MAURITIUS RESEARCH COUNCIL

Thematic Working Group

Marine Resources

FINAL REPORT

August 2001

PREFACE

As the apex institution for the promotion of research and the advisor to government on matters pertaining to science and technology, the Mauritius Research Council has set up nine working groups with a view to defining priority areas for research in key sectors for sustainable national development. Each working group was expected to hold regular meetings and produce a short report on its findings.

This report represents the deliberations of the Marine Resources Thematic Working Group.

The Chairman and members of the Marine Resources Thematic Group would like to thank the Mauritius Research Council for the trust placed in them and for providing them with the opportunity to share their views and experience for national policy making.

Dr. Mitrasen BHIKAJEE
Chairman,
Marine Resources Thematic Group

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LIST OF ABBREVIATIONS

AFRC	***Albion Fisheries Research Centre, Ministry of Fisheries***
DOE	***Department of Environment***
EEZ	***Exclusive Economic Zone***
GDP	***Gross Domestic Product***
GEF	***Global Environment Facility***
GIS	***Geographical Information System***
ICMP	***Integrated Coastal Management Plan***
IOC	***Intergovernmental Oceanographic Commission***
MOI	***Mauritius Oceanography Institute***
MRC	***Mauritius Research Council***
NEAP	***National Environment Action Plan***
NOSCP	***National Oil Spill Contingency Plan***
OIDC	***Outer Island Development Corporation***
OTEC	***Ocean Thermal Energy Conversion***
UoM	***University of Mauritius***

1. THE RELATIVE IMPORTANCE OF MARINE RESOURCES FOR MAURITIUS.

The Exclusive Economic Zone (EEZ) of Mauritius represents a zone, which is around one thousand times larger than its land area. This zone is largely unexploited except for its fishery resources on the shallow sand banks and in the coastal regions. Tuna fishing is also carried out in the open sea. Occasional studies have shown the presence of yet-unexploited fish stocks and of metallic nodules. The discovery of new resources (gas hydrates, petroleum) or development of new technologies (OTEC, open-sea cage aquaculture, pearl oyster culture) in the Mauritian EEZ can drastically change the economy of the country. The outer islands also represent a potential for development which can generate income for the nation.

On the other hand, the Mauritian coastal zone is under intense pressure through coastal urbanization, tourism development and effluent discharge from land-based sources. Baseline studies are lacking and unless timely studies are carried out, our existing economic assets will be at stake. Figure 1 shows coastal area distribution in 1998.

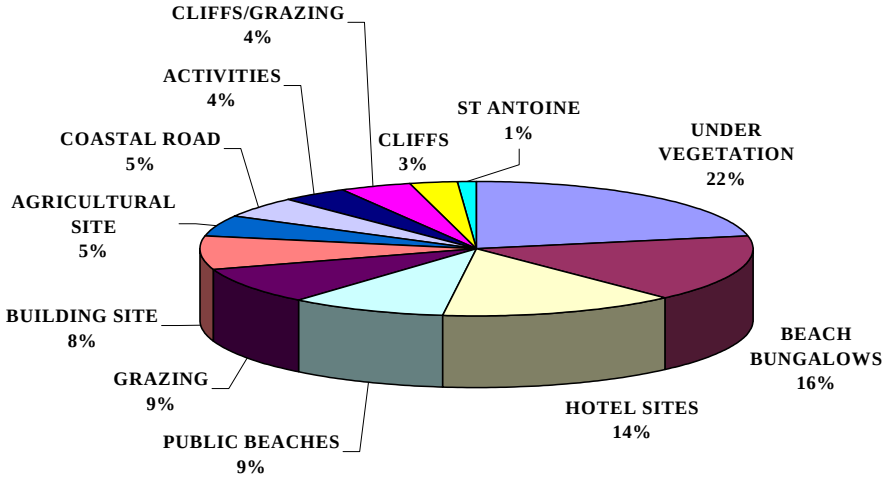

Figure 1: Distribution of Coastal Land of Mauritius in 1998.
(Source: Ministry of Environment)

2. THE CURRENT STATUS OF MARINE RESOURCES IN MAURITIUS.

Coastal development has undergone rapid expansion during the last decade. Initially the primary aim was to generate employment and no due consideration was given to the marine environment. This has given rise to marked degradation of the coastal zone. Coastal erosion, due to ill-conceived protective measures and sand-extraction, is currently widespread. In some region the shoreline has receded inland by almost 30 m. Water quality and the health of coral reef have deteriorated mainly because of pollutants from land-based sources. In case this trend is not reversed, preservation of the coastal zone for sustainable development of the living and non-living marine resources will become almost impossible, thus putting at risk various interdependent socio-economic sectors. Global warming and sea-level rise will exacerbate the problems.

