafts which are important causes of coral damage. To deal with these tourism-related impacts, a Tourism Authority has been set up in 2004[ix] with the objective to regulate the tourism development in Mauritius and to ensure its sustainable development. It has the power to issue, renew, and suspend licenses in the tourism industry. One of its objectives is to reduce the number of pleasure crafts operating in the sector and has already set limitation on the power of engines for the pleasure crafts. Mooring buoys are increasingly installed in the lagoon and in the open water near the back-reef to prevent coral damages. Unsustainable fishing practices are another cause of lagoon ecosystems degradation. These often result from a general lack of environmental awareness among amateur and professional fishermen, but also the partly ineffective surveillance by the Fisheries Protecting Services. To reduce pressure on coastal fisheries, the Ministry of Fisheries encourages traditional fishermen to exploit resources offshore or to explore other livelihood options[x]. A network of Marine Protected Areas has been created in order to allow the recovery and the conservation of lagoon ecosystems. The management of theses protected areas needs however to be improved based on international best practices.

As part of the 1990 *National Environmental Investment Programme*, Mauritius has developed a *Sewage Master Plan,* which aims to develop a comprehensive sewage network system at the scale of the main island. Priority has been given to urban regions where works started first. A sewage system currently exists in the Northern Tourism Zone, though not yet in the South Western Zone which had recently seen an important urbanization.

3. Human Environment

Mauritius is composed of a wide area of flat low land on the coastal zones and some discontinuous mountains surrounding the central plateau. It has therefore a relatively large extent of arable land and in 1986, 48% of the total land area was under agricultural cultivation. The historical mono-culture of sugar cane has favoured a compact form of human settlements. Historically, the employees of the sugar cane industry lived in rural villages close to the sugar cane fields or exploitation sites while smaller fishermen communities had created coastal villages. Many of the latter had developed after the abolition of slavery when the freed slaves were allowed to settle freely on state land. The island's various settlements were connected by a well-developed road network that facilitated the transportation of sugarcane and ultimately that of sugar to the capital city Port Louis for export. The good linkages of the settlements with Port Louis and the short distances facilitating daily commutation have favored a rural life despite the fact that Mauritius has a very high population density[xi]. In 2008, only 42 % of the total population lived in the big conurbation Port Louis and the other five towns of the central plateau: Beau-Bassin/Rose-Hill, Quatre Bornes, Vacoas and Curepipe. The rate of urbanisation is kept very low at less than 1% yearly.

It is estimated that the population below the poverty line amounts to 8% of the total population in 2006[xii]. In 2001/2002 the relative poverty line is estimated 2,804 Mauritian rupees per adult equivalent per month[xiii]. A socio-economic study of the fishing communities of Mauritius[xiv] indicates that 74% of fishermen interviewed earn an income of less than 500 MRU a day. Most of them fall below the line of poverty. Most of them have low education level and come from social backgrounds. These facts illustrate a situation of poverty extending to entire local communities living in the coastal areas, currently largely excluded from the tourism development happening in these areas. Given that most of the holiday makers spend much of their time in the restricted areas of the high quality hotel resorts in the coastal areas and spend most of their budget there, as indicated by the *Tourist Outgoing Survey Report 2006*, a considerable amount of livelihood opportunities are linked to the hotel systems (supplying industries, employment, shareholders). Yet, interviews conducted by ReCoMaP[xv], indicate that the large majority of the employees of beach resorts come from the urban centres of the island whereas only rarely from rural and coastal communities. According to available sources, there are no policies that would facilitate the integration of the coastal communities in tourism developments. This social exclusion is further emphasized by a socially segregated access to beaches. Indeed, an official distinction exists between public beaches and resort beaches, which makes the latter de facto private.

There are 90 declared public beaches administered by the Beach Authority. The demarcation between public and reserved beaches gave repeatedly rise to conflicts of access to beaches and lagoons for fishermen. A study commissioned by Ministry of Tourism in 1998, shows that tourism is well accepted by the local populations while "there is a fear that with an increasing number of tourists and more hotel/bungalow construction, locals' rights will be impinged upon further"[xvi]. According to a very high official, a Principal Tourism Planner, at the Ministry of Tourism, Chamarel which is a mountain tourist destination, is the only exception to this rule. In this unique mountain tourist village, local inhabitants are fully involved in the hospitality sector. It should be noted however that some fishermen have been able to engage themselves in the pleasure craft activities but these are few.

4. Policy and Governance

Tourism policy-making and planning are responsibilities of the Ministry of Tourism, Leisure and External Communications. However given the cross-cutting nature of the tourism sector and its strategic importance to the country, its planning is closely monitored and influenced by the top-most level of the Government.

The main policy currently guiding the development of the tourism sector is based on a 2006 decision by the Government in 2006 to reach a target of 2 million annual tourist arrivals in 2015. To guide this growth objective, a *Mauritius Sector Strategic Plan on Tourism* (2008-2015)[xvii] has been elaborated in 2007. It adopts the same principles of tourism development as did the 2002 *Tourism Development Plan* yet emphasizes some of the new challenges for the industry. The core approach is to maintain the policy of attracting low volume-high spending tourism audiences by means of targeting the up-market segment. According to the plan, there is no environmental limitation to the growth of tourism given the relatively small number of expected tourists in relation to the resident population (50,000:1, 300,000) and the low density of hotels in Mauritius (4 hotels/km^2) as compared to that of many other islands (e.g. 115 in Caymans, 77 in Bermuda, 13 in Barbados and 7 in Martinique)[xviii].

Given the cross cutting-nature of the tourism sector, the *Mauritius Sector Strategic Plan on Tourism (2008-2015)* proposes the setting up of a high Level National Council of decision makers as well as a Project Co-ordination Unit to promote coordination among the stakeholders. One important aspect is also to promote linkages between the tourism sector and other sectors like the agricultural sector so the benefits are widely distributed across the sectors and the population. Furthermore, the National Development Strategy calls for the preparation of *Action Area Plans for the Tourism Zones* as defined in the NDS.

In a context of a quickly spreading global economic crisis, Mauritius' tourism sector has in 2009 experienced a contraction of 6.4 % in real terms as compared to the performance of the previous year, the first contraction since 1982. In response to the effects of this crisis, the Government launched in 2010 the Economic Reconstruction and Competitiveness Program (ERPC) at a cost of 12 Billion Mauritian rupees (380 m US$) over 5 years. One of the main objectives of the ERPC is to promote diversification in the tourism sector through further investment[xix] in tourism facilities and new promotional campaigns. The budget provision for tourism diversification was increased to 2.7 billion rupees (89 m US$) over the next five years.

With the new Corporate Social Responsibility (CSR) policy, which mandates companies to invest 2% of their book profit in social and environmental activities there is a real opportunity to develop pro poor policies that aim towards integrating the community in the development process but this requires a strong local development approach which is not very much known in the Mauritian administrative and public affairs culture.

5. Planning and Management

A major concern for future developments exists in the shortage of available land in the coastal zone. Given this scarcity, encroachments on public beaches or on Environmentally Sensitive Areas will have to be minimized. Moreover, new land policy approaches are also needed, so as to make private land available for tourism development. Developments complementary to the

all beach model are currently being publicly encouraged. Options are forms of cultural and nature tourism, and the creation of new facilities such as golf courses, wellness and shopping centers, marinas, and museums. Several developments of this type have already been initiated under the program *Integrated Resort Scheme* (IRS), initiated by the Government in 2002.

The quality of natural environments is the single most important asset for the Mauritius tourism industry. The country has a well-established framework for the conduction of environmental management. The Department of Environment has here a leading role in the policy implementation and environmental management. The 1999 *National Environment Policy* (NEP, renewed in 2007) the *Environment Protection Act* (EPA) 2002 provide a legal framework to regulate the growth of hotel activities on the beaches so as to keep their impact on the environment minimal. The 2007 NEP strengthens the consideration of tourism developments within the country's Integrated Coastal Zone Management (ICZM) plan (among others in an effort to gain "Green Destination" status). The EPA establishes the regulatory process and statutory bodies for the Preliminary Environmental Report and Environmental Impact Assessments which are essential tools for environmental management. These two latter environmental management tools are to be further reinforced to enhance environmental management in Mauritius. Various tools exist for the implementation of environmental policy: the *Environment Sensitive Areas Report* (ESA) of 2009, the ICZM plan of 2009, the *Policy Planning Guidelines* (PPG) based on the *National Development Strategy* (NDS) of 2003 and the *National Environmental Strategy* (NES) of 2008.

Major hotels, with more than 80 rooms represent 76% of both total room capacity and total bed places (in 2009). The predominant role of very large hotels in the tourism sector in Mauritius suggests that mechanisms need to be found to promote participation of micro-businesses to operate in the sector while at the same time constraining and regularising informal businesses. This requires some change in current practices mainly focussed on promoting economic growth, employment and foreign exchange. It also requires opening opportunities for local producers to integrate the value chain of hotel operators and benefit from training programs (offered in particular by the international hotel groups). A number of programs geared towards local communities have been initiated. Among others companies are currently mandated to pay 2% of their book profits towards programs that contribute to the social and economic development of the country. Moreover a Tourism Fund, funded by investors and hotel developers, has been created to financially contribute to community projects.

6. Development, Trade and Projects

While the Mauritius' 2002 Tourism Master Plan aimed at attaining the target of 1.5 million international tourists visiting Mauritius per year by 2020, the government decided in 2006 to modify this target and aimed instead at achieving 2 million tourist arrivals by 2015. It is expected that tourist arrivals for the year 2010 would be around 915,000. The new objective would imply more than doubling the performance of 2010 within only 5 years. Over the past 25 years, the growth of tourism has been uninterrupted and exceptional. It is owing to the fact that the Government has emphasised up-market tourism development generating a relatively higher economic impact and employing more staff (upscale hotels have a much higher staff-per-client ratio) than mid-range tourism developments.
With the new objective of attaining 2 million arrivals by 2015, the Government currently faces a challenge of maintaining the same growth pattern of high value tourism. As illustrated by the

figures in Table 1, the growth of the sector during the past 5 years has been lower and less steady as compared to the continuous high growth (around 9%)[xx] observed during the previous 20 years (1985 to 2005). Table 1 also demonstrates that the revenue and the employment generated by the sector depend on the number of tourists visiting the country. Information obtained from the Ministry of Tourism and l'*Association des Hôteliers et Restaurateurs de Maurice* (AHRIM) indicates that 35 new hotels are currently under construction (all but one in the coastal zone of the island) which is to generate 3787 additional rooms by 2014. In addition, one hotel is being renovated, 4 are being reconstructed and 2 extended.[xxi].

