



European Commission

EuropeAid Cooperation Office

Framework contract Beneficiaries LOT 6 - Environment

Country: Overseas Countries and Territories

Project title: OCT Environmental Profiles
Request for services no. 2006/12146

Final Report

Part 2 - Detailed Report

Section B - Indian Ocean Region

January 2007



Consulting Engineers and Planners A/S, Denmark

PINSISI Consortium Partners

PA Consulting Group, UK

ICON Institute, Germany

IIDMA, Spain

Scanagri, Denmark

OVERSEAS COUNTRIES AND TERRITORIES

ENVIRONMENTAL PROFILE

PART 2 - Detailed Report

Section B – Indian Ocean Region

This study was financed by the European Commission and executed by the Joint-Venture of NIRAS PINSISI Consortium partners. The opinions expressed are those of the consultants and do not represent any official view of the European Commission nor of the governments of the territories involved.

Prepared by: Helena Berends
Jonathan Pears

LIST OF ABBREVIATIONS AND ACRONYMS USED

ACAP	Agreement on Conservation of Albatrosses and Petrels
ACOR	Association Française pour les Récifs Coralliens
ACS	Association of Caribbean States
AEPS	Arctic Environmental Protection Strategy
AFL	Aruba guilders
AI	Ascension Island
AIG	Ascension Island Government
AIWSA	Ascension Island Works & Services Agency
AMAP	Arctic Monitoring and Assessment Programme
ANG	Anguilla
ANRD	Agricultural & Natural Resources Department
AOSIS	Alliance of Small Island States
APEC	Asia–Pacific Economic Cooperation
ARU	Aruba
BAS	British Antarctic Survey
BAT	British Antarctic Territory
BIOT	British Indian Ocean Territory
BRGM	Bureau de Recherches Géologiques et Minières
BVI	British Virgin Islands
CARICOM	Caribbean Community and Common Market
CAFF	Conservation of Arctic Flora and Fauna
CAY	Cayman Islands
CCAMLR	Convention on the Conservation of Antarctic Marine Living Resources
CCC	Cod and Climate Change Programme
CDB	Caribbean Development Bank
Caribank	Caribbean Development Bank
CARICOM	Caribbean Community
CARIFORUM	Caribbean Forum
CBD	Convention on Biological Diversity
CCAMLR	Convention on the Conservation of Antarctic Marine Living Resources
CDERA	Caribbean Disaster Emergency Response Agency
CDS	Catch Documentation Scheme
CEHI	Caribbean Environmental Health Institute
CESC	Conseil Economique, Social et Culturelle (FP)
CIA	(US) Central Intelligence Agency
CITES	Convention on International Trade in Endangered Species
CMS	Convention on the Conservation of Migratory Species of Wild Animals
CNRS	Centre National de Recherche Scientifique
COLTO	Coalition of Legal Toothfish Operators
CoP	Conference of the Parties
CPA	Country Poverty Assessment
CPACC	Caribbean Planning for Adaptation to Climate Change
CR	critically endangered (IUCN classification)
CRISP	Coral Reefs in the South Pacific
CROP	Council of Regional Organizations of the Pacific
CSD	Commission on Sustainable Development
CSM	Caribbean Single Market
DAF	Direction de l'Agriculture et de la Forêt (Mayotte)
DCNA	Dutch Caribbean Nature Alliance
DEACI	Department of Economic Affairs, Commerce and Industry

DEFRA	(UK) Department of Environment, Food and Rural Affairs
DEPD	Development & Economic Planning Department (St Helena)
DfID	(UK) Department for International Development
DIP	(Aruba) Directorate of Infrastructure and Planning
DK	Denmark
EC	European Community
ECE	Economic Commission for Europe
ECCB	Eastern Caribbean Central Bank
EDF	European Development Fund
EEZ	Exclusive Economic Zone
EIA	Environmental Impact Assessment
EIB	European Investment Bank
EIS	Environmental Impact Statement
EN	endangered (IUCN classification)
ENSO	El Niño Southern Oscillation
EPA	Economic Partnership Agreement
EPD	environment, planning and development
EU	European Union
F	France
FAO	Food and Agriculture Organisation
FCO	(UK) Foreign and Commonwealth Office
FDA	Aruba Development Foundation
FEA	Fonds pour l'Environnement et l'Agriculture
FI	Falkland Islands
FIG	Falkland Islands Government
FP	French Polynesia
GCRMN	Global Coral Reef Monitoring Network
GDP	gross domestic product
GEF	Global Environment Facility
GGF	Good Governance Fund
GHG	greenhouse gas(es)
GIWA	Global International Water Assessment
GoA	Government of Anguilla
GR	Greenland
GSGSSI	Government of South Georgia and South Sandwich Islands
HMS	His Majesty's Ship
IAATO	International Association of Antarctica Tour Operators
IBA	Important Bird Area
ICCAT	International Commission for the conservation of tuna-like fish in the Atlantic
ICES	International Council for the Exploration of the Sea
ICES-CCC	ICES Cod and Climate Change Programme
ICRI	International Coral Reef Initiative
IFRECOR	Initiative Française pour les Récifs Corraliens
IIED	International Institute for Environment and Development (UK)
IMF	International Monetary Fund
IPCC	International Panel on Climate Change
IRD	Institut de Recherche pour le Développement (France)
IUCN	International Union for Conservation of Nature
IUU	illegal, unregulated and unreported (fishing)
JCNB	Joint Commission on Narwhal and Beluga
JNCC	(UK) Joint Nature Conservation Committee
LPO	Ligue pour la Protection des Oiseaux
LSB	Landbased Sources of Marine Pollution (protocol of the Cartagena Convention)
MAB	Man and Biosphere (Reserve)
MACC	Mainstreaming Adaptation to Climate Change
MAHLE	(Montserrat) Ministry of Agriculture, Lands, Housing and Environment

MAY	Mayotte
MDGs	Millennium development goals
MEA	Multilateral environmental agreement
MINA	(NL Antilles) Ministry of Public Health and Social Development
MON	Montserrat
MoU	Memorandum of Understanding
MRAG	Marine Resources Assessment Group
MVO	Montserrat Volcano Observatory
n.a.	not available
NACRI	Netherlands Antilles Coral Reefs Initiative
NAFO	North Atlantic Fisheries Organisation
NAMMCO	North Atlantic Marine Mammal Commission
NC	New Caledonia
NDP	National Development Plan (St Pierre & Miquelon)
NEMS	National Environmental Management Strategy
NGO	non-governmental organisation
NL	Netherlands
NLA	Netherlands Antilles
NNR	National Nature Reserve
NT	National Trust
NZ	New Zealand
NZ\$	New Zealand dollars
OECS	Organisation of Eastern Caribbean States
OCT	Overseas Countries and Territories
OCTA	Overseas Countries and Territories Association
OTCC	(UK) Overseas Territories Consultative Council
OTD	Overseas Territories Department (of UK FCO)
OTEF	(UK) Overseas Territories Environment Fund
OTEP	(UK) Overseas Territories Environment Programme
PADD	Plan d'Aménagement et de Développement Durable (Mayotte)
PAME	Protection of the Arctic Marine Environment
PEP	Poverty and Environment Partnership
PGA	Plan Général d'Aménagement
PGEM	Plan de gestion de l'Espace Maritime
PID	Pacific Islands Development Programme
PNG	Papua New Guinea
POP	persistent organic pollutant
PROE	Programme régional océanien de l'environnement
PWSD	Public Works and Services Department
RFMO	Regional Fisheries Management Organisation
RSP	Regional Seas Programme <i>or</i> Regional Strategy Paper
RSPB	(UK) Royal Society for the Protection of Birds
SAWG	South Atlantic Working Group (of the UK OTCF)
SCOR	Scientific Committee on Oceanic Research
SCP	Strategic Country Programme
SD	sustainable development
SDP	Sustainable Development Plan
SEA	Strategic Environmental Assessment
SEAFO	South-East Atlantic Fisheries Organization
SEF	Service de l'Environnement et de la Forêt (Mayotte)
SGSSI	South Georgia and South Sandwich Islands
SHI	St Helena Island
SIDS	Small Island Developing States
SIDSNet	Small Island Developing States Information Network
SITAS	Service d'Inspection du Travail et des Affaires Sociales (Wallis & Futuna)
SMOC	(NL Antilles) Stichting Schoon Milieu Curaçao

SOPAC	South Pacific Applied Geoscience Commission
SPA	Specially Protected Area
SPAW	Protocol concerning Specially Protected Areas and Wildlife
SPEM	Service de la Pêche et de l'Environnement Marin (Mayotte)
SPD	Single Programming Document
SP&M	St Pierre & Miquelon
SPREP	South Pacific Regional Environment Programme
SPT	South Pacific Tourism Organisation
STH	St Helena
TAAF	Terres Australes et Antartiques Françaises
TAC	total allowable catch
TCI	Turks & Caicos Islands
TDC	Tristan da Cunha
TEAP	Taxe pour l'environnement, l'agriculture et la pêche
TERV	taxe pour l'enlèvement et le recyclage des véhicules
UK	United Kingdom
UKOTCF	United Kingdom Overseas Territories Conservation Forum
UN	United Nations
UNCED	United Nations Conference on Environment and Development
UNDP	United Nations Development Programme
UNFCCC	United Nations Framework Convention on Climate Change
UNECLAC	United Nations Economic Commission for Latin America and the Caribbean
UNEP	United Nations Environment Programme
UNESCO	United Nations Educational, Social and Cultural Organisation
VMS	Vessel Monitoring System
VROM	Netherlands environment ministry
VU	vulnerable (IUCN classification)
W&F	Wallis & Futuna
WH	World Heritage
WRI	World Resources Institute
WTO	World Trade Organisation
WW2	second world war