The fisheries sector consists of commercial fishing, small-scale artisanal fishing, sport and recreational fishing, aquaculture and fish processing. Currently the fishing industry in Mauritius contributes about 1% to the GDP and around US$ 40 million to export earnings. The sub-sector supplies about 25% of the national animal protein and provides employment to about 6000 persons who are directly and indirectly involved in fishing activities at sea. It also provides employment to about 1000 workers for tuna canning and an undetermined number of skilled and unskilled people in the various areas related to fisheries.

The current level of exploitation represents about 9000 tonnes of fish per year (5000 tonnes from banks fisheries and 4000 tonnes from artisanal fisheries). However, this figure represent a declined since. In 1993 the commercial fish landings mainly from the marine sectors, was 21 200 tonnes. This is due mainly to the cessation of operations of the tuna purse seine fleet and the application of a quota system in the bank fishery as part of the present management strategy. Freshwater and marine aquaculture, using semi-intensive and extensive methods, produce about 100 tonnes per year.

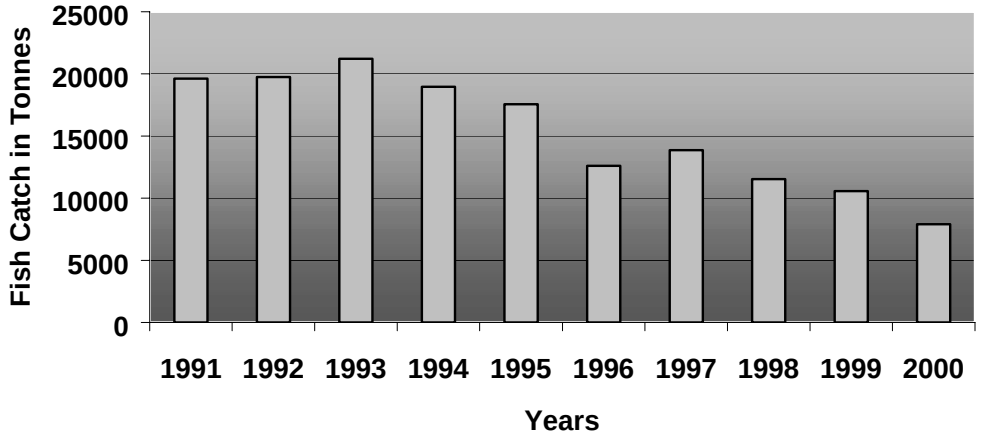

Figure 2: Total Fish Catch (in tonnes) from 1991 to 2000 for Mauritius
(Source: Ministry Fisheries)

In 2000, small-scale artisanal fisheries employed 4,000 fishermen (including Rodrigues and Outer Islands), the banks and tuna fisheries employed approximately 600 and aquaculture employed 80 persons (including both full time and part-time workers). The fisheries sub-sector (tuna canning, cold storage, salting/smoking, boat building and ancillary services) employs about 1,500 people.

In Rodrigues, the living marine resources which are mostly exploited are fish and octopus. The marine and coastal zones are also used for sand extraction (4,000 tonnes are extracted yearly), and for tourism activities. A chilled fishery operates from St. Brandon.

3. CONSTRAINTS AND CHALLENGES FACING SUSTAINABLE MARINE RESOURCES EXPLOITATION.

For the Exclusive Economic Zone (EEZ), marine resources represent an enormous untapped potential whereas for the coastal zone, these resources represent an existing asset which is at risk because of the pressure exerted on it. Constraints and challenges in this sector are numerous but these can be overcome through a systematic and long-term planning. The constraints identified are:

3.1 Lack of Data.

The rate of deterioration of the coastal zone, a prerequisite for proactive effective measures, is unknown and this represents a major constraint. No systematic, routine and long-term measurement and observation, besides a few parameters, are being undertaken by any Ministries or Institutions.