To develop new coastal resorts, the government introduced three major schemes allowing non-Mauritian citizens to buy property in the islands: Integrated Resort Scheme (IRS), Residential Estate Scheme (RES) and the Invest-Hotel Scheme (IHS). IRS has so far proven most successful in achieving its aims. It is based on the concept of creating ensembles of luxury villas built to international standards with high level facilities primarily meant for foreign investors and sold at a minimum price of US$ 500,000. Investors are offered vast tax benefits. Current price levels for bungalows already built as part of this scheme range from US$ 850,000 to US$ 2,5 million. IRS already approved and currently on sale include[xxii]:

- The Tamarina Golf, Spa & Beach Club
- Anahita The Resort
- Akasha
- Belle Rivière Estate
- Les Villas de la Plantation d'Albion
- Matala Lifestyle Estate and Spa
- Villas Valriche
- Les Villas Telfair
- Les Salines
- La Balise Marina
- La Reserve Leisure Resorts Ltd - Solares
- River Club
- Dolphin Coast Marina Estate Limited
- Bouigue Developpement (Mauritius)

The RES scheme was launched in 2005. It consists of smaller scale investments in resort developments. It does not impose a minimum investment and is geared both toward foreign investors Mauritian land owners. A detailed list of around 30 approved RES can be found on the Board of Investment website. The IHS scheme is designed to allow property developers to sell hotel rooms, villas, suites or any other part of a hotel to individual buyers during and after their construction. While this scheme facilitates better financial planning of new hotel projects, it offers individual buyers the facilities of an exquisitely-furnished new luxury resort hotel with amenities like full-service spas, health and fitness centres, resort-style pools, sophisticated business centres and maid service and the promise of rental income.

Tourism related projects

Project and Agency	Contact
Prime Minister's Office The *Maurice Ile Durable (MID)* project. Is an ambitious government programme that aims towards energy autonomy for the island Since 2008. Funding: Government of Mauritius, AFD, taxes, EU	Mr O Mohamed, www.maurice-ile-durable.com
Association pour le développement durable (ADD) The stabilisation of a severely eroded coastline around Poudre d'Or Village Historic site with the collaboration of coastal communities and awareness raising on the sustainable development of coastal and marine resources Since 2009 (Funded by Regional Programme for the Sustainable management of the Coastal Zones of the Countries of Indian Ocean –ReCoMaP)	Mr S Ragoonaden, Coordinator Tel: 465 0116 e-mail: rajouma@yahoo.com
Association of Inbound Operators Mauritius (AIOM) Empowering Tourist Guides to implement sustainable tourism and environment protection principles Since 2009 (Funded by ReCoMaP)	Jeenarain Soobagrah, Coordinator Tel: 208 3013 e-mail: soobagra@intnet.mu www.aiom.mu
Mauritius Marine Conservation Society (MMCS) Etude de faisabilité pour la mise en place d'une Aire Marine Protégée sur la Côte Sud-Ouest de Maurice Since 2009 (Funded by ReCoMaP)	Emilie Anderson, Coordinator Tel: e-mail: eanderson@mmcs-ngo.org www.mmcs-ngo.org
Reef Conservation Mauritius Innovation in ways of communication for the sustainable management of Balaclava Marine Park Since 2009 (Funded by ReCoMaP)	Kathy Young, Manager Tel: 262 6775 e-mail: admin.reef@intnet.mu www.reef-mauritius.com
Reef Conservation Mauritius Mainstream Marine Conservation and Resource Management in Coastal Zone Management through Tourism Industry in Mauritius Since 2008 (Funded by ReCoMaP)	Kathy Young, Manager Tel: 262 6775 e-mail: admin.reef@intnet.mu www.reef-mauritius.com
Association des Hôtels de Charmes (AHC)	Mr Mungroo, Chairman

Implementing environmental friendly best practices in Small and Medium Hotels in Mauritius Completed (Funded by ReCoMaP)	Tel: 453 8558 http://www.smhan.net

7. SWOT Analysis of the Coastal Tourism Sector[xxiii]

Strengths	**Weaknesses**
• Outstanding natural landscapes (including quality beaches and several WHS) • Outstanding cultural heritage (archaeological, historical and WHS) • Good tourism planning and management capacity at ministry level • Commercially competitive tourism Products • Outstanding notoriety and up-market brand image in source markets • Mix of mid range, up-market and top end tourism infrastructures organised in coastal tourism clusters • Direct airline connections with source markets • Good vocational training facilities	• Focus on beach tourism products • Limitation of coastal land • Strong social disparities and persistence of poverty 'pockets' in particular in coastal areas • No income generating objective of national park administrations • Insufficient liquid waste management in urban coastal areas • Coral reef depletion and coastal erosion • High population density • Strong dependency on tourism economy • Tropical diseases (e.g. Chikungunya)
Opportunities	**Threats**
• Macro-economic growth and diversification, job creation and poverty reduction through alternative livelihoods • Innovative environmentally sound hotel constructions (e.g. use of alternative energy technologies) • Land and sea based ecotourism Activities • Asset preservation through good governance of tourism-conservation nexus • Socio-professional empowerment and Economic democratization at community level • Creation of regional pole of excellence in tourism education and training	• Up-market tourism brand threatened by mass tourism image • Anthropogenic and natural pressures on coastal environments and resources • Direct environmental damage due to tourism activities leisure crafts, diving, etc.) • Further coral reef depletion, acceleration of coastal erosion • Non-accessibility of the poorest to the tourism economy • Transformation of cultural practices and sites (e.g. ceremonies, cemeteries) into spectacle economy • Drinking water scarcity • Transport infrastructure congestion

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[ii] Bank of Mauritius (2010) *Annual Report – Year ending 30 June 2009*, Port Louis, p23

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III. Mariculture - Prepared by Dr. Thomas Ashley Shipton,

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1. Introduction

Farming Activity	Culture Species	Culture Technology	Production Scale	Annual Production (2008)	Employment	Number of Farms	Consumption		
							Export	Domestic	Household
Goldlined Sea bream, Red Drum and Cobia	Rhabdosargus sarba, Scianops ocellatus and Rachycentron canadum	Cage culture	Commercial	750 tons	65	1[1]	X	X	

[1] In 2009, only one farm was in operation, however a further six mariculture licences had been granted (NIFS, 2009).

2. Biophysical

Farming Activity	Geographical Extent	Environmental Issues
Marine finfish	Mahebourg	Mauritius is in a cyclone region, and the impacts of storm events on cage culture operations could potentially result in catastrophic production losses. During cyclone events, small near shore cage systems need to be brought ashore and the fish harvested prematurely, thus small-scale cage culture is an unattractive development option. However, larger scale open-water cages can be designed to be sunk for short periods, reducing damage risks. To mitigate the effects of cyclones, the potential to develop large scale submersed cage culture technology in the deeper waters needs to be assessed. This would represent a complex and expensive technology transfer that would likely require government support.
Seaweed and sea cucumber farming	Lagoon areas in Rodriguez	Rodriguez has extensive lagoon areas that provide significant scope for the development of small scale mariculture operations, most notably seaweed farming and sea cucumber ranching. However, at present there is no substantive mariculture expertise on the island, and while feasibility studies have been undertaken to establish the mariculture potential, significant resources will be required to realise these developments.

3. Human Environment

Farming Activity	Developmental Paradigm and Livelihood Issues
Marine finfish	Marine finfish culture in Mauritius is being developed as cage culture operations in the lagoon and offshore areas. The sector has the potential to provide significant employment opportunities in the coastal zone. The current farm at Mahebourg employs in the region of 65 people and produces approximately 750 tons per annum. The aquaculture Masterplan indicates that there is some (limited) potential for small scale livelihood opportunities (oysters / mussel farming) in the near shore areas and the barrachoise (marine inlets), possibly as a component of eco-tourism developments. However, in contrast with lagoon and offshore cage culture, the potential for small scale mariculture to significantly impact on coastal livelihoods remains small. Furthermore, potential conflicts with other resource users, such as the tourist sub-sector, makes access to coastal land expensive, further curtailing the potential for the small scale sector.

4. Policy and Governance

4.1 Policy

Legislation	Present	Comment
Fisheries Act	Yes	Fisheries and Marine Resources Act (Act 27 of 2007)
Aquaculture Act / Bill	Yes	Mariculture activities in Mauritius are legislated for under the Fisheries Act (Act 27 of 2007). The Act enables the Minister to grant discretionary permit exemptions to individual farmers. In 2007 an Aquaculture Activities Bill was developed to provide the legal framework for the development of sea based culture systems. This bill has now been promulgated into law.
Aquaculture Policy	No	While the Fisheries Act is regulatory in nature, to date no formal aquaculture policy has been developed, Nevertheless, the Aquaculture Masterplan (strategic development plan) is generally viewed as filling this policy vacuum. Notably, it is anticipated that sector development will focus on large scale commercial production and less on small scale / artisanal production.
Sub-Sector Development Plans	No	
Aquaculture Masterplan	Yes	The Masterplan is restricted to Mauritius and does not include Rodriguez. The Masterplan is a comprehensive document comprising the usual components that would be anticipated in such a document – potential culture species, technology requirements / transfers, potential culture zones, policy requirements, institutional issues etc. On Rodriguez, The Strategic Action Plan and IFAD Rodriguez Seaweed Feasibility Study have identified opportunities and constraints to mariculture development.
Aquaculture Zoning	Yes	The Aquatic Business Activities Act was primarily designed to legislate for the leasing of the lagoon areas, and it is anticipated that the legislation will be used to designate the aquaculture zones that are proposed in the Strategic Development Plan

Environmental Management Acts	Yes	The Environment Protection Act (2002)
EIA Requirements	Yes	Guidelines for Coastal Water Quality (General Notice No. 620 of 1999) provide information regarding coastal water quality requirements for mariculture. Under the revised Environmental Protection Act (2002) aquaculture is not a listed activity. However, unlisted activities that are likely to have an impact on the environment are usually subject to an EIA (requested by the relevant Minister). It is therefore highly likely that any commercial scale aquaculture development would require an EIA

4.2 Governance

The Ministry of Agro Industry, Food Production and Security, Department of Fisheries Research Services: Aquaculture Division is responsible for the management and development of aquaculture in Mauritius. With respect to the administration of mariculture developments, The Board of Investment (BOI) acts as a one stop shop for commercial applications, and ensures that the relevant permits are obtained from MAIF, and that the environmental legislation is adhered to.