Table of Contents

1	Environmental profile of Indian Ocean OCTs – Regional report	8
1.1	Introduction	8
1.2	Description of the region	8
1.3	Relevant regional organisations and programmes	9
2	The territories: present situation and trends	10
2.1	Population	10
2.2	Economic	11
2.3	Nature of islands, habitats, wildlife.....	11
2.4	Flora and fauna	12
3	Issues and threats.....	13
3.1	Introduction	13
3.2	Climate change and energy	14
3.3	Environmental degradation due to development and tourism	14
3.4	Waste management	15
3.5	Conserving biodiversity	15
3.6	Water and seas	16
3.7	Air pollution	17
3.8	Natural hazards.....	17
3.9	Environmental governance	18
4	Recommendations for cooperation in the environment between the EC and Indian Ocean OCTs	19
5	List of references consulted	21
	Annex A: Environmental profile - British Indian Ocean Territory	31
	Annex B: Environmental profile - Mayotte.....	41
	Annex C: Environmental profile - French Antarctic and Austral Territories	50

1 Environmental profile of Indian Ocean OCTs – Regional report

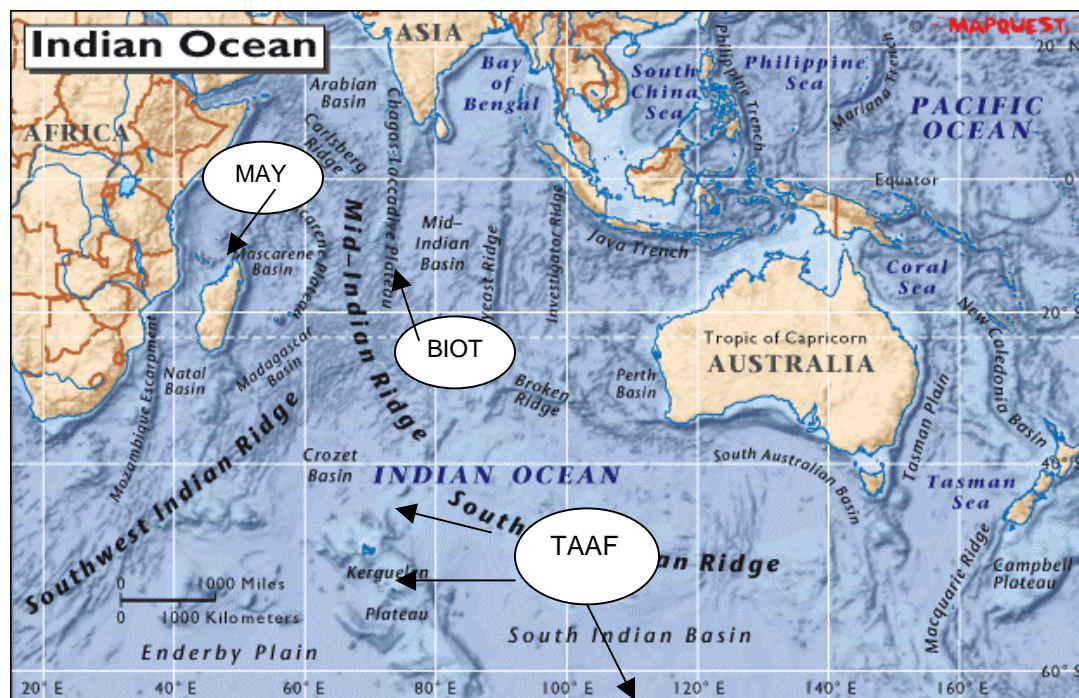
1.1 Introduction

This volume is part of a 6-volume report made at the request of the European Commission. It presents environmental profiles for the three overseas countries and territories (OCTs)¹ in the Indian Ocean region. There are companion volumes for the OCTs in the Caribbean, Pacific, North Atlantic and South Atlantic regions. The purpose of the environmental profiles is to feed discussions on the environment and possible consequences environmental trends may have on OCTs socio-economic development, and more specifically, to assist the EU in programming its EDF assistance to the OCTs.

This volume comprises an overall profile in which the territories are treated in the context of the Indian Ocean region as a whole, followed by the environmental profiles for the individual territories (Appendices A to C). The regional findings for all regions are brought together and consolidated in Part 1 - Main Report.

1.2 Description of the region

We here regard the Indian Ocean region as the area being bounded to the north by the Asian continent, to the west by Africa, to the east by the Malay Peninsula and Australia, but including Antarctica.



There are 3 OCTs in the Indian Ocean region, namely:

- Linked to France: Mayotte and French Southern and Antarctic Territories (TAAF)
- Linked to the UK: British Indian Ocean Territory (BIOT)

Apart from the OCTs, the Indian Ocean region comprises:

- 6 independent nations: Madagascar, Mauritius, Comoros, the Maldives, Sri Lanka and the Seychelles. Many East African nations participate in regional agreements.

¹ The term overseas countries and territories refers to the 20 countries and territories which, although falling within the sovereignty of a member state of the European Union are wholly or partly autonomous

- Réunion, which is an overseas French department, and classified as 'Outermost Region' in relation to the EU. The French Iles Eparses (Europa, Glorieuses, Juan de Nova, Bassas da India in the Mozambique channel) and Tromelin (near Réunion) are also in the region.

1.3 Relevant regional organisations and programmes

There are a number of regional organisations and denominations important in a technical or financial sense for the purpose of these environmental profiles. These include:

Name	OCT	Other members	Remarks
IOC - Indian Ocean Commission		Comoros, Mauritius, Madagascar, Seychelles, Réunion	<p>Founded in 1982, Comoros and France (for Réunion) joined in 1986. Three senior staff members (one funded by France) plus secretarial staff and technical assistants from EU and World Bank.</p> <p>Budget 2002: €326,000</p> <p>Headquarters in Mauritius.</p> <p>Goal: Free Trade Agreement and Customs Union COMESA in smaller region.</p> <p>Tasks among others: co-operation in the field of agriculture and fishing, sustainable management of marine and coastal resources, scientific, technical fields, education, meteorology, higher education, tourism, IT development</p>
COMESA - Common market for Eastern and Southern Africa		Angola, Burundi, Congo, Comoros, Djibouti, Egypt, Eritrea, Ethiopia, Kenya, Madagascar, Malawi, Mauritius, Namibia, Rwanda, Seychelles, Sudan, Swaziland, Uganda, Zambia, Zimbabwe	<p>Established in 1994 to replace the Preferential Trade Area for Eastern and Southern Africa (PTA) which had been in existence since 1981 within the framework of the Organisation of African Unity's (OAU).</p> <p>A Free Trade Agreement was concluded in 2000 and a Customs Union established in 2004, among others for agricultural and fisheries products, transport, energy, research.</p> <p>Headquarters: Lusaka.</p> <p>Budget € 3 million.</p> <p>Tasks: Co-operation in the field of agriculture, of sea fishing and of the conservation of resources and of ecosystems.</p> <p>Réunion not included as it is part of Metropolitan France.</p>
SADC- Southern Africa Development Community		Angola, Congo, Malawi, Mauritius, Namibia, Seychelles, Swaziland, Tanzania, Zambia, Zimbabwe	<p>Free Trade Union planned for 2008.</p> <p>Among others: Food, Agriculture and Natural Resources; Infrastructure and Social Sector; Tourism and Mining</p>
IOR-ARC Indian Ocean Rim/Association for Regional Co-operation		Kenya, Madagascar, Mauritius, Seychelles, Tanzania	
RIFF- Regional Integration Facilitation Forum		Burundi, Comoros, Kenya, Madagascar, Malawi, Mauritius, Namibia, Rwanda, Seychelles, Swaziland, Tanzania, Uganda, Zambia, Zimbabwe	
LDC Least Developed Countries		Among others: Comoros, Madagascar	

Name	OCT	Other members	Remarks
WTO- World Trade Association		Among others: Madagascar, Mauritius, Réunion, Kenya, Tanzania, Uganda	
Indian Ocean Tuna Fish Commission (IOTC)			Body under FAO for the management of tuna fisheries in the Indian Ocean, set up in Seychelles in 1997
International Whaling Commission			In 1979 The International Whaling Commission (IWC) declared the Indian Ocean (north of 55° S) a sanctuary following an initiative by the Seychelles (WWF 2002).

For the three OCTs in the Indian Ocean, and in particular for Mayotte, the IOC is geographically the nearest organisation. France participates in this organisation for Réunion. IOC has the same free trade goals as the much larger COMESA but for a smaller area.