3.2 Lack of Co-ordination.

Many Ministries/Industries are involved in coastal development and management and the lack of co-ordination and interaction is seriously felt. The policy and legislative framework is inadequate and there are no legal mechanism dedicated solely for the holistic management and proper development of the coastal zone.

3.3 Lack of Local Expertise.

Coastal management and development needs a specialised manpower. This is not being produced locally due to lack of facilities and limited opportunities.

3.4 Maximum or Near-Maximum Exploitation of Traditional Fishing Grounds.

The shallow fishing banks in the Mauritian EEZ have reached their Maximum Sustainable Yield and the lagoons are overexploited.

The challenge is to overcome these limitations through a holistic long-term plan and a national co-coordinated effort in promoting marine science research.

4. PROPOSED MEASURES TO ENHANCE DEVELOPMENT OF MARINE RESOURCES EXPLOITATION.

The environmental problems of the coastal zone cannot be addressed in isolation. They are intricately interwoven with each other. A comprehensive, systematic and sustained approach through an INTEGRATED Coastal Management Plan (ICMP) is required to ensure sustainable development. However, to be successful, an ICMP should gradually evolve from a simple local programme dealing with a few pressure issues to a more comprehensive national programme starting initially with scientific aspects such as coastal dynamics and erosion. Both local (for measurement) and overseas (for modelling) expertise will be required.

In the case of capture fisheries where the resources are not being optimally tapped, development incentives and investment facilities should be given to prospective investors to further develop existing resources and tap new resources. Regarding the highly migratory tuna, fishing agreements made with foreign organisations and countries whereby fishing possibilities are granted within the Mauritian EEZ through a fishing vessel licensing system should reflect the opportunity costs of the resource.

Opportunities exist for offshore migratory pelagic species such as tunas and swordfish and for marine aquaculture. Diversion of fishing effort from the overexploited lagoon towards the exploitation of off-lagoon resources including deep-sea fisheries, small pelagic on the banks and tuna fishing should be promoted through appropriate fiscal policy options. Incentives and investment will be required for:

- The modernization of the fleets used in the banks fishery;
- The development of tuna fisheries;
- The development of deep-sea fisheries;
- Fish processing; and
- Aquaculture.

Furthermore local investment and joint ventures should be encouraged in tuna and swordfish fisheries.

All fisheries should be managed according to internationally recognized codes of conduct and adequate monitoring and resource assessment and control systems should be established. As more information becomes available, detailed biological management plans for each fishery should be developed.

There should be a medium and long-term policy framework for the development of the EEZ. Within a realistic time frame and budget, an EEZ development plan and an operational plan should be designed. Stakeholders would include the government and private sector. Data on living and non-living resources have to be collected from different sources and pooled in order to identify the available living and non-living resources. This can be achieved through better co-ordination among local and overseas institutions engaged in marine scientific research in our EEZ. Training needs to develop a training strategy for capacity building should be identified.

It is important to define a strategy and policy for the development or preservation of the natural and environmental assets for Rodrigues, Agaléga and St. Brandon.

5. RESEARCH PROJECTS THAT NEED TO BE UNDERTAKEN.

The number of individual research projects identified by the committee was quite large. The research topics were therefore classified into the following sectors: (Details of these topics are available in Annexure 1).

1. Coastal Zone;
2. Exclusive Economic Zone (excluding outer islands);
3. Outer Islands (including Rodrigues); and
4. Fisheries and Aquaculture.

The topic were then individually examined bearing in mind the on going and past research projects of any organisation and the existence and implementation of national development plans namely; the 10 Years' Fishery Plan and the National Environment Action Plan, among others.

The list of topics provided in no way represents the totality of research projects which can be carried out in the marine sector. Rather, it is a compilation of topics of economic importance to the country which, in the opinion of the committee, should be given priority but are not being addressed at present.

6. RECOMMENDATIONS

There are several agencies, in Mauritius, which carry out research in the marine environment and there are, presently a number of similar projects which are being proposed by these institutions. It will be important for all stakeholders to meet during a national consultation so that duplication is avoided and multidisciplinary teams are formed.

It is also expected that during the proposed studies, an integrated approach be taken so that all aspects of the problem be taken into consideration.

Considering the vast amount of information required for the management and exploitation of our, yet untapped, marine resources, it is expected that a major policy decision be taken by Government (as has been done for the development of information technology) for this sector. The Exclusive Economic Zone of Mauritius represents an area which is about one thousand times its land area; the future of the economy of Mauritius, in the long term, may very depend on this sector.