The adoption of the Aquaculture Business Activities Act alters this system somewhat, and an Advisory Council incorporating the relevant government departments will decide permitting issues. While there are no sector specific incentives for mariculture development, the Finance Bill (2006) has been designed to attract foreign investment to Mauritius through the blanket introduction of low corporate taxation and tax breaks.

The country's extension and research facilities are restricted to the Albion Research Centre (MAIF). Currently, funding at Albion is a major constraint, and the facilities are underutilized. Nevertheless, Albion has excellent research facilities and a research staff that are able to provide assistance to the sector – most notably in respect to research assistance and the provision of water quality monitoring services. MAIF (Albion Centre) ensures that all new aquaculture projects have baseline environmental data collected, and are monitored over the project lifecycle for environmental impacts - e.g water quality degradation, sediment pollution etc. In addition, the Government Veterinary Services (MAIF) are developing protocols for the export certification of aquaculture products. Currently, there are no mariculture research facilities or capacity at the University of Mauritius.

On the Island of Rodriguez, mariculture administration capacity within the Commission for Fisheries is weak and the Commission relies heavily on support and advice provided by the Albion Fisheries Centre on Mauritius. Applications are submitted to the Commission for Fisheries, which takes the responsibility of running the application through the relevant departments. Under the current system, applications are screened by the Departments of Environment, the Town & Country Planning Office, Ministry of Agro Industry and Fisheries, Ministry of Public Infrastructure, Transport & Shipping. Applications must comply with all

environmental guidelines. As yet there are no requirements for an Environmental Impact Assessment for proposed developments.

5. Planning and Management

The Mauritian Government has identified the mariculture sector as having significant growth potential. In 2006, the Board of Investment commissioned an aquaculture master plan. Completed in 2007, the Masterplan proposes potential sites / zones for aquaculture, identifies potential culture species and technologies, and identifies potential physical, technical and legal constraints to development.

The Masterplan focuses on developing commercial culture in the lagoons and the open sea (multiple species; minimum farm size 300 tons per annum). Under the developmental paradigm outlined in the Masterplan, the focus of future developments will be to promote large scale commercial mariculture based on cage culture technology and primarily based in the lagoons and open ocean, with alternative technologies being applied to a lesser extent in the barrachoise, and inland areas. In total, the Masterplan indicates that the sector could produce in the region of 27,000 to 29,000 tons of product per annum (lagoon - 15,000 tons per annum; open sea - 10,000 tons per annum; barrachoise – 2,000 tons per annum; inland – 2,000 tons per annum).

With respect to the scale of developments, it is interesting to note that no mention of small scale mariculture is made in either the Fisheries Act or the Aquaculture Business Activities Act, suggesting that the government generally view mariculture development in Mauritius as a large scale capital intensive enterprise following the Mahebourg example. Note: this is unlikely to be the case at the Albion Research Centre which has a history of supporting small scale farmer models through seed supply and extension services.

To date, there has been no Masterplan developed for Rodriguez. Mariculture opportunities and constraints have been identified in the Strategic Action Plan for Fisheries and by the IFAD Rodrigues seaweed feasibility study. In addition, several intergovernmental organisations and NGOs have also identified mariculture as an important component of ICZM. These include UNDP, ReCoMaP and the Shoals of Rodrigues programme. The Island Regional Council (IRA) has also recognised the potential of mariculture on the Island and is actively promoting the development of the sector. The primary opportunities comprise seaweed and sea cucumber culture in the lagoon. In 2002 the Ministry of Fisheries commissioned a study, through the FAD Fishery Development Sub-Programme (IFAD Loan 504-MU: Rural Diversification Programme) on the feasibility of seaweed farming in the Rodrigues lagoon. It was recommended to establish a demonstration farm and IFAD is currently in the process of developing the business plan and the implementation strategy for the farm. If executed, the project will, amongst others, provide the necessary technical back-up and extension capacity for the development of seaweed farming on Rodrigues. A review of the feasibility study suggests that the Rodrigues lagoon is ideally suited for the farming of Gracillaria (agarophyte) and Eucheuma (carageenophyte) and that seaweed farming has substantial potential.

In terms of management capacity, there is no technical mariculture capacity on Rodrigues and this is one of the greatest constraints facing the development of the sector on the Island. There is an urgent need for training both at the administrative and bio-technical level.

6. Development, Trade and Projects

In 1987, the Japanese International Cooperation Agency (JICA) initiated a programme to develop prawn culture on Mauritius. Despite a successful technology transfer, the private sector failed to embrace the technology – primarily due to high capital investment costs and the limited availability of coastal land.

In 1989, JICA funded the development of sea bream culture for trial culture in barrachoise. Seed production techniques were mastered, and fingerlings were regularly released in the coastal waters for stock enhancement. More recently, the Albion Fisheries Research Centre attempted to acclimatize the marine prawns for growing in freshwater in inland water bodies; however, the results were not encouraging, and it is reasonable to suggest that the potential to develop prawn farming on the Island is limited. Seed production of crab has also been attempted, however attaining sufficient juveniles for commercial grow-out remains problematic, and the potential for commercial production remains limited. Edible oysters and mussels have also been attempted; however low nutrient levels in the water column, and the slow growth rates associated with the culture species suggest that there is limited scope to develop commercial operations.

In 2008, Norad initiated a 3-year programme of co-operation between the Centre for Development Co-operation in Fisheries, the Norwegian Institute of Marine Research, the Directorate of Fisheries and the National Institute of Nutrition and Seafood Research (NIFES), and the Ministry of Agro Industry and Fisheries (MAIF) in Mauritius. The aim of the project is to share expertise on management of fisheries and fish farming activities. NIFES is contributing expertise to develop monitoring systems for the island's fish farming activities. This includes the production of fish feed, the use of therapeutics and the control of residual therapeutics in fish.

7. SWOT Analysis

Strengths	**Weaknesses**
• High quality seawater • Presence of a Sector Plan • High level of Government interest in developing the sector • Research and monitoring support capacity at Albion • Support for mariculture development from the Bureau of Investments • Existing fish processing and aquafeed production capacity • One stop shop for exports	• Limited Extension Capacity • Acces to the Coast • Poor status of funding at Albion Research Centre • Institutional perception that mariculture should be restricted to large scale developments • No research capacity at the University of Mauritius
Opportunities	**Threats**

• Increased government and / or bilateral support for mariculture development • Greater and dedicated NGO involvement • Large scale commercial mariculture • Integrated approach to value addition and export using diverse national resources • Support services for aquaculture development	• User conflicts in the marine environment • Cyclones • High level of competition for coastal land - particularly with respect to coastal hotel development • Limited access to the Barrachoise • Theft and vandalism

8. Recommendations to Promote Sectoral Development

With the adoption of the Aquaculture Activities Bill in Mauritius, the development of an aquaculture Masterplan for the Island, and the support for sectoral development from the Board of Investment, the framework for the development of the commercial sector on the Island has been set.

On Rodriguez, there is potential to develop livelihoods opportunities in the seaweed culture and sea cucumber sectors. However, there is currently no credible capacity on the island to develop these sectors. Without capacity and successful demonstration projects there is very little chance that mariculture initiatives on Rodrigues will succeed. As a starting point, it would be appropriate to support the development of the IFAD seaweed demonstration farm that was proposed for the lagoon (IFAD Loan 504-MU: Rural Diversification Programme). Realistically this is the most appropriate concept to stimulate mariculture development on the Island, particularly since it will be developed as a self-sustaining economic unit, and if successful it will demonstrate the biotechnical feasibility of marine farming on the island. Should this intervention and technology transfer prove successful the obvious next step would be to investigate the potential to promote sea cucumber ranching on the Island.

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Sector Development Plans

Government of Mauritius, Aquaculture Masterplan

http://www.gov.mu/portal/site/fisheries/menuitem.631fb833e0bded6e7f7a98ada0208a0c/

The Rodrigues Islands Strategic Action Plan

www.gov.mu/portal/sites/moasite/download/rod_islets_strategic_plan.pdf

IFAD Rodriguez Seaweed Feasibility Study

http://operations.ifad.org/web/ifad/operations/country/home/tags/mauritius

The Aquatic Business Activities Bill

http://www.gov.mu/portal/site/agroind/menuitem.d490d8adc962f9036a7a98ada0208a0c/?content_id=20f740d877293110VgnVCM1000000a04a8c0RCRD

Strategic Development Plan

http://moi.gov.mu/publication/StrategicPlan.pdf

IV. Agriculture and Forestry - Prepared by Dr. Elizabeth Ann Daley,

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1. Introduction

About 95 per cent of the entire population of the Small Island States of the WIO, namely Seychelles, Comoros, Mauritius, and La Réunion live within 100 km of the coast. Their combined population is about 2.78 million (Wio-Lab 2008).

Fuelled by booming exports, Mauritius has recently become an upper-middle-income country. Tourist arrivals have risen by some 45 per cent in the past decade. The Government is encouraging foreign investment, particularly in financial services and information technology. Rapid economic growth and strong social policies have translated into longer life expectancy, lower infant mortality and a significant reduction in poverty (IFAD 2005a). The contribution of tourism increased from 3 per cent of GDP in 1995 to 13 per cent in 2001 and the total direct employment in the tourism industry has more than doubled from 1990 to 2001, increasing from about 9,000 people to 20,000 people. Mauritius is also planning to develop new and upgraded resort complexes near the coast, with a total area of 2,000ha (Ibid).