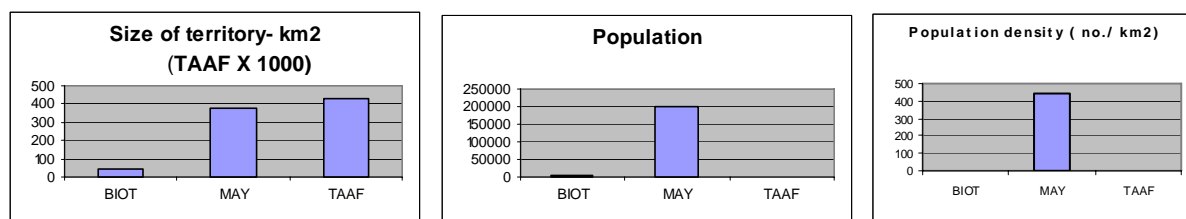
Some of these organisations (IOC, COMESA, EAC) work together and have prepared a common Regional Strategy Paper (RSP) and a common Regional Indicative Programme (RIP) for funding through the 9th EDF. This approach is in line with the EU strategy to promote and strengthen economic development and integration and co-operation amongst the ACP countries (African, Caribbean and Pacific, EU states' former colonies). The EU Cotonou Agreement for ACP countries provides for regional integration organisations (RIOs) with overlapping memberships, to work together.

The programming, implementation, monitoring, review and evaluation of the regional strategy and its operational programmes and projects will demand continuing co-ordination amongst the regional organisations, as well as with the European Commission (EC).

Another regional framework in which the Indian Ocean nations work together is the Nairobi Convention for the Protection, Management, and Development of the Marine and Coastal Environment in Eastern Africa. The Nairobi Convention, related protocols and the Action Plan were adopted in June 1985. See section 3.5)

2 The territories: present situation and trends

2.1 Population



There are huge differences in the physical and demographic characteristics of the territories. TAAF with its large tract of Antarctica is over 1000 times as large as the second biggest territory, Mayotte. Of the three territories, only Mayotte has a permanent population (of 200,000). There are 300 scientists temporarily based on TAAF, and BIOT is uninhabited except for 3,500 temporary military on the island of Diego Garcia. Mayotte has a high population density (at 440/km², the highest of all 20 OCTs) which is continuing to grow (4% p.a.), partly because of (illegal) immigration from the Comoros islands. On BIOT, the previously relocated population (some 1,500) and their descendants have expressed the wish to go

back to the islands and have won a judgement that they should be allowed to do so. However, there has been an appeal against the judgement, with a hearing set for February 2007.

2.2 Economic

The island states in the region (except Madagascar) have small and narrow domestic markets, transport problems, limited area for agriculture and a small range of export products.

There are no national accounts for the three Indian Ocean OCTs. GDP per capita on Mayotte is estimated to be €2200. For TAAF, limited tourism and fishing rights to 6 companies are estimated to earn some €15 million per year. Fishing rights for offshore tuna fishing and reef fishing by a Mauritian company are important for BIOT. On Mayotte, fishing in the lagoon is very important for the local population, but does not meet subsistence needs. The recently started aquaculture is becoming a significant source of external income.

Importance of fishing to Indian Ocean OCTs		
BIOT	MAY	TAAF
○	●	●
○ Unimportant ○ Mainly important for tourists and anglers ● Moderate economic activity ● Major economic activity		

In the western Indian Ocean region as a whole, marine fishery catches increased from a 1950s catch of about 0.5 million tonnes to nearly 3.8 million tonnes in 1992. Coastal fisheries in the region are substantial and are dominated by the local fishers whereas the more lucrative ocean fisheries are mainly operated by foreign vessels. Shrimp catches are also one of the most important components of landings in Madagascar because of their importance to foreign exchange earnings. (GIWA 2004 report).

Tourism in the region has increased, in particular in Seychelles and Mauritius. For the 3 OCTs in the region it is marginal (Mayotte), non-existent (BIOT) or very limited (TAAF). In recent years, a small number of passengers wishing to visit TAAF can travel on the Marion Dufresne, the boat that visits TAAF 4 times a year.

2.3 Nature of islands, habitats, wildlife


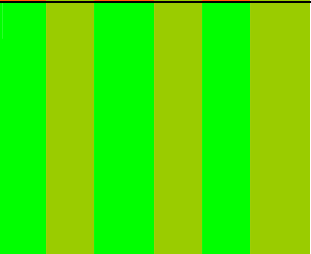
Mayotte, BIOT and TAAF are situated in different parts of the Indian Ocean. Mayotte lies near the east coast of Africa, between Madagascar and Mozambique and is part of the Comoros archipelago. BIOT is in the middle of the Indian Ocean, half way between Africa and Indonesia, on the Chagos-Maladive-Laccadive ridge. TAAF comprises two sets of islands in the southern part of the ocean and a territory on Antarctica (Adélie Land).

Most coralline islands of BIOT are low-lying with elevations of no more than 2-3 meters, Mayotte has higher areas but most of its population lives on smaller strips of land along the coast. On TAAF, the northern islands (Saint Paul and Amsterdam) have milder weather, but the southern Crozet and Kerguelen islands are swept by bitterly cold winds.




Mayotte has a very large lagoon, extensive coral reefs, many flowering plants and a number of endemic species. The Chagos Bank in BIOT has the largest lagoon in the world and many coral reefs. Thousands of birds breed on BIOT. TAAF is much older (Kerguelen is 40 million years old) and has a high number of endemic species. The beaches of Crozet contain many king penguins and elephant seals and some areas have the highest bird biomass in the world with 60 t/km². There are also thousands of albatross and petrels on Kerguelen.

On both Mayotte and BIOT there are protected nature reserves and (on BIOT only) a proposed Ramsar site. BIOT is a military area with restricted access, so the whole territory is a *de facto* protected area, although the US military have damaged coral reefs in the harbour of Diego Garcia, TAAF is also a restricted area and a nature reserve was established on some islands and marine areas in September 2006.

The table below shows how widespread coral reefs are on the territories and gives an indication of their state.

Coral reefs:	Occurrence	State of reefs	Remarks
Mayotte	●		100% of reefs at risk due to pollution, deforestation, sedimentation, over fishing. 40% of fringing reefs affected by rise sea temperature 1982-83 and 1998 ² .
BIOT	●		Chagos reefs were heavily impacted by the mass coral bleaching which occurred in 1998 as a result of the El Niño event. A 1999 survey showed that only 12% on seaward reefs was live coral. In lagoon: 30% living coral. . ³ Three years later juvenile corals were abundant, though mostly on eroding or unstable substrates, and were of less robust species. ⁴ However the reefs have undergone considerable recovery since then, with many sites regaining their status as thriving reef communities.
TAAF	○		Too cold for coral

● Extensive
● Some
○ None

 Relatively good for region
 Declining
 Degraded

2.4 Flora and fauna

BIOT has been called nature's stepping stone as it lies in the middle of the Ocean and ocean currents can transport fish larvae from the reefs in the Indo-Pacific basin to BIOT (nursery habitat) and then further west. The islands are also a breeding ground for many seabird species. Terrestrial biodiversity is not high because of the relatively young age of the islands and their remoteness. Marine biodiversity is still much higher than further north in the Indian ocean, in particular on the Chagos- Maldives- Laccadive ridge, but important coral losses have also taken place on BIOT due to climatic events in 1998.

Mayotte has much higher terrestrial biodiversity, with endemic lemurs, fruit bats and lizards. As far as marine life is concerned, the dugongs (sea cows, a vulnerable species) and many whales, turtles and dolphins are found. At least 15 cetacean (whale) species have been recorded in the Indian Ocean.

As most TAAF islands are old, remote and have never been attached to a continent, they have many endemic species among them: the Amsterdam Albatross, the Kerguelen cormorant and the Eaton duck. It is estimated that some 40 million seabirds breed there.

	Biodiversity - Recorded number of species								
	Coral	Fish	Molluscs	Algae	Mammals	Reptiles and amphibians	Birds	Insects	Plants
Mayotte	200	240*	100	270			79		
BIOT		773	384				91		280 (45 native)
TAAF	0						48	180	70 flowering

	Recorded number of endemic species					
	Birds	Mammals	Reptiles and amphibians	Fish	Insects	Plants
Mayotte	4 (2 EN)	1	3		6	
BIOT	0			3		0
TAAF	3 (2 EN)				68	24

* on one part of the lagoon only

Note: blanks in above tables mean not known

² Reefbase.

³ See Cordio (1999), chapter on BIOT by C. Sheppard.

⁴ Sheppard et al (2002): article on erosion vs. recovery of Chagos Reefs after 1998 El Niño.

3 Issues and threats

3.1 Introduction

The two OCTs in tropical waters suffer from coral reef degradation due to human activity (on Mayotte) and partly due to phenomena like sea temperature rise, cyclones, sea level rise. Reduction or depletion of fishing stocks is also an issue.

The populations of the Indian Ocean OCTs have (had) different impacts on the environment. On BIOT the large coconut plantations have reduced terrestrial biodiversity. Rats and cats brought with the human populations to BIOT in the late 18th century and by scientists to TAAF, have reduced the number of breeding birds. On Mayotte, lack of waste water treatment and household waste thrown into the rivers and lagoon destroy coral reefs and the associated eco-systems. Deforestation, overfishing, agricultural practices (leading to soil erosion) and urban sprawl have also been detrimental to the environment. Overfishing in the southern part of the Indian Ocean, partly illegal, is also an issue, as is longline fishing which has killed tens of thousands of albatrosses around TAAF since 2002.