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Annex 1: Composition of the Marine Science THEMATIC WORKING Group

Dr M. Bhikajee	Chairman
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Mr. M. Jhugroo	Outer Islands Development Corporation
Mr. P. Kallee	Ministry of Environment
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The Chairman and members of the working group would like to place on record the help and contribution of the following persons:

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Dr. S.M. Gupta	National Institute of Oceanography, India

Project 1: Options for coastal protection measures with emphasis on soft solutions in Mauritius and Rodrigues.

Objective:

To provide data and information on the most appropriate up to date options for coastal protection to decision makers with emphasis on soft engineering solutions thus contributing to solving the main coastal problem.

Background and Justification:

It is widely recognised that the degradation of the coastal zone is one of the major environmental problems facing Mauritius and Rodrigues with beach erosion as the most acute and pressing one. The phenomenon of coastal erosion has been ongoing since the formation of Mauritius and Rodrigues due mainly to natural forces. However, in the last 20 years as a consequence of ill-conceived coastal development and infrastructure in the quest to develop the tourism industry and to create employment, coastal erosion has accelerated significantly jeopardising the tourism industry. Global warming and sea-level rise will exacerbate this problem.

A major problem in solving the coastal erosion is lack of baseline data. The proposed project is in line with the recommendations of NEAP-II and National Climate Committee Action Plan and will constitute a solid foundation for the building up of an Integrated Coastal Zone Management plan. Hard engineering solutions are becoming more and more unpopular and soft solutions – beach nourishment and vegetations - are now being resorted to almost everywhere in the world.

The implementation of the project would be phase-wise, executed preferably by local expertise at the initial stage. The services of overseas experts and institutions would be resorted to at a later stage in the event of non-availability of local resources.

Methodology and activities:

Phase I

- Carry out an island-wise inventory of all hard engineering measures (sea walls, groins, revetment, jetties, gabions) in Mauritius and Rodrigues;
- Assess their impacts and contribution to changes in coastal dynamics and shoreline;
- Identify measures which are the most and least vulnerable to the driving forces (natural and man-made); and
- Organise a national consultation and recommend the most appropriate solutions.

Phase II

- Update and digitise available coastal geomorphology maps;
- Prepare a vulnerability Index Atlas making use of available materials such as CASI images and aerial photos;
- Identify a site for a beach nourishment project;

- Conduct preliminary studies and collect baseline data on physical, chemical and biological parameters and seasonal and annual rate of erosion;
- Map the beach profile and lagoon beds; and
- Seek overseas experts advice on the project.

Phase III

- Implement the beach nourishment project.

Proposed Institutions:

Meteorological Services, MOI, DOE, Survey Division of Ministry of Housing and Lands, Foreign institutions from South-Africa, The Netherlands, USA and India.

Duration:

Phase I – 3-6 months, Phase II 2 years, Phase III – to be determined after preliminary results.

Estimated Costs:

Phase I. Rs. 300,000, Phase II – Rs. 500,000, Phase III to be determined

Infrastructure & Logistics:

Transport facilities, survey equipment, digital camera

Expected Outcome:

Data and information for coastal protection measures and formulation of a beach nourishment project.

Project 2: Study of biodiversity in our maritime zone and the setting up of a marine herbarium and biodiversity database.

Objectives:

To establish a databank on local marine flora and fauna. With a view of providing baseline information for initiating research in fields like Natural Product Chemistry, commercial agar production and medicinal extracts. In addition, the databank will be an essential tool in the protection of marine biodiversity

Background and Justification:

The "Convention on Biological Diversity" signed at the Earth Summit in Rio de Janeiro in 1992 required consenting states to develop national plans or programmes for the sustainable use of biodiversity in order to maintain their biological heritage. The presence of a biological record of the marine organisms will serve as an important tool in the management process of different ecological sites. Besides, preserved collections provide an important, verifiable, record of living biota and, in addition, natural science objects are kept in preference to data because of the complex nature of the information they contain. Furthermore, an underestimated value of such collections is that they are verifiable records of an alga's existence in space and time; voucher collections and collections-data may therefore contribute to the recognition of climate and environmental change. Hence, a herbarium will be supportive in the development of national plans or programmes for the sustainable use of marine biodiversity in order to maintain the marine biological heritage of Mauritius and Rodrigues. An example where our marine biodiversity is under threat is during ballast water discharge from ships in our waters. Again, a marine herbarium would be a tool in the monitoring of such kind of activities. In another perspective a marine herbarium will be the stepping stone to the setting up of various scientific research such as: (a) Isolation of biologically active compounds from marine organism which could lead to new drugs discovery (b) Identification of marine organism that could be used for mariculture and the industrial application of which could find an economic importance in the development of the country.