Sugar cane processing is the main industrial activity in Mauritius, with 18 sugar mills producing 500,000 tonnes of sugar in 1994. The manufacturing sector, dominated by textile and clothing has been a growing industry since 1970. However, the declining sugar prices and end of an era of preferential trade agreements with the European Union, as well as growing competition for Asian textile manufacturing industries, is increasingly putting pressure on these traditional employment sectors (Wio-Lab 2008).

Forty three per cent of the land in Mauritius is used for agricultural purposes, with 90 per cent of this land planted with sugar cane. The rest of the agricultural land is used for tea, tobacco and food crops. The main food crops cultivated are onion, tomato, chili and eggplants. The past decade has witnessed a constant conversion of agricultural lands to land for industrial and urban development. In this context agricultural land has decreased by approximately 5,500ha over the past ten years (Wio-Lab 2008)

Nonetheless the agricultural sector has been the backbone of the Mauritian economy until the establishment of an EPZ. Arable land devoted to sugar production is gradually decreasing, and in 2006, the share of agriculture in the national economy was 5.5 per cent. Besides sugar cane, the other activities namely livestock, food crops and fishing also contributed to the agricultural sector. From the data available in 2005, sugar cane, tea and tobacco contributed to 52 per cent of the overall agricultural production in terms of output; food crops and others 19 per cent; livestock and poultry 14 per cent and fishing 4 per cent (Ministry of Environment and NDU 2007).

Agriculture has also witnessed a continuing decline in its economic importance from around a 30 per cent share of the national economy in the early 1970s, dropping to around 13 per cent in the late 1980s and 5 – 6 per cent now. IFAD's data differs from that of the Ministry of Environment and NDU (2007), however. Sugar (growing, milling and transport) represents nearly 70 per cent of the GDP generated by agriculture and related activities. Food crops generate around 12 per cent, and livestock and poultry production accounts for a further 9 per cent. The remaining 9 per cent are divided among fishing, fruits, flowers, forestry, tea and tobacco (IFAD 2005a).

2. Biophysical

Mauritius has a rich algal flora. Over 160 genera of marine algae have so far been identified from the coastal waters. The Mauritius herbarium has a collection of more than three hundred marine algae. Basket trap fisherman mostly uses algae as baits. Furthermore, over 36 species of seaweeds have been identified in Mauritian waters. Some species of seaweeds commonly found in Mauritius are *Enteromorpha*, *Ulva*, *Sargassum*, *Caulerpa sp*, *Padina* and *Halimeda* (Ministry of Environment and NDU 2007).

Mauritius has an area of 2,040km^2 that is forested, as Table 1 (below) shows, yet the area of good quality native forest, (i.e. that with more than 50 per cent native plant cover), is estimated to cover less than 2 per cent of the island The rest consists of plantation forestry, deer-ranches or highly degraded vegetation invaded by alien plant and animals species. As a result, Mauritian biodiversity is amongst the most threatened in the world.

Table 1: Valuation of Ecosystem goods and services in Mauritius

Coral Reefs		**Mangroves**		**Coastal Forests**		**Sea grass beds**		**Total**
Area	Value	Area	Value	Area	Value	Area	Value	Value

(km2)	(Million US$)	(km2)	(Million US$)	(km2)	(Million US$)	(km2)	(Million US$)	(Million US$)
870	529	1	1	2,040	410	70	133	1,072

Source: Wio-Lab 2008

There are 44 coastal wetlands in Mauritius with two species of mangrove, *Rhizopora mucronata* and *Bruguiera gymnorhiza*, growing around Mauritius. Over the years the extent of mangrove cover around the islands has significantly decreased (from 20 km^2 in 1987 to 14 km^2 in 1994, for example) through extraction for firewood, construction purposes and for providing boat passage (i.e. boat building). The Fisheries and Marine Resources Act, 1998, makes provision for the protection and the conservation of mangroves and stipulates that "no person shall cut, remove, damage or exploit a mangrove plant or part of a mangrove plant except with the written approval of the Permanent Secretary" (Ministry of Environment and NDU 2007).

All of Mauritius' marine ecosystem components are interrelated: wetlands provide a natural buffer, controlling surface water run-off to the lagoon by neutralising pollutants, nutrients and sediments which might damage the lagoon eco-system; mangroves provide a habitat for juvenile fish; invertebrates; and the fringing coral reef protects the coastline of Mauritius from the waves coming from the open ocean and is pivotal to the ecology of tropical oceans.

The freshwater biodiversity of Mauritius is mainly contained within some 90 rivers and rivulets, several man-made reservoirs such as Midlands Dam and Mare aux Vacoas, natural lakes such as Grand Bassin, Bassin Blanc Crater Lake, ponds and marshy areas /wetlands.

Fifteen vegetation types have been classified, varying in species composition and structure, and ranging from coastal sand dune vegetation to cloud forest. Remnants of some vegetation types are concentrated in the Black River Gorges National Park in the south west, the Bambous Mountain Range in the south east and the Moka-Port Louis Ranges in the north west. There are also some isolated mountains which are important e.g. Corps de Garde, Trois Mamelles and Le Morne Brabant, and several offshore islands with remnants of coastal and mainland diversity. About 700 species of indigenous plants occur in Mauritius out of which about 300 are endemic (Ministry of Environment and NDU 2007).

3. Human Environment

In relation to rural poverty, the main opportunities for rural poverty reduction lie in: (a) the sustainable management of marine resources, linked to environmental issues; (b) improving the vocational skills and employability of the rural poor in the growing sectors of the economy (services, construction and tourism); (c) diversifying agricultural production and improving market linkages; and (d) small- and micro-scale income generation, generally through non-agricultural pursuits (IFAD 2005a).

However, the distinction between rural and urban households in Mauritius is unclear. On Mauritius Island, apart from Port Louis and its surroundings, almost everyone lives in villages

where their livelihoods involve farming combined with employment in the manufacturing and service sectors. Rural households are rarely totally dependent on agriculture, but it is nonetheless important. Coastal communities also tend to be isolated from the main off-farm employment opportunities in the sugar industry and remain heavily dependent on marine resources and fishing for subsistence and cash income. On Rodrigues Island, almost all households are regarded as rural and dependent on subsistence agriculture, fishing, microenterprises and part-time (mainly government) employment (IFAD 2005a).

4. Policy and Governance

The second National Environment Strategy was adopted in 1998. Provision was made for the implementation of an Integrated Coastal Zone Management project as one of the priority projects under the National Environment Action Plan (NEAP 2) and the setting up of an ICZM division at the Ministry of Environment and NDU. This division is responsible for the coordination of the various activities with the relevant stakeholders in coastal zone planning and management. Moreover, in the EPA 2002, part VII deals with the coastal and maritime zone management. Provision has been made for the setting up of an ICZM Committee comprised of governmental Institutions as well as NGOs, parastatals and private organisations which are important stakeholders of the coastal zone.

The Objectives of the ICZM Committee are to:

- Develop an integrated management plan;
- Coordinate regional and international projects;
- Monitor coastal water quality and coastal resources including wetlands;
- Conduct and recommend studies on Beach Erosion and propose measures for its control;
- Make recommendations for the upgrading of recreational facilities;
- Coordinate the management of islets and outer islands;
- Make recommendations on guidelines for coastal construction;
- Propose oil spill contingency planning and sensitivity mapping; and
- Generally make recommendations to the Minister on the Management and protection of the coastal zone.

The National Development Strategy was adopted in 2005 by the Government. It is a land use planning tool to guide new developments which defines the different zones of development (tourism, industrial, residential, agricultural) and also gives guidance on the type of buildings and setbacks to be provided. The recommendations are being implemented at local level through Outline Schemes.

The Environment Protection Act gives power to the Minister of Environment to prepare an integrated coastal zone management plan which shall be used for coastal zone planning, management and development. However, no such management plan has as yet been prepared. There has been massive development in the coastal zone without proper planning which is giving rise to several environmental problems such as coastal erosion, pollution problems etc. in different coastal zones. Present policy is to increase the number of tourists with a target of 2 million by 2015. There is therefore an urgent need to establish a comprehensive ICZM framework for the planning of the coastal zone (Ministry of Environment and NDU 2007).

5. Planning and Management

The Ministry of Environment and NDU commissioned a study on coastal erosion around Mauritius in 2002. The main recommendations concerned the implementation of a beach/ lagoon /reef restoration plan including the monitoring of the coastal systems, the regulation of the opening and closure of passes, and the need to address fishing and destructive fishing practices, to establish more marine protected areas, implement a lagoon reef restoration project, and so on. Following this study the Ministry of Environment and NDU set up an Implementation Committee with the collaboration of all stakeholders concerned with coastal zone management to implement the recommendations made by the study. The sites that were prioritised for action were Belle Mare, Flic en Flac, Riviere Des Galets and Grand Bay. Follow up and monitoring of the beaches is also being carried out by the Ministry of Environment and NDU (Ministry of Environment and NDU 2007). The ministries responsible for coastal zone management are more thoroughly explained in Table 2 below.

Table 2: Ministries Responsible for Coastal zone management

The Ministry of Environment and NDU	The Ministry is responsible for the environmental matters and coastal zone. This Ministry was set up in 1989 and the first EPA was promulgated in 1991. This act was revised in 2002 and is now being updated. A Department of Environment headed by a Director of Environment has also been created under the Ministry of Environment. The Director of the Environment is responsible for the enforcement of the environmental laws. The Director issues programme notices, approval notices, enforcement notices, variation notices, prohibition notices and stop orders against any person who breaches environmental laws. Under the EPA there are several committees that have been set up for the control and monitoring of environmental matters.
Ministry of Agro-	The Ministry of Agro-Industry and Fisheries ensures the sustainable

Industry and Fisheries	development and management of fisheries resources, conservation and protection of living aquatic resources and the marine environment in the waters of Mauritius. Its objectives are: • to ensure the proper implementation of government policies in respect of fisheries and • marine conservation; • to provide the legal framework and mechanisms for the management and protection of marine living resources; • to promote responsible fisheries; • to promote the welfare of fishermen; • to ensure the contribution of fisheries to national socio-economic development; • to ensure an adequate supply of fish to the population; • to support and strengthen national research capacity for fisheries development • management and conservation of marine biodiversity; and • to ensure that Mauritius cooperates regionally and internationally for the development management and conservation of marine living resources and the promotion of responsible fisheries.