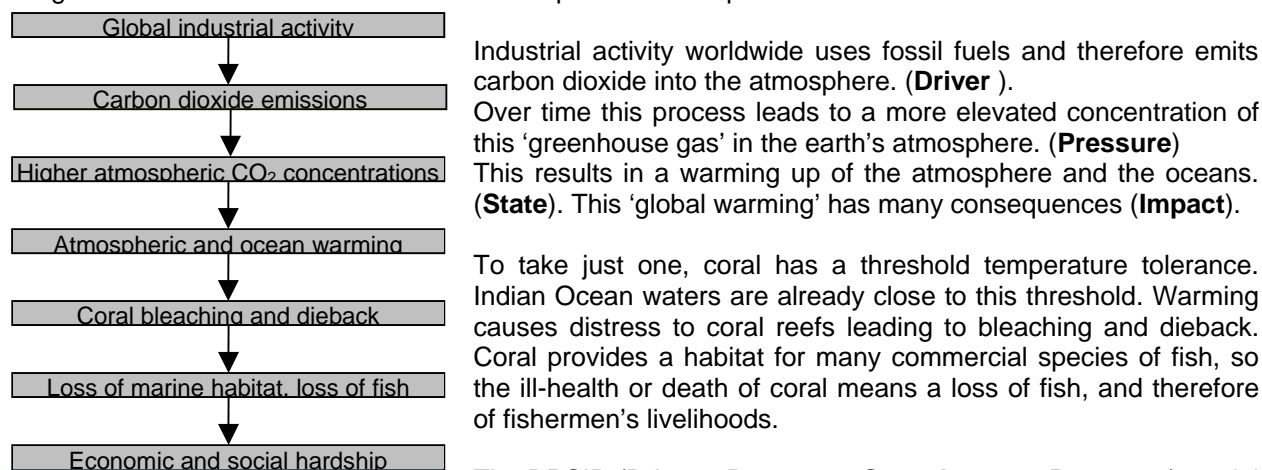
The main environmental issues for the Indian Ocean islands (including Mayotte) are:⁵

1. Pollution
2. Global change
3. Damage to ecosystems: habitat and community modification
4. Unsustainable exploitation of fish and other living resources
5. Freshwater shortage

For BIOT and TAAF the issues are somewhat different as they are effectively uninhabited (but with a military base on one island) but affected by man's presence (and introduced species). Like Mayotte, both are already experiencing the effects of climate change: morbidity of coral reefs due to warmer waters, coastal erosion, sea level rise, adaptation of new species to warmer weather.

Searching for adequate responses to such events, in particular at regional level, understanding the long chain of cause and effect and the time period involved, is essential. The two following diagrams for climate change and for coral reefs show the complexity of the processes facing the OCTs in this region.

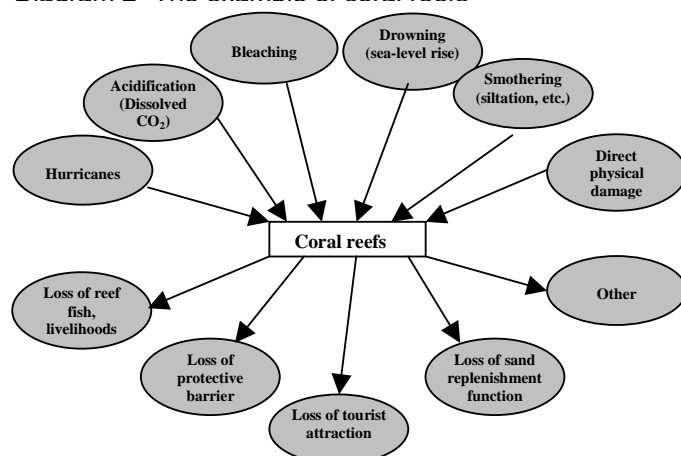
Diagram 1- The Drivers- Pressure – State - Impacts and Response model



The DPSIR (**D**rivers, **P**ressures, **S**tate, **I**mpacts, **R**esponse) model shows how Drivers (human, economic activities) lead to Pressures on the environment, which in turn cause a change in the State of the environment (e.g. CO₂ concentration in air). This then has a whole chain of Impacts on the physical world and ecosystems, and ultimately these have economic impacts. In the diagram grey indicates a driver, yellow a pressure, pink a state and blue the impacts.

⁵ Our own assessment and GIWA (2004).

Diagram 2- The example of coral reefs



Although the term causal chain is used above, the term causal web would be a better one. This is because each of the boxes in diagram 1 has many causal antecedents and many consequences. Carbon dioxide is not the only greenhouse gas. Industry is not the only source of carbon dioxide, etc. Take coral, for example. Warmer seawater is not the only threat with which it must contend. It is also harmed by hurricanes (probably more intense in the future as a result of climate change), by direct damage by fishermen, ship anchors, tourists and divers, by pollution originating from the island, particularly sewage (which contains nutrients harmful to coral) and suspended particulates (which run off the land as a

as a result of development and from natural sources) and results in smothering, by acidification of seawater (the result of increased absorption of carbon dioxide as atmospheric concentrations rise) and by 'drowning' if the sea-level rises more rapidly than the coral's ability to accrete. At the same time, the loss of marine habitat and of fish stocks is not the only impact of coral damage. Coral reefs protect their host island from wave and sea damage during storms, protect the lagoons and seagrass beds behind them which are important fish nurseries, comprise a major tourist attraction and activity (dive tourism) and have a crucial function of the sand balance on beaches. Reef loss means an impairment of all these functions.

3.2 Climate change and energy

The likely/possible main impacts of climate change on the three OCTs in the Indian Ocean are worked out in their individual environmental profiles (annexes A to C). Faced with the climate change threats, there are essentially two types of action possible:

1. actions aimed at reducing their own GHG emissions.
2. actions aimed at adapting their territories to reduce the negative impacts.

For Mayotte, reducing emissions of GHG is not an issue given its low level of economic development. However, higher consumption levels are already now having an environmental impact and higher impact on GHG: increasing numbers of plastic bottles and tin cans which need fossil fuels for their production, and more cars expelling GHGs. At TAAF, where generators and heating consume a lot of fuel, research has started into renewables.

For BIOT the issue is different. The UK has leased the largest island to the USA military who use large quantities of fuel for aircraft, causing considerable GHG emissions.

Adaptation activities will in any case be necessary: even on the most optimistic scenario for GHG emissions climate change will continue to some extent.

3.3 Environmental degradation due to development and tourism

As described in section 2.2 there is little or no tourism (TAAF, BIOT.), or a modest start (Mayotte). Even though Mayotte is one of the least developed of the inhabited OCTs, there is a desire for economic growth and development of the tourist sector. The Sustainable Development Plan sees as the main issues: population growth, education, lack of water, wastewater, maintaining forestry ecosystems, preserving nature (in particular the lagoon), anticipating the enormous increase in the number of cars over the coming 15 years.

On BIOT an important issue is whether the former population will return after the lease to the US military ends (2016, with an option of a further 20 years). If the courts rule in their favour, they could return earlier.

This would certainly have an environmental impact on the territory, the nature of which would depend on many factors. On TAAF the issue is how to control illegal fishing effectively given the area to be monitored and the harsh weather conditions.

3.4 Waste management

All small island states face special problems in relation to waste management:

- lack of the critical size and therefore ability to benefit from the economies-of-scale needed to make modern waste management techniques (sanitary landfills, safe incinerators) economic;
- lack of facilities, critical size and markets to make recycling and composting feasible;
- lack of public awareness about waste, need for prevention and reduction;
- lack of facilities for dealing with hazardous waste including infectious clinical waste;
- lack of suitable space for and resistance by local residents to new landfills;
- tropical storms can generate large volumes of waste and debris, which may be toxic, e.g. timber treated with preservatives.

The situation in the territories is briefly as follows:

Territory	Description
BIOT	General waste on the Diego Garcia base is disposed of by burning. The contract company is in the process of building a new, more environmentally friendly incinerator.
Mayotte	100,000 t of waste per year (2004). The 3 open air landfills are full. There is no selective waste collection nor recycling. The are projects in pipeline.
TAAF	Waste management plan introduced in 2003. Site of former petrol harbour on Kerguelen needs to be cleaned up. Idem for landing site (Piste du Lion) on Antarctica.

In the whole region, GIWA estimates that a total of 1.32 million tons of waste from Comoros, Madagascar, Mauritius and Seychelles is likely to end up in the Indian Ocean, as only 660,000 t of domestic waste is collected leaving a balance of 1.26 million tons.

3.5 Conserving biodiversity

Following the United Nations Conference on Environment and Development (UNCED) in Rio de Janeiro in 1992, 188 nations ratified a number of multilateral environmental agreements (MEAs) which protect the environment and conserve natural resources, in view of a sustainable development of nations.

The OCTs cannot sign MEAs in their own right. But OCTs can take on the responsibilities of an MEA if the associated sovereign state (in the case of the Indian Ocean: France and UK) has signed the MEA and asks, at the request of the OCT, that the MEA is extended to the territory of the MEA.

The Convention on the Conservation of Biological Diversity is such an MEA, undertaking to protect natural habitats and threatened species, to counteract the massive extinction of species of flora and fauna which the world has been witnessing for centuries. Neither Mayotte nor BIOT are subject to this Convention. They have however agreed to comply with a number of MEAs (see table) and have drafted and adopted the necessary environmental laws so that the agreements become effective.

The situation with regard to some of the most relevant MEAs is as follows:

OCT	CBD	Ramsar	CITES	CMS	WH	London	MCE-Nairobi	Antarctica	Remarks
BIOT		✓	✓	✓	✓	✓			Proposed Ramsar site, WH applied voluntarily. The Indian Ocean Turtle MoU is not effective yet
Mayotte	+/-	✓	✓	✓			✓		All French OCTs are participating in French CBD reports
TAAF	+/-		✓					✓	All French OCTs are reporting its biodiversity, as part of France's implementation plan under CBD. Antarctica areas protected under Antarctica Treaty.