Methodology:

The setting up of a marine herbarium and biodiversity database in Mauritius will require:

- A search in all the national marine institutions in order to list all the marine organisms already collected and taxonomically identified;
- Trained personnel in the field of marine flora and fauna taxonomy. This person will be responsible for identification processes of all organisms collected;
- Trained staff in practical herbarium techniques, construction and operation of an appropriate database; and
- Trained personnel who would be good divers and to whom the skill of specimen collection should be given.

Proposed Institutions:

The Mauritius Oceanography Institute, The Mauritius Sugar Industry Research Institute, The University of Mauritius, The British Natural History Museum

Estimated Time Frame: 3 years

Estimated Cost: Rs. 3 million

Infrastructure: Building with laboratory facilities.

Expected Outcomes:

It is expected that the herbarium and biodiversity database will serve as a guide to educate us about the state of our marine environment and as a tool in its management. In addition it can be served as a basis for some new researches which can contribute towards the economic development of the country.

Project 3: Setting up of a Geographical Information System (GIS) for the Republic of Mauritius.

Objectives:

The objective of this project is to set up a Geographical Information System (GIS) for the proper mapping of the marine resources of Mauritius and its EEZ

Background and Justification:

At present, various organizations collect data and these are either stored in the forms of printed or in formats which are not compatible with one another. Furthermore each organization tends to keep its data for its own use and very often projects are duplicated because of non-dissemination of information.

The sustainable management of the marine resources of the Republic of Mauritius is based on the proper mapping of its marine resources. The setting up of a GIS would allow an integration of the existing data as well as the collection of missing data on the living and non-living marine resources of the Republic.

Methodology:

- Determination of appropriate software for the archiving and retrieval of information in the form of maps, data and reports;
- A search in order to determine the existence of available data that can be stored in a GIS System; and
- Data archiving, maintenance and management.

Proposed Institutions:

University of Mauritius, Ministry of Fisheries, Outer Islands Development Corporation.

Estimated Time Frame: Two Years

Estimated Costs: Rs. 1,000,000

Infrastructure & Equipment: Computer, Scanner, digitiser, plotter

Expected Outcome:

This project should set up a Marine Resources Geographical Information System for the Republic of Mauritius. The GIS data should be shared by various institutions to undertake research works or take decisions concerning future developments.

Project 4: Developing an oil spill model for the maritime zone of the Republic of Mauritius.

Objectives

The project aims at producing an oil spill model in order to:

(i) Forecast of trajectories of spilled oil;
(ii) Locate the possible sources of spill;
(iii) Predict the chemical fate of spilled oil along its trajectory;
(iv) Provide information for shoreline protection and impact assessment; and
(v) Adjust and update the forecasted results with field observation.

Background and Justification:

In line with Government policy to address the issue of oil pollution, a National Oil Spill Contingency Plan (NOSCP) was set up, under the aegis of the Ministry of Environment. The NOSCP acknowledges the importance of estimating the size and predicting oil movement in the event of an oil spill. It also recommends the development of user-friendly software to be used for this end. Thus, a predictive model requiring a minimum set of parameters should be developed.

Several models have been developed since the early sixties, which simulate the fate and transport of oil. Research is still being carried out in this field because of extremely complex phenomena.

Private companies have also invested in oil spill models and are now selling their products. OILSPILL for Windows and OILSTAT for Windows are models that have been developed by OCEANOR, Norway. Such models can be modified and adapted for Mauritius.

Methodology:

(i) Carry out a survey of the various mathematical oil spill models which exist in the region.
(ii) Develop the most cost-effective and appropriate oil spill model for Mauritius.
(iii) Provide training in the use of this model.

Proposed Institutions:

MOI, University of Mauritius, Meteorological Services, Ministry of Environment, IOC, International Agencies.