Source: Ministry of Environment and NDU 2007

6. Development, Trade and Projects

The Mangrove Propagation Programme

This was initiated in 1995 in Mauritius with the main objectives to restore denuded areas with mangroves and propagate them at places where natural regeneration was slow (see Ministry of Environment and NDU 2007). The mangrove propagation programme was implemented and both the indirect method (2-3 months seedlings raised in nurseries are planted) and the direct method (propagules are directly planted) were used for the propagation. The details of the propagation programme from 1995 to 2005 are presented in Table 3 below.

Since 1995, a total of 214,800 of mangrove seedlings were propagated over an area of 129,500m^2. The mangrove propagation programme was in general successful and the overall survival rate was estimated to be around 78 per cent.

Awareness campaigns are also regularly conducted to sensitize the public on the importance of mangroves. The following elements are included:

- Distribution of pamphlets to school children and fishing communities;
- Delivering of talks at community centres and at the Albion Fisheries Research Centre (during guided visits)
- Communication through mass media and press.

Table 3: The Mangrove Propagation Programme from 1995 to 2005

Sites	Period	Number of Seedlings	Areas Covered (m2)	Survival rate
Providence to Baie du Cap (East/South)	June 1995 to June 1996	12,400	23,750	60-70%
Petite Rivière Noire to Le Morne (West)	June 1997 to Dec 1998	47,500	23,750	80-90%
Poudre d'Or to Roches Noire (North)	Feb 2000	40,000	20,000	70%
Providence, Bambous Virieux and Pointe du Diable (East)	March 2001 to October 2002	58,000	29,000	60%
Grande Riviere Noire (West)	April to May 2003	42,000	25,000	95%
Anse Petite Sable and Pte Brochus (East)	April 2004 to May 2004	14,000	7000	70%
Pointe Jerome/ Souillac	2005	900	1000	
Total		**214,800**	**129,500**	

Source: Ministry of Environment and NDU 2007

Reuse of Effluent for Irrigation and to Safeguard Lagoon Water Quality in the Grand Bay

Grand Baie is a village which lies in the Coastal Northern Plains of Mauritius, extending from Trou aux Biches to Cap Malheureux. This village has seen unprecedented growth over the last three decades from being a small coastal village with a few fishermen and the cultivation of sugar cane and vegetables inland to being one of the most populated and frequented tourist resorts (see Republic of Mauritius 2004). Grand Baie is bounded on the southern side by high grounds resulting in all its surface water flowing to the sea through wetlands. This has led to tremendous pressures on the land, with accompanying rising land values, resulting in illegal back filling of wetlands and fast degradation of the lagoon water quality. Unfortunately, the infrastructure development with regard to land use and treatment of waste water did not keep pace with this fast growth.

To deal with these problems, the Government of Mauritius embarked on a Sewerage Scheme for this region. A project was prepared to collect all waste water and sewage for effective treatment. The effluents after treatment will be used for irrigation purposes, mainly in the sugar cane plantations. The project will cover an area of 575ha; details can be found in Table 4 overleaf.

Table 4: Project to Reuse Effluent Water and Safeguard Lagoon Water

Donor	Purpose of Project	Location	Environmental Issues Addressed	Aim
Agence Francaise de Developpement has provided a loan of 11.4 million Euro for financing the project.	The proposed development will not only help in conserving a precious resource, but will contribute towards the improvement of the environmental quality in the whole coastal zone. The project is intimately linked with the management of the coastal zone and fisheries given that Grand Bay is a major coastal resort.	The project is located in the North of Mauritius, extending from Trou aux Biches in the South to Cap Malheureux in the north, passing through Pte aux Cannoniers, Grand Baie and Pereybere. The whole project extends over a shoreline of 20 km, 15 km2 of lagoon, 500ha of coastal touristic agglomerations, 1400ha of urbanised area, 130ha of wetlands and a large expanse of sugar cane plantation.	It helps to increase the volume of freshwater available in the island, particularly in rain-deficit areas. It helps in improving coastal water quality and protection of the coastal zone. It contributes towards improved sanitation and better living environment. It promotes sustainable agriculture and food security	At present only 22 per cent of the population are connected to the sewerage network. The goal is to connect at least 50 per cent of the population by the year 2010 and 80 per cent by the year 2020. The budget for the implementation is US $40m.

Source: Republic of Mauritius 2004

7. SWOT Analysis

Strengths	Weaknesses
• Most population coastal and involved in farming to at least some degree so there are popular incentives to strengthen and support the sector; however most people also have diversified livelihoods which helps with resilience. • Policy measures in place to support the environment to manage coastal resources.	• Heavy and historical reliance on the sugar industry limits long term and sustainable livelihood diversification. • Policies not yet widely implemented, yet efforts to boost tourist numbers are increasing which could put additional strain on delicate coastal resources.
Opportunities	**Threats**
• Tourism could generate more revenues and popular interest in developing livelihoods among coastal people if this is promoted in the form of ethical and eco-tourism. • Programmes to counter past mangrove depletion could be extended.	• Poverty reduces options for coastal communities and encourages illegal activities that are detrimental to coastal resources. • Increasing tourism could undo all coastal management efforts if visitor numbers rise above sustainable levels

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List of Datasets

None found.

List of Sector-Related Projects

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Reuse of Effluent for Irrigation and to Safeguard Lagoon Water Quality in the Grand Bay Area

http://www.unep.org/gc/gcss-viii/Mauritius.sanitation.pdf

See details of this project in Section 6 above.

RECOMAP – the Regional Coastal Management Programme of the Indian Ocean Countries

The RECOMAP programme which is based in Mauritius, issues calls for proposals for supporting different types of projects and activities in relation to all aspects of coastal zone management. Under the First Call for Proposals in November 2007, there were two tourism-related projects supported in Mauritius. Under the Second Call for Proposals, whose evaluation was completed in October 2009, four projects have been funded in Mauritius, two in tourism, one in community environmental awareness-raising, and one focusing on upland soil erosion control in vegetable plantations for protection of the coastal and marine environment, and poverty alleviation of the farmers and fishermen, of the South East region of Mauritius.

See http://recomap-io.org/home/

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V. Energy - Prepared by Mr Francois Busson, E-mail: rafrabus@free.fr

1. Introduction

The Republic of Mauritius is a small volcanic island nation south east of Africa, nearly 1000 km east of Madagascar. In addition to the island of Mauritius, the republic incorporates the islands of Rodriguez, Cargados and Agalega. The country's area is 2040 km2, with a 330 km coast line surrounded by coral reefs that form lagoons bordered by white sand.

Uninhabited until the 17th century, Mauritius was colonized by the French and then became a British colony following the Napoleonic Wars. The Republic of Mauritius became independent in 1968. Port Louis is the capital and the largest city. The official language is English, however, the lingua franca is Mauritian Creole, while television and newspapers are predominately French. Mauritius has a parliamentary system of government. The majority of the 1,300,000 inhabitants are of Indian origin, however, there are many persons of African and Malagasy descent, as well as European and Chinese minorities. Hinduism is the predominant religion, however, there is a significant number of Christians and Muslims.

Fuelled by booming exports, Mauritius has recently become an upper-middle-income country. The government is encouraging foreign investment, particularly in financial services and information technology. Rapid economic growth and strong social policies have translated into longer life expectancy, lower infant mortality and a significant reduction in poverty (1).

Forty three per cent of the land in Mauritius is used for agricultural purposes, with 90 per cent of this land planted with sugar cane. Arable land devoted to sugar production is, however, gradually decreasing due to both declining sugar prices, as well as the end of preferential trade agreements with the European Union.
Sugar cane processing is the main industrial activity in Mauritius, and sugar (growing, milling and transport) represents nearly 70 per cent of the GDP generated by agriculture and related activities

1.1 Oil and Gas Sector overview

Mauritius has no known oil or gas reserves, thus, there is no upstream oil industry. The country does have a significant quantity of renewable energy resources in the form of hydro-electricity, bagasse from the sugar cane industry, as well as woody biomass and solar energy.

Given its economic growth (and therefore its growing energy demand) and its status as a "small island developing State" with a vulnerability to climate change and rising sea levels, Mauritius is focussed on improving "clean energy availability". This trend is outlined in the 2007 Energy policy (2). As for its general approach, Mauritius is encouraging greater competitiveness in the energy sector, avoiding monopolistic market structures in both the public and private sectors.

The Central Electricity Board (CEB) is a parastatal body responsible for the production of 58% of electricity in the country. In 2005, CEB used some 230,000 tonnes of imported fuel oil, and

340,000 tonnes of imported coal (burned in power plants operated by Independant Power Producers: IPPs, linked to sugar production).