CBD = Convention on Biological Diversity

Ramsar = Ramsar Convention on Wetlands

CITES = Convention on International Trade in Endangered Species of Wild Flora and Fauna

CMS = Bonn Convention on the Conservation of Migratory Species of Wild Animals (i.a. turtles, birds, whales)

WH= Convention concerning the Protection of the World Cultural and Natural Heritage (World Heritage)

London= London Convention on Prevention of Marine Pollution by Dumping of Wastes and Other Matter

MCE = Convention for the Protection, Management, and Development of the Marine and Coastal Environment in Eastern Africa (Nairobi Convention)

Antarctica Treaty including Madrid Protocol designating Antarctica as a natural reserve, and the Commission for the Conservation of Antarctic Marine Living Resources (CCAMLR).

On species, turtles are protected under respectively the CMS agreement for protection of the Indian Ocean Turtle (and the Sodwana resolution on a cooperative strategy for conservation of turtles). Catches of krill and other commercial fish species are limited under the rules of CCAMLR so as to conserve the food for other marine wildlife. Albatross and petrels are protected under the Agreement on the Conservation of Albatross and Petrels (ACAP).

For Mayotte, the most recent and legally binding regional framework is the MCE Nairobi Convention for the Protection, Management, and Development of the Marine and Coastal Environment in Eastern Africa. The Convention, related protocols and the Action Plan were adopted in June 1985. Although Integrated Coastal Zone Management (ICZM) is not defined in the Convention, in Article 2 (a) specific reference is made to the coastal environment, and (b) identifies activities having an impact on coastal habitats and resources. Due to severe constraints, the Action Plan previously drafted was reviewed in 1999, and a new programme reflecting the needs of the parties was prepared in the form of a Biennial Work Programme for the Implementation of the Nairobi Convention. The new programme focuses on coral reefs, shoreline changes, and land-based sources of pollution, all areas of priority determined by a regional study by UNEP (1998). An exercise to update and review the Convention and its protocols is also ongoing and expected to be completed shortly for consideration by the Parties.

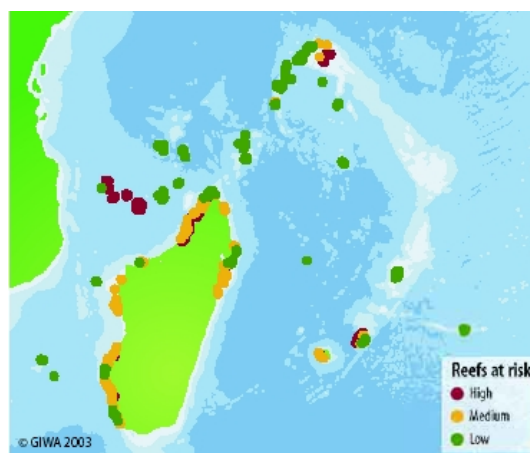
3.6 Water and seas

Sewage systems only serve a limited proportion of households in Mayotte and a "generally unhealthy situation" led to feasibility studies for conserving freshwater and treating wastewater. A start has been made with a few projects. The situation on the military base on BIOT is as follows: sewage is treated and then pumped into the sea about 1 mile from the coast. On TAAF, illegal fishing has endangered the Patagonian Toothfish. There are quotas which are enforced by French Navy patrols.

For the Indian Ocean as a whole, the Global International Waters Assessment (GIWA, 2004) assesses the state of the water resources and the sea as follows, on a scale of 0 = no impact to 3= severe impact. 1 means slight impact, 2 means moderate impact,

	SCORE	Worsening ?
Fresh water supply	1.5	Yes
Pollution of existing supplies	2	
Seas Pollution	1.7	Yes
Eutrophication	2	
Solid waste	2	
Spills	2	
Habitat and community modification	1.5	Yes
Loss of ecosystems	1.3	
Modification of ecosystems	1.8	
Unsustainable exploitation of fish	1.6	yes
Over exploitation	2.5	
Global Change	1.2	yes
Sea level change	2	

The same GIWA study says that as a result of increased sea surface temperatures that persisted for several months in 1998, Comoros experienced over 55% coral mortality, Madagascar 30% and Mauritius 1 to 15%. The Seychelles were perhaps the most severely affected, with live coral cover on the granitic islands reduced to less than 10% in some areas. Another study of the state of the coral reefs in the Indian Ocean after the sea warming event in 1998 is also pessimistic.⁶ It says that besides the catastrophe in the Seychelles, large areas of coral reef from Sri Lanka and the Maldives (in South Asia) to the East African coastal line stretching from Kenya and Tanzania to Madagascar were also severely effected.



Reefs at Risk: Red= High, Orange= medium, green: low. Source: GIWA

3.7 Air pollution

Air pollution is not an issue in the OCTs of the Indian Ocean.

3.8 Natural hazards

Mayotte and BIOT are in areas with tropical storms but BIOT has been spared cyclones.

The two tropical Indian Ocean territories have known earthquakes, Mayotte on February 2005 and a major one on BIOT in November 1983 (magnitude 7). This strong earthquake led to a small tsunami and a 1.5 m rise in wave height in the Diego Garcia lagoon, causing some damage to buildings, piers and the

⁶ CORDIO (1999)

runway. The December 2004 tsunami in the Indian Ocean was experienced as a “minor increase in wave activity” on BIOT as there is a deep (4,900m) trench to the east of the archipelago that broke the force of the wave.

3.9 Environmental governance

To be able to effectively protect the environment, a number of means are needed:

- qualified human resources dealing specifically with environmental issues
- financial resources
- policy plans (for the environment but also for physical planning/ land –use and integration of environmental issues in economic and social development plans)
- action plans (with priorities, timetables, manpower and budgets)
- legislation (among others Environmental Impact Assessments (EIA))
- monitoring, policing, sanctions/ fines
- reporting / information
- participation of stakeholders

The following table summarizes the findings on the three Indian Ocean OCTs:

OCT	Policy paper?	Env. action plan?	Legislation?	EIA?	Protected areas?	Remarks
BIOT	✓	+/-	✓	+/-	✓	Very few people are responsible for the environment. Policy statement says BIOT is to be treated as if it were a World Heritage site. The US facility is to conform to environmental ordinances. There is an environmental management plan for Diego Garcia and a draft for BIOT as a whole. Laws in place to protect birds and turtles in general (not certain species). There are strict nature reserves. Private company patrols the seas. Environmental Monitoring: by the British Representative on Diego Garcia.
MAY	✓	✓	✓		+/-	Specific services deal with the environment. There is a sustainable development plan. Fishing regulation in place (protecting corals too). French rural code and French water laws apply. EIA is not mandatory. A surveillance service is operational. Two protected coastal areas and several other areas. No modern protected area plans nor legislation. Good information material for the general public. Consultative Commission for the Environment and Protection of the National Heritage in place.
TAAF			✓	✓	✓	Staff of 5 for environmental issues based at Réunion, a Committee for the Polar Environment and IUCN advises. Budget available. Not many action plans but legislation in place. Good informational material (e.g. website, film). Protected areas.

Environmental management covers a wide and complex range of issues and policy areas, particularly in Mayotte: groundwater, rivers, the lagoon, coasts and high sea, household waste, industrial waste, hospital waste, wastewater, oil spills, storms, deforestation, agricultural practices, etc.

A regional study has identified that the legislation relating to pollution in the Indian Ocean nation states is therefore “dispersed and fragmented”.⁷ In Madagascar more than 60 legislative texts covering control in use of chemicals, wastes and pesticides exist. The more recent environment management plans in countries in the region have led to a proliferation of legislation addressing water quality, land-based activities which have implications for the coastal integrity, etc.

Both the Mauritius and Seychelles Economic Partnership Agreements (EPAs) with the EU have very detailed pollution control provisions including provisions for declaration of effluent and emission standards, access to industry sites, as well as sample collection and analysis protocols.

4 Recommendations for cooperation in the environment between the EC and Indian Ocean OCTs

The consultants were asked to make recommendations about possible areas of cooperation between the EC and the OCTs. Recommendations with regard to individual OCTs are made at the end of the individual OCT environmental profiles. Part 1 of this report looks at cooperation at the overall and interregional levels. This section considers areas which might be considered for funding at the regional level.

On the face of it, the three Indian OCTs form a rather unlikely group in terms of their opportunities for cooperation:

- they do not form a natural grouping like the Caribbean or Pacific territories. The distances involved are vast (Mayotte - BIOT 3000 km, BIOT - Kerguelen 4000 km, Mayotte – Adelie Land > 7000+ km; BIOT is particularly complicated because of the presence of the US military and a US legal jurisdiction;
- the political situation is very different: BIOT and TAAF are ‘enclave’ territories, with few or no permanent residents and no resident government;
- while two of the territories are tropical islands, the third is cold temperate/polar;
- Mayotte is in transition to becoming a French department, and will then fall under EU environmental legislation, but as an outermost region, Mayotte will probably not be asked by France to comply to all EU environmental legislation.