Estimated Time Frame: 6 months
Costs: Rs. 300,000
Infrastructure & Equipment: Computer and software

Expected Outcomes:

A model of the maritime zone of the Republic of Mauritius with seasonal data on current patterns, winds and other meteorological parameters. This model will be used to predict oil movement in case of an oil spill

Project 5: Inventory of the living and non-living resources in the EEZ of the Republic of Mauritius.

Objectives:
To map the EEZ of the Republic of Mauritius with a view to identifying its living and non-living resources.

Background and Justification:
Development in Mauritius had so far been focused mainly on terrestrial activities, even though the Mauritian Exclusive Economic Zone (EEZ) extends over an area of about 1.9 million km^2. This ocean territory holds an immense potential for development which could play a vital role in the future economic well being of Mauritius. There are indications that gas hydrates and manganese nodules may exist in our EEZ. It is therefore imperative to identify these resources and exploit them.

Many expeditions have been carried out in the EEZ of Mauritius over the past decade. There is a need to pool existing data on the living and non-living resources in the EEZ. Exploration of the resources through surveys should also be undertaken. In this context, public and private organisations (local and foreign) may set up joint ventures to undertake deep-sea expeditions with a view to exploring the marine resources in our EEZ.

Methodology:
The project would consist of:

(i) Bathymetric surveys covering the entire EEZ of Mauritius for the preparation of bathymetric charts. This will help in locating potential fishing grounds; and

(ii) Seismic profiling to identify types and thickness of sediments for the assessment of non-living resources, particularly hydrocarbons and minerals.

The scope of work would also include sedimentary profiling, bottom coring and sea floor mapping and the study of physico-chemical parameters.

Proposed Institutions:
MRC, MOI, AFRC, Ministry of Environment, Ministry of Housing and Land, University of Mauritius, Remote Sensing Centre and International Agencies.

Estimated time frame: 15 years

Estimated Costs: Rs. 150 million spread over 15 years

Infrastructure: (i) Laboratory facilities
(ii) Fully equipped ocean research vessel (chartered)

Scientists: Hydrographers, oceanographers, geophysicists, geologists, marine biologists, ocean engineers.

Output : Bathymetric, geomorphological and geochemical maps.

- Resource maps and a database to locate living and non-living resources.

Project 6: Development potential of Agaléga with special reference to freeport activities.

Objective:
This project aims at defining a development strategy for the island of Agaléga taking into consideration that it is presently in a pristine state but also that it is closer to the main commercial cities of the world.

Background and Justification:
This project concerns the outer island of Agaléga which is 1000 km North of Mauritius with a land area of 2600 hectares. Agaléga, so far, appears to have been more of an economic liability than an asset to the Government. Not only has the vast economic zone which they have brought to Mauritius hardly been exploited, but maintenance of a physical presence and the development of infrastructure on these islands have also proved to be very onerous undertakings. The overall population is about 200 persons. The Outer Islands Development Corporation is responsible for the management and development of Agaléga.

It is to be noted that, over the past few years, there has been a marked improvement in the standard of housing and of other facilities at Agaléga. Yet, much remains to be done – be it in terms of infrastructure, productive employment, social development or environmental protection. Time has now come to start thinking about economic development which will bring greater prosperity and also to reduce dependency on Government grants. This strategy is in conformity with the spirit of the Outer Islands Development Corporation Act i.e. 'The Corporation shall conduct its business according to sound commercial principles'. The Corporation has a number of projects that could be implemented on Agaléga. However, we are recommending that a study on freeport activities be carried out.

Methodology:
Considering the pristine state of Agaléga, it is essential, at the beginning of the project to determine with Government and with all stakeholders what type of development will be encouraged in Agaléga. For the purpose of this proposal, we are considering the idea of the OIDC of developing the island into a freeport. A feasibility study will be carried out to know whether there is a potential for sustainable development in Agaléga. A detailed technical feasibility study for the construction of a proper harbour and port area at Agaléga will be carried out. A socio-economic study in order to determine the income that could be generated from the freeport activities will also be required.

Proposed Institutions:
Outer Islands Development Corporation, Mauritius Port Authority, Ministry of Trade and Shipping, Private Sector

Time Frame: 6 months

Cost: Rs. 1 million

Expected Outcome: This project should result in a development plan for Agaléga so that the island becomes more of an asset than a liability to the government

Project 7: Enhancement and sustainable development of the marine resources of Rodrigues and the outer islands.