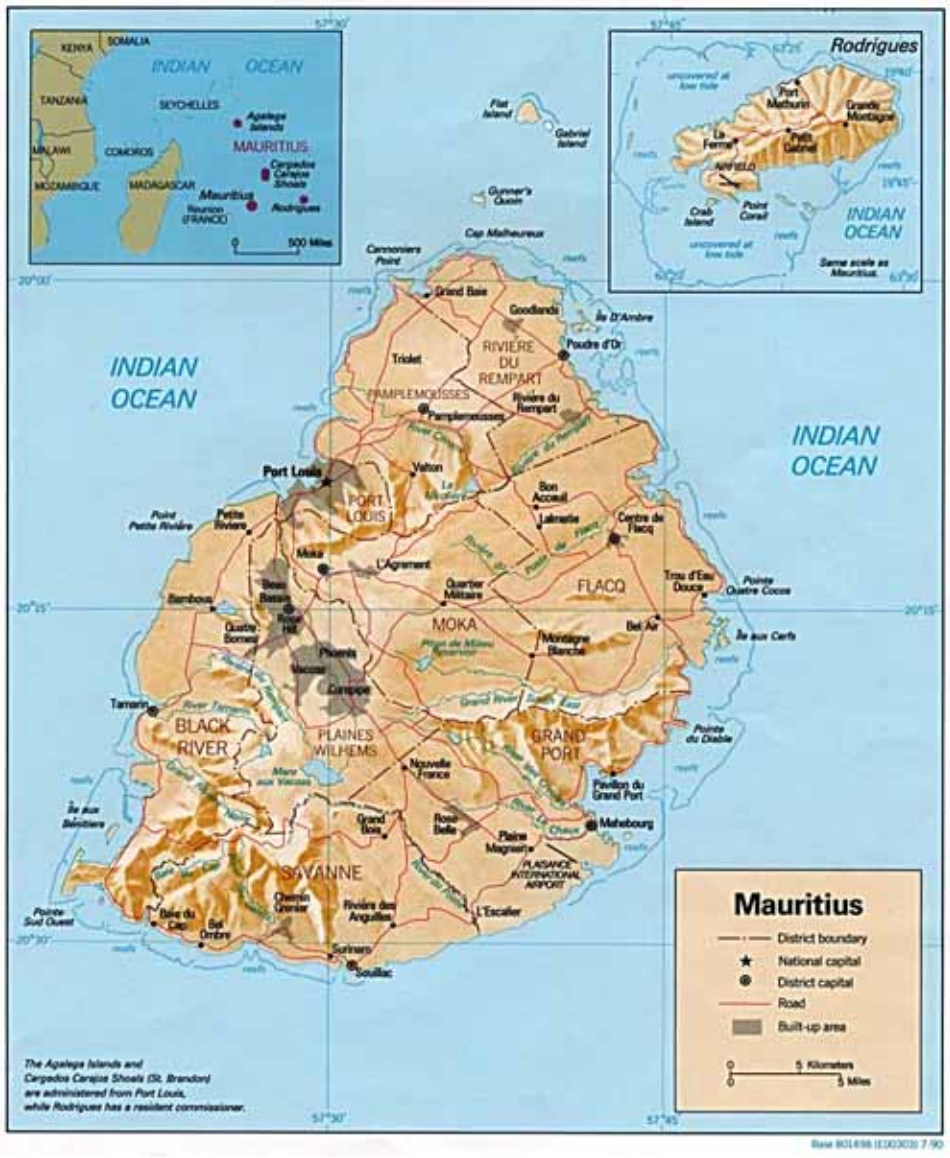


Figure 1: Map of Mauritius

1.2 Biofuels sub sector

As noted above, Independant Power Producers linked to sugar production are already producing 42% of the electricity used in Mauritius, mainly from bagasse and imported coal.

Ethanol production, with molasses as feedstock, is currently carried out by three entities in Mauritius, including Beau Plan, Alcodis and Medine. Between 2004 and 2008, 8 million litres of hydrous ethanol was produced and exported.

Development of energy from bagasse and increases in ethanol production (from sugar cane) are the main trends in Mauritius energy policy.

There is no biodiesel production in Mauritius at the moment, however, opportunities to produce biodiesel from imported palm oil are being studied.

1.3 Trends and prospects

In 2007, a new sugar plant, operated by Savannah Sugar Milling, was to begin operations in the south of the country.

In 2003, a memorandum of understanding (MoU) for cooperation in oil and gas exploration off the Mauritius coast was signed between India and Mauritius. However, no activities appear to have been implemented so far.

2. Biophysical

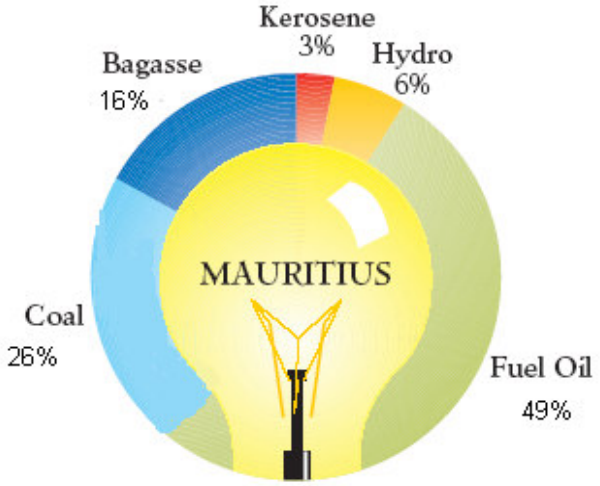
All of Mauritius' marine ecosystem components are interrelated. Wetlands provide a natural buffer, controlling surface water run-off to the lagoon by neutralising pollutants, nutrients and sediments which might damage the lagoon eco-system. Mangroves provide a habitat for juvenile fish and invertebrates, while the fringing coral reef protects the coastline from the waves coming from the open ocean, and is crucial to the ecology of tropical oceans.

Mangroves are strongly protected in Mauritius, and any exploitation or cutting requires a written approval from the Permanent Secretary.

Table 1: National data on energy consumption and impacts of climate change

Energy use (kt of oil equivalent)	Combustible renewables and waste (% of total energy)	Fossil fuel energy consumption (% of total)	CO2 emissions (kt)	CO2 emissions (metric tons per capita)
			3,847.2	**3.07**

Source: World Bank, year 2005



(From" Outline energy policy", GoM, 2007)

Being a Small Island Developing State (SIDS), Mauritius is vulnerable to rising sea levels, which can have a negative impact on the coastal tourism industry. In this context, Mauritius is willing to implement measures that correspond to the Kyoto Protocol.

While reducing the country's dependence on imported fuels (targeting a 70% self-sufficiency in terms of energy supply), the national energy strategy states that over the next 25 years green house gas emissions will be reduced by nearly 30%.

Table 2: Environmental and social issues of oil, gas and biofuel activities in the coastal zone

Coastal Oil & Gas Activity	Environmental issues	Social issues
Offshore exploration	• Oil spills, accidents	• Restrictions for fishing zones • Opportunities for employment
Oil & Gas transport	• Oil spills, accidents • Water and soil contamination • Invasive species in ballast waters	• Risks of accidents (fire, collision, etc.) • Improvements in transportation network
Gas station and retail	• Oil spills, accidents • Water and soil contamination	• Opportunities for employment • Opportunities for new services • Fuel availability
Biofuels development	• Swamp drainage • Monoculture and biodiversity loss • Pollution	• Opportunities for employment • Opportunities for new services • Competition for arable land

Table 2 highlights the different potential impacts inherent in the oil and gas sector. In the case of Mauritius, offshore exploitation is not presently a major issue, while biofuels development relies on already existing sugarcane cultivation and processing. Potential negative impacts are, therefore, well monitored.

3. Human Environment

About 95 per cent of the entire population of the Small Island States of the WIO, namely Seychelles, Comoros, Mauritius, and La Réunion, live within 100 km of the coast. Their combined population is about 2.78 million (3).

The distinction between rural and urban households in Mauritius is unclear. On Mauritius island, apart from Port Louis and its surroundings, the majority of the population lives in villages where livelihoods involve farming, combined with employment in the manufacturing and service sectors. Rural households are rarely completely dependent on agriculture, however, it is nevertheless important. Coastal communities also tend to be isolated from the main, off-farm employment opportunities in the sugar industry, remaining heavily dependent on marine resources and fishing for subsistence and income. On Rodrigues island, nearly all households are regarded as rural and dependent on subsistence agriculture, fishing, microenterprises and part-time (mainly government) employment (1).

In 2009, according to the Central Statistics Office (4), employment in the "upstream" activities around sugarcane (agriculture) accounted for 15,500, while "downstream" sugarcane accounted

for 1,800 jobs. During the same period, the entire electricity, gas and water sector accounted for 3,100 jobs, compared to a total of 545,800 jobs recorded for the whole country.

3.1 Socio-economical indicators

Table 3: National economic indicators

GDP (million current US$)	GDP growth (annual %)	GDP per capita (current US$)	GDP per capita growth (annual %)	GINI Index (2007)
9,319	4.53	7,344.99	3.86	(not available)

Source: World Bank, year 2008, and HDI

Table 4: National social indicators

Population, total (million)	Population growth (annual %)	Poverty headcount ratio at $1.25 a day (PPP) (% of population)	Human poverty index (HPI-1)	Human development index
1.27	0.64	(not available)	9,5	0.804

Source: World Bank, year 2008, and HDI, year 2005

Table 5: National gender indicators

Life expectancy at birth, female (years)	Life expectancy at birth, male (years)	Literacy rate, adult female (% of females ages 15 and above)	Literacy rate, adult male (% of males ages 15 and above)	Gender-related development index (GDI)
76.11	69.2	84.8	90.4	0.797

Source: World Bank, year 2008, and HDI, year 2005

3.2 Details of corporate and social responsibility programmes of the oil and gas companies

No specific corporate and social responsibility programmes related to the energy sector have been found for Mauritius.

4. Policy and Governance

In 2005, the National Development Strategy was adopted by the Government. It is a land-use planning tool to guide new developments, which defines the different zones of development (tourism, industrial, residential, agricultural) and also gives guidance on the type of buildings and setbacks to be provided. The recommendations are being implemented at local level through Outline Schemes.

For energy, key objectives of Mauritian policy are:

- Limit the vulnerability of Mauritius to imported fossil fuels and their volatile prices
- Promote economic growth and job creation
- Democratize energy supply

- Secure affordable energy to consumers
- Ensure the financial sustainability of the utility

A key aim of the policy is to encourage the emergence of new producers and suppliers in the energy sector, as well as facilitate the development of biofuels. This policy is to be executed in accordance with economic and environmental sustainability.

The Ministry of Agro-Industries and Fisheries has also prepared a Multi Annual Adaptation Strategy (MAAS 2006-2015), which provides for an increase in the annual production of electricity from bagasse from 300 to 600 GWh, and the production of nearly 30 million litres of ethanol annually. Opportunities to introduce ethanol in gasoline and biodiesel in diesel fuel are presently under appraisal.