On the other hand there are also complications if the OCTs look further afield :

- The Comoros islands claim Mayotte as part of their territory, and this diplomatic dispute could complicate matters.
- Similarly, Mauritius has a territorial claim on BIOT.
- For TAAF there are also issues making regional environmental cooperation difficult. On the one hand, the French Iles Eparses of the Indian ocean are to be integrated into TAAF, enlarging further the area of the territory. On the other hand, many countries do not recognize France’s claim to the Antarctic territory (Adelie Land), another complicating issue.

Nevertheless the three territories do share a number of common challenges where cooperation might be a possibility:

- Developing frameworks for the creation and management of protected areas.
- Preparing for climate change effects, in particular sea level rise.

The two tropical OCTs (BIOT and Mayotte) might work together (and with others in the region, e.g. Reunion) on:

- Coral reef research, protection and proper management, in particular concerning bleaching as a result of warmer sea waters.
- Hurricane- and seismic-proof building regulations. Individual OCTs in other tropical regions such as French Polynesia and the Cayman Islands have been successful with individual approaches to this

⁷ GIWA (2004).

problem, but it should be possible to reach a consensus across a number of OCTS facing similar problems.

Finally, Mayotte can work together with other nation states and organisations in the region on:

- *Coastal management*: Continue working together in the framework of the Nairobi convention for the Protection, Management, and Development of the Marine and Coastal Environment in Eastern Africa.
- *Waste* Tackling the waste problem and pollution of the seas, by comparing and developing waste strategy policies and projects, by improving waste collection and in some cases (joint) treatment to reach economies of scale.

Common questions are:

- Sources of waste: what measures can be taken to reduce waste volumes, from households, tourists and from ships?
- Efficiency of waste collection system: is selective waste collection possible and for which waste streams is it realistic to attempt re-use or recycling and with which instruments?
- Clean up efforts and costs involved: treatment technologies and devising standards for landfills to ensure they are safe and do not pollute groundwater or coastal waters.
- approaches for difficult waste streams: car wrecks, waste oils, other hazardous or clinical waste.

5 List of references consulted

NON-TERRITORY- OR -REGION SPECIFIC

Bryant, D., Burke, L., McManus, J., and M. Spalding. 1998: Reefs at Risk: A Map Based Indicator of Threats to the World's Coral Reefs. World Resources Institute. Washington D.C.

DFID (UK Department for International Development), 2006: Reducing Poverty in Europe, Central Asia, the Caribbean and the Middle East.

EC (2000): Council Decision 2000/483/EC of 23 June 2000, Official Journal L 317 of 15.12.2000

EC (2006): Halting the loss of biodiversity and beyond: sustaining ecosystem services for human well being. Communication from the Commission of the European Communities. COM(2006) 216 final.

EC (2006a): Council / European Parliament / Commission Statement 2006/C 46/01 Official Journal C 41 of 24.2.2006

French Biodiversity Strategy. http://biodiv.mnhn.fr/convention/cbd_national

Gargominy, O. (ed.), 2003: Biodiversité et conservation dans les collectivités françaises d'outre-mer. Collection Planète Nature. Comité français pour l'IUCN, Paris. http://biodiv.mnhn.fr/information/outre_mer/fol088503

Gjerde, K. M., 2006: Ecosystems and Biodiversity in Deep Waters and High Seas. UNEP Regional Seas Reports and Studies No. 178. UNEP/ IUCN, Switzerland. This overview was prepared by the Regional Seas Programme of the United Nations Environment Programme (UNEP), in cooperation with the World Conservation Union (IUCN).

International Panel on Climate Change (IPCC), 2001: Third assessment report 2001.

JNCC (Joint Nature Conservation Committee), 1999: Biodiversity: the UK Overseas Territories. By Procter, D., & Fleming, L.V., Peterborough, UK.

Kaly, U., Pratt, C. and Howorth, R., 2002: Towards managing environmental vulnerability in small island developing states (SIDS), SOPAC, South Pacific Applied Geoscience Commission.

OAD (2001): Council decision on the association of overseas territories within the European Community ('overseas association decision'): 27th November 2001. 2001/822EC.

Pienkowski M.W. (ed.), 2005: Review of existing and potential Ramsar sites in UK Overseas Territories and Crown Dependencies. Final Report on Contract CR0294 UK Overseas Territories Conservation Forum to the UK Department of Environment, Food and Rural Affairs.

Procter, D., & Fleming, L.V., editors, 1999: Biodiversity: the UK Overseas Territories. Global Coral Reef Monitoring Network GCRMN, Australian Institute of Marine Science, Joint Nature Conservation Committee JNCC, Peterborough, UK.

Quantitative Ecosystem Indicators for Fisheries Management - Special Issue of the ICES Journal of Marine Science, Volume 62, Issue 3, Pages 307-614 (May 2005)

Sanders S. (ed) 2006: Important Bird Areas in the United Kingdom Overseas Territories, The Royal Society for the Preservation of Birds, Sandy, UK.

Sear C., M. Hulme, N. Adger and K. Brown, 2001: The Impacts of Global Climate Change on the UK Overseas Territories- Issues and Recommendations. A Summary Report, Natural Resources Institute (UK), Tyndall Centre for Climate Change (UK), A report commissioned by the DFID Overseas Territories Unit.

Tompkins E. L., S.A. Nicholson-Cole, L-A. Hurlston, E. Boyd, G. Brooks Hodge, J. Clarke, G. Gray, N. Trotz and L. Varlack, 2005: Surviving Climate Change in Small Islands- A guidebook, Tyndall Centre for Climate Change Research, Norwich, UK. Funded by the UK Department for International Development

and the UK Foreign and Commonwealth Office through the Overseas Territories Environment Programme (OTEP).

UICN, 2003: Biodiversité et conservation dans les collectivités françaises d'outre-mer. Collection Planète Nature. Paris. Author: Gargominy, O. (ed.).

UK Foreign & Commonwealth Office (UKFCO), 2005: UK International Priorities - The FCO Sustainable Development Strategy. March 2005.

UK Government, 1999: Partnership for Progress and Prosperity - Britain and the Overseas Territories. Presented to Parliament by the Secretary of State for Foreign and Commonwealth Affairs, March 1999.

Wilkinson, C, (editor), 2000, Status of Coral Reefs of the World: 2000, Global Coral Reef Monitoring Network (GCRMN) and Australian Institute of Marine Science.

Wilkinson, C. (editor), 2004: Status of Coral Reefs of the World: 2004, Global Coral Reef Monitoring Network GCRMN and Australian Institute of Marine Science.

Organisation	Website address	Remarks
ACOR- French Coral Reefs Association	http://www.univ-perp.fr/ephe/acorweb/francais/menu.html	Association Française pour les Récifs Coralliens
ADEME- French energy conservation Agency	http://www2.ademe.fr/servlet/getDoc?id=11433&m=3&cid=96	Agence de l'Environnement et de la Maîtrise de l'Energie
Caribbean Development Bank	http://www.caribank.org/Publications.nsf/EReview2005_turkscaicos/\$File/ECReview2005_turkscaicos.pdf?OpenElement#se arch=%22pier%20construction%20turks%20caicos%22	
CEDRE- French documentation centre for accidental water pollution	http://oceanprevention.free.fr/cedre2.htm	Centre de documentation, de recherche et d'expérimentations sur les pollutions accidentelles des eaux
CIA	www.cia.gov/cia/publications/factbook/index.html	Info per OCT
CITES or Washington Convention on trade in endangered species (1973)	www.cites.org	
Coalition of legal toothfish operators	http://www.colto.org	Fisheries, particularly Southern Hemisphere
CRED- Centre for Research on the Epidemiology of Disasters	http://www.em-dat.net/disasters/country.php	Interesting database on disasters
EU- Indicative programmes VIII EDF	http://ec.europa.eu/comm/development/oct/ind_prog_en.htm	
EU- on all OCTs	http://ec.europa.eu/comm/development/oct/index_en.htm	
EU- on individual OCTs	http://ec.europa.eu/comm/development/oct_new/oct_en.cfm	
EU- Regional strategy papers:	http://ec.europa.eu/comm/development/body/csp_rsp/rsp_en.cfm	

Organisation	Website address	Remarks
EU- Single programming documents IX EDF	www.ec.europa.eu/comm/development/body/csp_rsp/spd_en.cfm	
European Commission	http://ec.europa.eu/comm/development/body/development_policy_statement/docs/edp_summary_en.pdf (English) http://ec.europa.eu/comm/development/body/development_policy_statement/docs/edp_summary_fr.pdf (French)	Summary of EDP
FAO regional fisheries bodies	http://www.fao.org/fi/body/rfb/index.htm	
French Centre for Biodiversity Convention	http://biodiv.mnhn.fr/	Centre d'Echange français pour la Convention sur la diversité biologique. Portail de la biodiversité en France pour la Convention sur la diversité biologique
French Fund for the global environment	http://www.ffem.net/jahia/Jahia/lang/fr/pid/224	Fonds Français pour l'environnement mondial
French Ministry Ecology and SD	www.ecologie.gouv.fr general site On overseas: http://www.ecologie.gouv.fr/rubrique.php3?id_rubrique=970	Ministère de l' Ecologie et Développement durable
French National Inventory of Species	www.inpn.mnhn.fr general site http://inpn.mnhn.fr/inpn/fr/inpn/diversity_DT.htm on biodiversity overseas	Inventaire National du patrimoine naturel (INPN)
French Overseas Ministry	http://www.outre-mer.gouv.fr/outremer/front?id=outremer/decouvrir_outre_mer http://www.outre-mer.gouv.fr/outremer/front	Ministère de l'Outre-Mer on Overseas countries and territories and 2007 budget
French Prime minister's office	http://www.premier-ministre.gouv.fr/information/actualites_20/transferts_fonds_europeens_collectivites_57080.html	Transfer of EU funds to French OCTS
Futura Sciences	http://www.futura-sciences.com/comprendre/d/index.php	Dossier on coral reefs
GIWA- Global assessment of international waters	www.giwa.net	A UNEP/ GEF / Kalmar university project
Global Ocean Ecosystem Dynamics	http://www-cger.nies.go.jp/cger-e/db/info-e/InfoDBWeb/prog/globec.htm	Global Ocean Ecosystem Dynamics
ICRI	http://www.icriforum.org	ICRI international coral reef initiative
IFEN- French institute for the environment	http://www.ifen.fr	
IFREMER Institut français de recherche pour l'exploitation de la mer	http://www.ifremer.fr/francais/index.php http://oceanprevention.free.fr/ifremer2.htm	