Objectives:

(i) To determine the development potential of coastal living and non-living marine resources of Rodrigues and the Outer Islands;

(ii) To identify the development potential and its socio-economic and environmental impacts; and

(iii) To define a strategy paper for the sustainable development of living and non-living marine resources of Rodrigues and the Outer Islands.

Background and Justification:

One of the main component of the development potential of Rodrigues and the Outer Islands is based on marine resources, as the available land area is very limited. Moreover, the population of Rodrigues heavily depends on an overexploited lagoon as main source of income. The strategy paper will identify alternative living and non-living marine resources that can be tapped to reduce the stress on the lagoons in Rodrigues and the Outer Islands.

Methodology:

The following studies will be carried out:

- Bibliographic study to determine the available data and further studies that need to be carried out to define the available living and non-living marine resources that can be exploited in Rodrigues and the Outer Islands;
- Hydrographic and Oceanographic surveys of the lagoons around Rodrigues and the Outer Islands to identify the available living and non-living marine resources;
- Environmental and socio-economic assessments to define the resources that can be exploited in a sustainable manner to reduce the pressure on the lagoon; and
- Definition of priority areas and time frame for the implementation and exploitation of the living and non-living marine resources for Rodrigues and Outer Islands.

Proposed Institutions:

Ministry of Local Government and Rodrigues, Outer Islands Development Corporation, Ministry of Fisheries, Bank fishing operators

Estimated Time Frame: Two years
Estimated Costs: Rs. 5,000,000
Infrastructure: Small Vessel & Oceanographic Equipment

Expected Outcomes

The information obtained during the project will be used by decision makers to define priority areas, projects and target dates for the enhancement of marine resources of Rodrigues and the Outer Islands while at the same time taking into consideration socio-economic and environmental aspects.

Project 8: Ocean Thermal Energy Conversion (OTEC) as a source of renewal energy for Mauritius, Rodrigues and Agaléga.

Objective:

To gather data and information from local and overseas sources for a preliminary study on the potential of an Ocean Thermal Energy Conversion project.

Background and Justification:

OTEC offers at present the most promising potential source of renewable energy for tropical and sub-tropical islands. It takes advantage of the thermal difference of at least 20ºC between the sea-surface and deep water of 600 to 1000 m to support a thermodynamics cycle and run a heat engine producing mechanical energy with practical efficiency of 2 to 3 %. The promising prospect of OTEC for Mauritius, Rodrigues and outer-islands was presented at the National Energy Conference (University of Mauritius, Réduit, 15-19 December 1980).

Emphasis is being made at national, regional and international levels on renewable sources of energy in order to reduce Greenhouse gas emission to mitigate global warming and sea-level rise. The project is in line with the recommendations of the United Framework Convention on Climate Change and the Kyoto protocol. It can attract funding from GEF under the clean energy mechanism within the framework of activities implemented jointly.

A team of scientists from the National Institute of Oceanography, Goa, India, recently carried out a preliminary study at Albion and Rodrigues for finding suitable sites for an OTEC plant.

Methodology and Activities:

No local expertise and equipment exist at present to gather data and information on sub-surface temperature, salinity, and bathymetry of the coastal region and seabed which are critical for a feasibility study and technical and economic evaluation of an OTEC plant project.

It is proposed therefore that preliminary studies should include: -

Phase I
Carry out a feasibility study of the OTEC plant.

Phase II
Measurement of the sub-surface temperature and salinity parameters over a seasonal cycle and detailed mapping of bathymetry of coastal zone and seabed at potential sites to be identified from available bathymetric charts

Phase III
Install the OTEC plant, if found feasible and economical.

Proposed Institutions:

Ministry of Public Utilities, CEB, MRC, MOI, Meteorological Services, OIDC, UoM, AFRC, DOE Ministry of Rodrigues, Coast Guards, Ministry of Housing and Lands (Survey Division). IOC (UNESCO), USA, France, India, Japan and Germany could assist.

Duration:

Phase I - Six months.
Phase II – Six months.
Phase III- Two years.

Estimated Costs:

Phase I. Rs. 200,000; Phase II: Rs. 2m; and Phase III – to be determined.