The Environment Protection Act gives power to the Minister of Environment to prepare an integrated coastal zone management plan, which is to be used for coastal zone planning, management and development. However, no such national management plan has yet to be prepared. There has also been massive development in the coastal zone without proper planning, which is facilitating several environmental problems in different coastal zones, such as coastal erosion, pollution, etc. Present policy aims to increase the number of tourists with a target of 2 million by 2015, thus, there is an urgent need to establish a comprehensive ICZM framework for planning in the coastal regions (Ministry of Environment and NDU 2007).

4.1 Policy and Legislation

Strategies / Regulations	Description - Comments
Energy sector	• Electricity Act 2005
Agriculture and land planning	• Sugar Efficiency Act, amended in 2007 (allows land conversion for setting up power stations of more than 15 megawatt)
Environmental regulations	• Environment Protection Act 2002 (EIA needed for setting up power projects) • Environment Protection (Amendment) Act 2008 • Regulations on Environment Protection Act 2010-11-25 • Environment Protection (Effluent Discharge Permit regulations 2003 (Consolidated Version)

Mauritius first adopted formal procedures for EIA's in June 1993, following the amendment of the Environment Protection Act (EPA) 1991. In order to further consolidate and reinforce the institutional and legal framework for the protection of environmental assets and promote sustainable development, a new Environment Protection Act has been in place since 5 September 2002. The EPA 2002 provides for environmental stewardship, greater transparency and public participation in the EIA process, as well as a streamlining of the EIA procedures. The EPA 2002 also specifies the contents of the EIA.

4.2 Governance

Entity	Responsibility/ Description
Ministry of Public Utilities	Regulator of the energy sector, based on the Utility regulatory Act 2004 and Electricity Act 2005
CEB	Parastatal electricity producer and sole agency for transmission and distribution of electricity

Ministry of Environment and Sustainable Development	This Ministry was set up in 1989 and the first EPA was promulgated in 1991. The act was revised in 2002 and is now being updated The Ministry of Environment is responsible for the management of the environment in Mauritius. It is also responsible for coastal and maritime zone management and controls land use planning and development.
ICZM Division	This division of the department of environment is responsible for the planning and management of the coastal areas through the development of an ICZM plan. Several projects concerning beach erosion, creation of marinas, ski lanes, bathing areas, protection of wetlands and islets are underway.
Ministry of Agro-Industry and Fisheries	Aims to further develop agriculture and promote agro industry, focusing on safety, supply, quality, innovation and new technology through service and institutional provision, as well as consultation with stakeholders in the region.

5. Planning and Management

Policy Planning Initiative	Objective
Environmental Investment Program (EIP)	The EIP provides the main guidelines for environmental protection in Mauritius.
The National Physical Development Plan (NPDP)	The NPDP was one of the most important projects under the Environmental Investment Program (EIP1) and is used as the main guide for national spatial planning. However, with the passage of time, some of the basic concepts of the NPDP need reviewing, which is being carried out under EIP2.
National Environmental Strategies (NES)	The NES provides options to meet the challenges of the growing economy through action plans that assess the pressures on the environment amd the impacts of these pressures. It also provides policy changes and environmental improvement programs

Integrated Coastal zone Management (ICZM)

In Mauritius, the ICZM Capacity Development has been completed (Policy Development, Planning Processes, Monitoring and Reporting). The National ICZM committee has decided to concentrate on Flic-en-Flac, Le Morne and La Gaulette (all on the southwest coast) as focus/pilot areas for the development and implementation of an ICZM plan. Local ICZM committees have been established and are operational at Flic-en-Flac and Le Morne / La Gaulette. The Department of Environment and NDU has finished its project 'Developing a Strategic Plan for Integrated Coastal Zone Management for Mauritius and Rodriguez'. A final report was published in early 2010. In Rodriguez, the development of ICZM plan is on-going.

6. Development, Trade and Projects

Development project	NGO / Donor / Private Sector	Project details
Regional Coastal Management (ReCoMap)		ReCoMap is a regional programme for the sustainable management of the coastal zones of the countries of the Indian Ocean. It is an initiative of the Indian Ocean Commission which deals with seven countries in the region, including Mauritius, the Seychelles, Madagascar, the Comoros Islands, Kenya, Tanzania and Somalia. The programme started in August 2006 and will end in 2011. The Programme aims to improve valorisation and sustainable management of coastal resources in the seven countries of the region
Western Indian Ocean Marine Highway Development and Coastal and Marine Contamination Prevention Project	GEF	Concerned countries: South Africa, Mozambique, Tanzania, Comoros, Madagascar, Mauritius, Seychelles and the Reunion Island. All countries are required to have a NOSRCP to provide a national framework for responding to oil spills and protecting coastal resources
SWIOLaB Project	UNEP	The project "Addressing Land-Based activities in the Western Indian Ocean" (WIO-LaB), under the Nairobi Convention, aims to address marine pollution from land based activities. The project represents a strong partnership between the participating countries (including Mauritius), the Norwegian Government, United Nations Environment Programme (UNEP) and GEF (Global Environment Facility)

7. SWOT Analysis

Strengths • Strong environmental regulations • Government supports clean energy development, mostly from existing sugar industry • Strong coastal protection regulations	**Weaknesses** • Heavy reliance on the sugar industry limits sustainable livelihood diversification. • Coal remains an important source of energy
Opportunities • Mauritius is in a position to become a regional leader for "green energy"	**Threats** • Focus on energy demand through the development of sugarcane cultivation could hamper food security

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A Roadmap for the Mauritius Sugarcane Industry for the 21st Century - http://www.gov.mu/portal/sites/moasite/download/roadmap.pdf

Strategic options in crop diversification and livestock sector - http://www.areu.mu/files/pub/areunssp.pdf

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Environment protection Act (amendment) - http://www.gov.mu/portal/site/menvsite/menuitem.6ba669dd8caae23bcf6d2f2ba0208a0c/

Regulations Envir Protection Act - http://www.gov.mu/portal/goc/menv/files/CDM0001.pdf

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Programme for the Agulhas and Somali Current Large Marine Ecosystems: Agulhas and Somali Current Large Marine Ecosystems Project (ASCLMEs) - http://gefonline.org/projectDetailsSQL.cfm?projID=1462

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Development and Protection of the Coastal and Marine Environment in Sub-Saharan Africa - http://gefonline.org/projectDetailsSQL.cfm?projID=849

Western Indian Ocean Islands Oil Spill Contingency Planning - http://gefonline.org/projectDetailsSQL.cfm?projID=533

Demonstrating and Capturing Best Practices and Technologies for the Reduction of Land-sourced Impacts Resulting from Coastal Tourism - http://gefonline.org/projectDetailsSQL.cfm?projID=2129

VI. Ports and Coastal Transport - Prepared by Professor Gavin Maasdorp,

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1. Overview

The island state of Mauritius was formerly a French and later a British dependency, and has retained some of the links and character of the French colonies**.** The main activities are manufacturing, tourism, sugar production and fishing. The interior is mountainous but the coastal plain gives access to beautiful sandy beaches that have provided the main attraction for development of the very successful tourist industry. The island of Rodrigues is part of the Mauritian state.

2. Extent of ports and transport activities

The only commercial port on Mauritius itself is Port Louis which is also the capital. Souillac at the southernmost point of the island serves as a safe harbour for leisure craft, as does Grand Bay on the west coast north of Port Louis. Some fishing fleets are based in Grand Bay.

Port Louis

Port Louis is located at 20°10' South, 57°31'30" East. It has the second largest container-handling facility in the Indian Ocean, and can accommodate fourth-and fifth- generation container vessels. Equipment at the port is often inadequate and delays frequently occur, but two new gantry cranes delivered in 2007 have boosted throughput capacity. In 2008, Port Louis received over 2000 vessel calls, dominated by container (543), fishing (479) and general bulk vessels (193). The port handled 6.3 million tons of cargo comprising 5.1 million tons of imports and 1.2 million tons of exports. Containerised cargo amounted to 2.8 million tons in 2008, including 2.3 million tons of imports and 501,000 tons of exports. Container movements were 225,500 TEUs of imports and 109,400 TEUs of export cargo.

Port Louis handled almost two million tons of dry-bulk cargoes in 2008, made up of cement, coal, fertiliser, maize, soya bean meal, sugar, wheat and aggregates. Imports of 1.6 million tons dominated the dry-bulk traffic. The port handled 1.4 million tons of liquid-bulk imports which included bitumen, black oil, bunker, edible oil, liquefied petroleum gas, liquid ammonia, molasses, tallow and white oil. General cargo (excluding fish), totalled 31,800 tons (21,000 tons of imports) and included bagged cargo, unitised break-bulk, and general cargo. Port Louis imported 113,000 tons of fish for the local market and transhipments, and exported 434,000 tons.

Terminal I consists of a total of 1,180 metres of quay with six berths with depths from 3.0-12.2 metres. Quay A handles black oil, edible oils, molasses, general cargo, wheat, base, soya bean meal, inter-island trade and passengers. The three fishing quays have depths alongside from 3.0-9.5 metres, while the three cargo-handling quays are 9.0-12.2 metres in depth.

Terminal II consists of 986 metres of quays with six berths. The Mauritius Freeport Development berth handles fish and has a depth of 9 metres. Three cargo-handling berths have alongside depths of 12.2 metres and handle general cargo, containers, black and white oil, fertilisers, tallow, cement, coal, liquefied petroleum gas and bitumen. Terminal II contains storage facilities with capacity for 4,500 tons of tallow and 1,000 tons of caustic soda.

The Mauritius Sugar Terminal Corporation operates a dedicated terminal in Port Louis for loading bulk sugar at a 198-metre quay for vessels with up to 11 metres draft. The terminal has the capacity to store 175,000 tons of cargo in two sheds, and it can load sugar at a rate of 1,450 tons per hour.

Terminal III has two quays, each 280 metres long with a depth of 14 metres. They handle containers and bulk ethanol. There are 13.5 hectares of storage area and 288 reefer points as well as on-quay bunkering facilities. The terminal is able to handle 550,000 TEUs per year.