Organisation	Website address	Remarks
Info on cities threatened by hurricanes	http://www.hurricanecity.com	Info on hurricanes by country
Innovation Centre, University of Exeter	http://www.innovation.ex.ac.uk/imm/Disaster_management.htm	Climate change and the poor
Innovation Centre, University of Exeter	http://www.innovation.ex.ac.uk/imm/PovertyAndReefsProgress.htm	Poverty and Reefs
Inventaire National du patrimoine naturel (INPN)	http://www.inpn.mnhn.fr	
IPIECA	www.ipieca.com	On oil spills
IRD- French research institute for development	www.ird.fr	Institut de recherche pour le developpement
Island Resources Foundation	http://www.irf.org/	Foundation is dedicated to solving the environmental problems of development in small tropical islands
Island vulnerability	http://www.islandvulnerability.org	Good data on all territories except Greenland
IUCN	www.iucn.org	International Union for the Conservation of Nature
London Convention on prevention of marine pollution by dumping of waste and other matter	http://www.londonconvention.org/	
NOAA	http://www8.nos.noaa.gov/biogeopublic/reef_photos.aspx http://www.oceanservice.noaa.gov/education/kits/corals/coral09_humanthreats.html	Centre for coastal monitoring and assessment of coral reefs
NOAA- National Oceanic and Atmospheric Administration	http://www.noaa.gov	General site
OCTA	www.octassociation.org	Organisation of OCTs
POLMAR	http://oceanprevention.free.fr/polmar2.htm www.polmar.com	French institute and rules for action in case of pollution of seas
Reefbase	On reefs in all countries: http://www.reefbase.org/global_database/default.aspx?section=s1	
Reefbase	http://www.reefbase.org/references/ref_Literature.asp?searchactive=yes&ID=13887	Search facility reefs database
Reefbase	http://www.reefbase.org http://www.reefbase.org/references/ref_Literature.asp?searchactive=yes&ID=13887	Search facility reefs database

Organisation	Website address	Remarks
Relief Web	www.reliefweb.int	On disasters
RFO	www.rfo.fr	Radio site for French OCTs (Reseau France Outre –mer) with info on OCTs
Scientific Committee on Oceanic Research (SCOR)	http://www.scor-int.org/	
Smithsonian Institute volcano site	http://www.volcano.si.edu	
UK DFID (Department for International Development)	http://www.dfid.gov.uk/countries/allcountries.asp?view=region	Country Profiles
UK FCO (Foreign and Commonwealth Office)	http://www.fco.gov.uk/servlet/Front?pagename=OpenMarket/Xcelerate/ShowPage&c=Page&cid=1013618138295	On overseas territories
UN Millenium Developmentt Goals	http://mdgs.un.org/unsd/mdg/Data.aspx	Situation per country and territory
UN-ECE	http://www.unece.org/	
UNEP	http://www.unep.net/profile/ http://www.un.org/esa/sustdev/natlinfo/natlinfo.htm	Country profiles (not on OCTS)
UNEP	http://www.unep.ch/	Register international environmental conventions secretariats based in Geneva
UNEP on sustainable tourism	http://www.uneptie.org/pc/tourism/policy/about_principles.htm	
UNEP on waste management	http://www.unep.fr/pc/pc/waste/waste.htm	
UNEP World Conservation Monitoring Centre	www.unep-wcmc.org	for instance on coral reefs, mangroves and sea grasses, etc.
World Resources Institute	http://reefsatrisk.wri.org/casestudy.cfm http://earthtrends.wri.org/features/view_feature.php?theme=1&fid=12	On reefs at risk- country reports
World resources institute	http://www.wri.org/	General site
World Resources Institute	http://earthtrends.wri.org/select_action.php?tool=3	Statistical data per country and territory, on biodiversity, energy, coastal and marine ecosystems, economics, population, etc.

INDIAN OCEAN REGION

Bigot, L., L. Charpy, J. Maharavo, F. Abdou Rabi, N. Ppaupiah, R. Aumeeruddy, C. Viledieu, A. Lieutaud, 2000: Status of Coral Reefs of the Southern Indian Ocean. Chapter 5 in: Wilkinson, C, (editor), 2000: Status of Coral Reefs of the World 2000, Global Coral Reef Monitoring Network (GCRMN) and Australian Institute of Marine Science.

Cordio, 1999: Coral reef degradation in the Indian ocean- Status reports and project presentations. CORDIO, SAREC Marine Science Program, Department of Zoology, Stockholm University, Stockholm.

http://www.cordio.org/reports/CORDIO_Status_Report_1999.pdf

EU, 2002: Regional strategy paper and regional indicative programme for the Period 2002 – 2007 in respect to: Indian Ocean Commission (IOC), Common Market for Eastern & Southern Africa (COMESA), East African Community (EAC), Intergovernmental Authority on Development (IGAD). Brussels.

GIWA, 2004: Global International Waters Assessment, Regional Assessment nr. 45b -Indian Ocean Islands. UNEP, GEF, Kalmar University, Kalmar, Sweden.

UNEP, 1999: Western Indian Ocean Environment Outlook, IOC, ENE, EU. Nairobi.

Wilkinson, C. (editor), 2004: Coral Reef Report 2004: Status of Coral Reefs of the World: 2004, written by the Global Coral Reef Monitoring Network GCRMN, and the International Coral Reef Initiative ICRI. In particular: Chapter 6 - Status of coral reefs in East Africa (Kenya, Tanzania, Mozambique and South Africa), Chapter 7 - Status of the coral reefs of the south west Indian Ocean island states and Chapter 8 - Status of coral reefs in South Asia.

Organisation	Website address	Remarks
Antarctic Treaty	www.ats.aq	
IOC- Indian Ocean Commission	www.coi-info.org	
IOTC- Indian Ocean Tuna Commission	http://www.iotc.org/English/index.php	
The Agreement on the conservation of Albatrosses and petrels	www.acap.aq	Accord pour la conservation des albatros et des pétrels
Unesco	http://ioc3.unesco.org/indotsunami/	Indian Ocean Tsunami website

British Indian Ocean Territory (BIOT)

Baldwin, E.A. (ed), 1975: Joint Services Expedition to Danger Island. Ministry of Defence Publication, London.

Barnett, L.K., & Emms, C.W., 1996: Insects and Lepidoptera of the Chagos Archipelago. Unpublished report, commissioned by the World Wide Fund for Nature (UK) and the Foreign and Commonwealth Office.

Bellamy, D.J., Hirons, M.J., & Sheppard, C.R.C., 1975: Scientific report of reef research. In: Joint Services Expedition to Danger Island, ed. by E.A. Baldwin. Ministry of Defence, London.

BIOT Administration, 1997: The British Indian Ocean Territory Conservation Policy, British Indian Ocean Territory Administration, Foreign and Commonwealth Office, London.

Carr, P., 2006 chapter on BIOT in: Sanders, S. (ed), 2006: Important Bird Areas in the United Kingdom Overseas Territories, The Royal Society for the Preservation of Birds, Sandy, UK.

CORDIO, 1999: Coral Reef Degradation in the Indian Ocean- Status reports and project presentations. CORDIO, SAREC Marine Science Program, Department of Zoology, Stockholm University, Stockholm. See in particular the Chapter on "Coral mortality in the Chagos Archipelago", by dr. Charles Sheppard of the Department of Biological Sciences, University of Warwick, UK.
http://www.cordio.org/reports/CORDIO_Status_Report_1999.pdf

Royal Naval Birdwatching Society expedition report, covering breeding seabirds on Diego Garcia and its surrounding islets, published in Sea Swallow (Carr 1998).

Sanders, S. (ed), 2006: Important Bird Areas in the United Kingdom Overseas Territories, The Royal Society for the Preservation of Birds, Sandy, UK. Chapter on British Indian Ocean Territory by Peter Carr.

Sheppard, C., Spalding, M., Bradshaw, C., & Wilson, S., 2002: Erosion vs. recovery of coral reefs after 1998 El Niño: Chagos reefs, Indian Ocean. In: Ambio 31: 40–48.

Sheppard C.R.C., 2002: Island elevations, reef condition and sea level rise in atolls of Chagos, British Indian Ocean Territory. In: Linden, O., Souter, D., Wilhelmsson, D., Obura, D. (editors). Coral Reef Degradation in the Indian Ocean, Status Report 2002. Kalmar, Sweden: CORDIO. p 202–211.