Infrastructure:

Expandable bathythermograph, sea surface temperature and conductivity sensors, boats and research ships with echo sounders.

Expected Outcome:

Data and information for an OTEC plant feasibility study and an operational OTEC plant as a renewable source of energy.

Project 9: Socio-economic study of the fishermen community in Mauritius and Rodrigues.

Objectives:

This project proposes to study the socio-economic status of the fishermen in Mauritius and Rodrigues, analyse the relation between the number of fishermen, the resource and their livelihoods and make recommendations on ways and means to improve the economic status of fishermen and the literacy and numeracy skills in the fishermen community. It is expected that proposals will then be made for the general upliftment of the social conditions of the fishing community and alternative job opportunities will be identified.

Background and Justification:

Mauritius has undergone a very important transformation both at the level of the country's economic and social structures in the last couple of decades. All these changes have had very important repercussions on the life styles of the Mauritian population and on inter-generational relationships. Although Mauritius has reaped net benefits from these changes, there are still certain groups of people especially among the fishermen community whose standard of living needs to be further improved.

The fishermen community has been among one of the leading actors of this industry over the past decades. However, fishermen still face socio-economic problems and many of them have not had their well being improved over the years. The Ten Year Development Plan strongly recommends a socio-economic study of the entire fishing community in Mauritius so as to enable decision makers to identify appropriate development strategies for this group of the Mauritian society.

Methodology and Activities:

The project team will consist, among others, of a fisheries economist/planner and a social scientist. The team will review the socio-economic status of the fishermen community taking into consideration:

- The provisions of the Fishermen Welfare Fund and other assistance provided by government;
- The role played by middlemen in the fishermen's milieu; and
- Illiteracy, alcoholism and other social problems prevalent within the fishermen community.

The team will analyse:

- The contributions of the various types of fishermen to overall fish production, their mobility within the fisheries sector as well as in other sectors of the national economy; and
- The contribution of government in the welfare of fishermen and socio-economic impacts of existing fisheries projects on the fishermen community.

It will also advise on appropriate management strategies and identify redeployment possibilities within the fisheries sector taking into consideration the following:

- Potential areas where fishermen are likely to suffer setbacks and recommend alternative employment for them;
- Reduction of fishing effort in view to cope with the fisheries resource available;
- Effects of coastal development projects/waste disposal on fishermen;
- Relocation of fishing effort to outer-lagoon areas;
- Effect of the buy-back programme of nets; and
- Effectiveness of the various incentives including allowances provided to fishermen.

Proposed Institutions:
Ministry of Fisheries, Ministry for Rodrigues, MRC, and the University of Mauritius.

Duration:
1year

Estimated Cost: Rs. 500,000

Infrastructure:

Existing infrastructure at the AFRC, University of Mauritius and MRC.

Expected outcome:

The project will identify the strategies to be adopted for the upliftment of the socio-economic conditions of the artisanal fishermen which will be beneficial both to the concerned community and to the coastal environment.

Project 10: Management plan for the octopus fishery in Rodrigues

Objective:

In order to manage the Rodrigues octopus fishery on a sustainable basis, it is proposed to undertake a complete assessment of the octopus fishery and to propose a management plan with short-term and long-term measures for the sustainability of the fishery.

Background Information and Justification:

The annual catch of octopus was estimated by Pearson (1988) to be around 226 tonnes in 1987. This represented 50% of what was landed 30 years ago. In recent years, with a drastic increase in the number of woman fishers, the annual catch has again increased to around 450 tonnes. The difference this time is a reduction of average size of octopus and extensive damages to the coral habitat which play an important part in the sustainability of the octopus stocks. The situation is further complicated as there is a lack of biological information on the octopus stock and no management measures have been applied to the fishery so far.

Methodology and Activities:

The historical catch and effort data of the octopus fishery of Rodrigues will be analysed and suitable models will be used to determine the Maximum Sustainable Yield. An assessment of the octopus habitat damage and of the fishing methods will be made. The project should provide remedial measures to the destructive fishing methods and should provide alternative solutions to the production of octopus.

Proposed Institutions: Ministry of Fisheries, Ministry for Rodrigues, MRC, University of Mauritius

Infrastructure: Existing

Duration: Six months

Estimated Cost: Rs. 500,000

Expected Outcome:

The project is expected to provide a long term, viable solution to the problem of octopus stock depletion in Rodrigues.