The private dry dock and ship repair facilities located at Terminal I are operated by Taylor Smith Group. The facility can accommodate vessels up to 100 metres long. A second facility at Terminal II is operated by Chantier Naval de l'Ocean Indien Ltd., and consists of a 150-metre dry dock and a ship construction and repair workshop.

Port Mathurin (Rodrigues)

The village of Port Mathurin (population 6,000) serves as the capital of the island of Rodrigues, a dependency of Mauritius. It lies on the north coast of the island and functions as the administrative, judicial and economic centre as well as the main harbour. A regular five times per month service between Rodrigues and Mauritius is provided by the two ships of the Mauritius Cargo Handling Corporation (MCHC).

3. Policy and Governance of Ports and Transport

The Mauritius Ports Authority (MPA), established by law in 1998, is responsible for the management of Port Louis. The MPA is a state-owned corporation designated as the sole national ports authority with responsibility for regulating and controlling the port sector and providing marine services.

4. Planning and Management of Ports

The MPA provides and improves port infrastructure, regulates all matters related to the ports, provides for the welfare of port employees, enters into concession contracts for port and cargo-handling services, promotes the use and development of the ports, licenses and regulates port and marine services, and implements the port master plans

5. Development and Trade

Mauritius has a well-developed manufacturing sector that is dominated by clothing and textiles, but also includes chemicals, plastics, and pharmaceuticals. The sugar industry that was the backbone of the economy has declined in importance, but the country is self-sufficient in sugar and exports the surplus.

The Mauritius Freeport Authority (MFA) was created in 1992 with the objective of positioning Port Louis as a hub and promoting it as a warehousing, distribution, marketing and logistics platform for the development of trade in the Indian Ocean region. MFA is the sole authority responsible for the management and control of the Freeport zones. It acts as a facilitator, and its activities range from warehousing to minor assembly. Between 2002/03-2005/06 the volume of trade through the Freeport rose from 228,000 to 244,000 tons per annum.

The Freeport has space in excess of 70,000m² for dry storage, cold rooms, exhibition centres and offices.

Mauritius is one of Africa's major financial centres (second only to Johannesburg), and the economy of the city of Port Louis is based on the port as it handles all the country's international trade except for airfreight.

6. Ports Impact and Benefits to Coastal Communities

The benefits of the port to coastal communities are directly related to the international trade in manufactured goods and the export of locally produced agricultural and fishery products.

The other major island activity of tourism is more dependent on air links to the outside world and the dedicated beaches and hotel zones along the coast.

The potential for improving the income levels of the coastal population is likely to be part both of the overall drive by the government to increase beneficiation of locally produced goods and of the aggressive development of manufacturing industries using the skills of the population. The potential for further exploitation of the sea will be limited by the declining fish populations and the competition from a wide range of countries fishing in this part of the ocean. A positive spinoff from the Somali piracy situation may be some protection from the exploitation of the Indian Ocean by foreign vessels.

7. SWOT Analysis

Strengths	**Weaknesses**
• Positive government promotion of economic development. • Industrious and skilful population. • Established tourist and agricultural industries. • Relative stability and good financial standing.	• Transport costs to market. • Exposure to cyclone damage.
Opportunities	**Threats**
• Increasing investment in coastal property and tourism facilities. • Further growth of financial centre. • Attraction of Far East investment in manufacturing. • Port expansion to claim more hub activities.	• Competition from Eastern countries in export markets for manufactured goods. • Competition for tourism and port activities from Madagascar.

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VII. Coastal Mining - Prepared by Mr. Thomas Cushman,

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1. Introduction

Mauritius or The Republic of Mauritius is a small volcanic island nation south east of Africa about 1000 km east of Madagascar. In addition to the island of Mauritius the republic incorporates the islands of Rodriguez Cargados and Agalega. Mauritius' area is 2040 km2 and Mauritius' 330 km coast line is surrounded by coral reefs forming lagoons of white sand.

Uninhabited until the 17th century Mauritius was colonized by the French and then became a British colony after the Napoleonic Wars. The Republic of Mauritius became independent in 1968. Port Louis is the capital and largest city. The official language is English but the lingua

franca is Mauritian Creole and the television and newspapers are predominately in French. Mauritius has a parliamentary system of government. Most of the 1,300,000 inhabitants are of Indian origin but there are many persons of African and Malagasy descent as well as minorities of Europeans and Chinese. Hinduism is the predominant religion but there are significant population of Christians and Muslims.

2. Mining Sector Overview

The mineral industry of Mauritius is not significant to its economy. There were few mineral resources in Mauritius. Annual production in 2000 was estimated at 1 million tons of stone, 300,000 tons of sand, 7,000 tons of lime, and 6,000 tons of salt.

Historically, mineral output consisted of the local production and use of basalt construction stone, coral sand, lime for coral, and solar-evaporated sea salt.

2.1 Coastal Mining Characteristics

Coral sand used to be extracted from the lagoon at the rate of 800,000 tons annually. Studies commissioned by the Government showed that this activity was having adverse, irreversible effects on the marine environment such as destruction of the marine habitat and coastal erosion. In 1997, Government of Mauritius decided to ban lagoon sand mining. Sand miners were given a moratorium up to 2001 to stop their activities and were compensated. This decision was enforced in October 2001. Compensation was paid to those engaged in the sand mining business. Adequate substitute materials are now available, particularly through use of advanced technologies for crushing rock and utilizing it for construction.

4. Human Environment

4.1 Socioeconomic Indicators

Social indicator	Mauritius
Social indicators	
Total population (2010 est.)	1,284,264

Population growth rate (2010 est.)	0.776
HIV/AIDS prevalence rate	1.7%
Economical indicators	
GDP (2009)	$8.761 billion
GDP (real growth rate)	3.1%
GDP per capita	$6,822

5. Policy and Governance

5.1 Policy and Legislation

Coastal Mining Regulations	Description - Comments
Mining activities laws and regulations	• Sand Mining Act of 1975
Environmental regulations	• Environment Protection (Amendment) Act 2008 • Environment Protection (Effluent Discharge Permit) Regulations 2003 (Consolidated Version)
Coastal Mining specific regulation	

5.2 Governance

Entity	Responsibility/ Description
Ministry of Environment and Sustainable Development	The Ministry of Environment is responsible of the management of the environment in Mauritius. It is also responsible for coastal and maritime zone management. It also provides for vigorous control over land use planning and development.

ICZM Division	This division of the department of environment is responsible for the planning and management of the coastal areas through the development of an ICZM plan. Several projects concerning beach erosion, creation of marinas, ski lanes, bathing areas, protection of wetlands and islets are underway.

5.3 Planning and Management

Investment Facilitator

The *"Board of Investment Mauritius" (BOI Mauritius)* is the official Investment Promotion Agency of the Government of Mauritius.

Environment Management

Mauritius first adopted formal procedures for EIA in June 1993 following the amendment of the Environment Protection Act (EPA) 1991. In order to further consolidate and reinforce the institutional and legal framework for the protection of the environmental assets of Mauritius and a sustainable development, a new Environment Protection Act is in force as from 5 September 2002. The EPA 2002 provides for environmental stewardship, greater transparency and public participation in the EIA mechanism as well as a streamlining of the EIA procedures. The EPA 2002 also specifies the contents of the EIA.

Undertakings requiring an EIA license are listed in Part B of the Environment Protection (Amendment of Schedule) Regulations 2006. The EPA 2002 also empowers the Minister to request an EIA for any non- listed activity, which, by reason of its nature, scope, scale and sensitive location could have an impact on the environment.

Integrated Coastal zone Management (ICZM)

For Mauritius, the ICZM Capacity Development for all structures was finished (Policy Development, Planning Processes, Monitoring and Reporting). The National ICZM Committee of Mauritius has decided to concentrate on Flic-en-Flac, Le Morne and La Gaulette (all on the southwest coast) as focus/pilot areas for the development and implementation of an ICZM Plan. Local ICZM Committees have been established and are operational at Flic-en-Flac and Le Morne / La Gaulette. The Department of Environment & NDU has finished its project 'Developing a Strategic Plan for Integrated Coastal Zone Management for Mauritius and Rodriguez'. A final report was published in early 2010. In Rodriguez, the development of ICZM plan is on-going.

5.4 Development, Trade and Projects

Policy Planning Initiative	Objective

Environmental Investment Program (EIP)	The EIP provides the main guidelines for the environment protection in Mauritius.
The National Physical Development Plan (NPDP)	The NPDP was one of the most important projects under the Environmental Investment Program (EIP1) and is used as the main guide for national spatial planning. However, with the passage of time, some of the basic concepts of the NPDP need reviewing. And this is being carried out under EIP2.
National Environmental Strategies (NES)	The NES provides options to meet the challenges of the growing economy through action plans that assess the pressures on the environment, the impacts of these pressures and provide policy changes and environmental improvement programs

Development project	NGO / Donor / Private Sector	Project details
WIOLaB Project	UNEP	The project "Addressing Land-Based activities in the Western Indian Ocean" (WIO-LaB), under the Nairobi Convention, aims to address marine pollution from land based activities. The project represents a strong partnership between the participating countries (including Mauritius), the Norwegian Government, United Nations Environment Programme (UNEP) and GEF (Global Environment Facility)
Regional Coastal Management (ReCoMap)	European Union	ReCoMap is a regional programme for the sustainable management of the coastal zones of the countries of the Indian Ocean. It is an initiative of the Indian Ocean Commission which deals with seven countries of the region, namely Mauritius, the Seychelles, Madagascar, the Comoros Islands, Kenya, Tanzania and Somalia. The programme started in August 2006 and will end in 2011. The Programme aims at the improved valorisation and sustainable management of coastal resources of the seven countries of the region.

6. SWOT Analysis

Strengths	Weaknesses
• Strong environmental regulation • Strong coastal protection regulations • The Ministry of Environment strongly concerned with the coastal zone protection • Sand mining activities have been banned from 2001. • No mineral potential identified	
Opportunities	**Threats**
• Good NGO involvement • ICZM implemented	

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