Sheppard, C.R.C., 1996: The 1996 research expedition to Chagos. Chagos News, 6: 2–5

Sheppard C.R.C., & Seaward, M.R.D. (editors), 1999: Ecology of the Chagos Archipelago, Linnean Society/Westbury Publishing, London. (Linnean Society Occasional Publications 2)

Sheppard, C.R.C., 1999: Corals of Chagos, and the biogeographical role of Chagos in the Indian Ocean. In: *Ecology of the Chagos Archipelago*, ed. by C.R.C. Sheppard & M.R.D. Seaward, 53-66. Linnean Society/Westbury Publishing, London. (Linnean Society Occasional Publications 2).

Sheppard, Charles and Spalding, Mark, 2003: Chagos Conservation Management Plan for British Indian Ocean Territory Administration (draft), Foreign & Commonwealth Office, London, University Warwick, Coventry.

<http://www.chagosconservationtrust.org/Conservation%20Plan/Chagos%20Conservation%20Management%20Plan%202003.pdf>

Symens, P., 1999: Breeding seabirds of the Chagos Archipelago. In: Ecology of the Chagos Archipelago, ed. by C.R.C. Sheppard & M.R.D. Seaward, 257-284. Linnean Society/Westbury Publishing, London. (Linnean Society Occasional Publications 2).

Wilkinson, Clive (editor), 2004: Coral Reef Report 2004: Status of Coral Reefs of the World: 2004, written by the Global Coral Reef Monitoring Network GCRMN, and the International Coral Reef Initiative ICRI. In particular: Chapter 8 – Status of coral reefs in South Asia.

Organisation	Website address	Remarks
CIA	https://www.cia.gov/cia/publications/factbook/geos/io.html	
Daily telegraph	http://www.telegraph.co.uk/news/main.jhtml?xml=/news/2006/05/12/wchag12.xml&sSheet=/news/2006/05/12/ixnews.html	On Diego Garcia law suits
Foreign and Commonwealth Office	http://www.fco.gov.uk/servlet/Front?pagename=OpenMarket/Xcellerate/ShowPage&c=Page&cid=1007029394365&a=KCountryProfile&aid=1018952687077	
Mind bit	http://great-chagos-bank.mindbit.com/ http://chagos-archipelago.mindbit.com/	
Reefbase	http://www.reefbase.org/global_database/default.aspx?section=s1	

Organisation	Website address	Remarks
The free dictionary	http://columbia.thefreedictionary.com/British+Indian+Ocean+Territory	
	http://www.blueventures.org/newsrecent_chagos.htm	

Mayotte

Bourjea, J., 2005: Evaluation de la variabilité génétique des différentes colonies de tortues vertes (*Chelonia mydas*) du Sud Ouest de l'océan Indien. Rapport final, convention Ministère de l'Outre Mer N°03D09 ; rapport IFREMER/DR/05/R/02/JB, 26p.

Ciccione S., Bourjea J., Jean C., Ballorain K., Rolland R., Quillard M. & Mari A., 2005: Inventaire quantitatif et qualitatif des herbiers basé sur du SIG. In: Assistance à la DAF de Mayotte pour l'encadrement scientifique et la formation des agents sur les programmes d'étude et de conservation des tortues marines et de leurs habitats à Mayotte, (Ciccione & Roland, eds). Rapport de Convention 2005, DAF de Mayotte/CEDTM/Ifremer, pp 17-21.

Gargominy, O. (ed.), 2003: Biodiversité et conservation dans les collectivités françaises d'outre-mer. Collection Planète Nature. Comité français pour l'UICN, Paris. Chapter on Mayotte.

Quod, J.P., Y. Dahalani, L. Bigot, J. B. Nicet, S. Ahamada and J.Maharavo, 2002:

Status of Coral Reefs at Réunion, Mayotte and Madagascar. In: Linden, O., D. Souter, D. Wilhelmsson, and D. Obura (eds.). Coral degradation in the Indian Ocean: Status Report 2002. CORDIO, Department of Biology and Environmental Science, University of Kalmar, Kalmar, Sweden.pp 185-199

Ciccione S., Bourjea J., Rolland R., 2005: Assistance à la DAF de Mayotte pour l'encadrement scientifique et la formation des agents sur les programmes d'étude et de conservation des tortues marines et de leurs habitats à Mayotte, rapport CEDTM/Ifremer 35p.

Collectivité Departementale de Mayotte, 1999 : Programme indicatif VIIIe FED- Cadre de la coopération (Indicative Programming) / Communauté Européenne.

Collectivité Departementale de Mayotte, Presentation Mayotte at EPA conference.

Collectivité Departementale de Mayotte, Conseil Général de Mayotte, 2004: Document Unique de Programmation de Mayotte (9e FED) Single Programming Document avec la Communauté Européenne.

INSEE Mayotte, 2006: Enquête flux touristiques 2005- Résultats de l'enquête flux touristiques 2005 - Conseil Général - INSEE - Comité du tourisme, Mayotte Résultats N°4 – May 2006.

http://www.insee.fr/Fr/insee_regions/reunion/zoom/mayotte/Publications/inseeinfos/pdf/resultats04.pdf

Thomassin, B. A., 1999: Bibliographie des travaux sur les milieux marins et du littoral de l'Ile de Mayotte, des bancs coralliens et fonds marins adjacents (Bancs du Geyzer et de la Zelee), Centre d'Océanologie de Marseille, Université de la Méditerranée, France (G.I.S. "LAG-MAY" project).

Wilkinson, Clive (editor), 2004: Coral Reef Report 2004: Status of Coral Reefs of the World: 2004, written by the Global Coral Reef Monitoring Network GCRMN, and the International Coral Reef Initiative ICRI. In particular: Chapter 7 - Status of the coral reefs of the south west Indian Ocean island states.

Organisation	Website address	Remarks
ACOR	http://www.univ-perp.fr/ephe/acorweb/francais/mayotte.html	Association Française pour les Recifs Coralliens
CIA	https://www.cia.gov/cia/publications/factbook/geos/mf.html	

Organisation	Website address	Remarks
Espaces (Consultancy)	http://perso.orange.fr/espaces/flore.htm http://perso.orange.fr/espaces/faune.htm	INGENIERIE DE L'ENVIRONNEMENT
French Centre for Biodiversity Convention	http://biodiv.mnhn.fr/information/outre_mer/foi088503/07_Mayotte.pdf	Centre d'Echange français pour la Convention sur la diversité biologique
French Ministry (Ecology and SD):	www.ecologie.gouv.fr/article.php3?id_article=767 www.ecologie.gouv.fr/article.php3?id_article=765 http://www.ecologie.gouv.fr/rubrique.php3?id_rubrique=335 http://www.ecologie.gouv.fr/article.php3?id_article=770	Ministere Ecologie et Développement durable
French Overseas Ministry	http://www.outre-mer.gouv.fr/outremer/front?id=outremer/decouvrir_outre_mer/mayotte&region=8	Ministère de l'Outre-Mer
INSEE	http://www.insee.fr/Fr/insee_regions/reunion/zoom/mayotte/	Statistical office Mayotte
Malango	http://www.malango-mayotte.com/ http://www.malango-mayotte.com/nature-flore-.htm http://www.malango-mayotte.com/nature-faune-.htm	Popular island's site
Mayotte online	www.mayotte-online.com	Popular island's site
Observatoire du Littoral:	http://www.conservatoire-du-littoral.fr/front/process/Content.asp?rub=8&rubec=146	On two nature reserves on Mayotte
Reefbase	http://www.reefbase.org/global_database/default.aspx?section=s1	Data base on state of reefs, page for Mayotte
RFO- Radio France Outre-Mer	http://mayotte.rfo.fr/article7.html	Article on Islam on Mayotte
UNEP		
WIKIPEDIA	http://en.wikipedia.org/wiki/Mayotte#Geography http://fr.wikipedia.org/wiki/Mayotte	

French Antarctic and Austral Territories (TAAF)

Paul Carroll on www.btinternet.com all islands. On Kerguelen:
http://www.btinternet.com/~sa_sa/kerguelen/kerguelen_islands.html

Organisation	Website address	Remarks
Antarctica Treaty	www.ats.aq	

Organisation	Website address	Remarks
CCAMLR – Convention on the conservation of Antarctic Marine Living Resources	www.ccamlr.org	
CIA	https://www.cia.gov/cia/publications/factbook/geos/fs.html	
Comité de l'environnement polaire	http://www.legifrance.gouv.fr/texteconsolide/UPH3Q.htm	
Discover France	http://www.discoverfrance.net/Colonies/Crozet.shtml http://www.discoverfrance.net/Colonies/Kerguelen.shtml	
Emile Victor Polar Institute (IPEV)	http://www.ifremer.fr/ifrtp/pages/institut_polaire.html	
French Center for Biodiversity Convention	http://biodiv.mnhn.fr/information/outre_mer/fol088503/10_TAAF.pdf	Centre d'Echange français pour la Convention sur la diversité biologique
Quid france	http://www.quid.fr/departements.html?mode=detail&dep=984&style=fi che	
TAAF official site	http://www.taaf.fr/rubriques/environnement/patrimoineBiologique/environnement_patrimoineBiologique_introduction.htm http://www.quid.fr/departements.html?mode=detail&dep=984&style=fi che	

ANNEX A: ENVIRONMENTAL PROFILE -

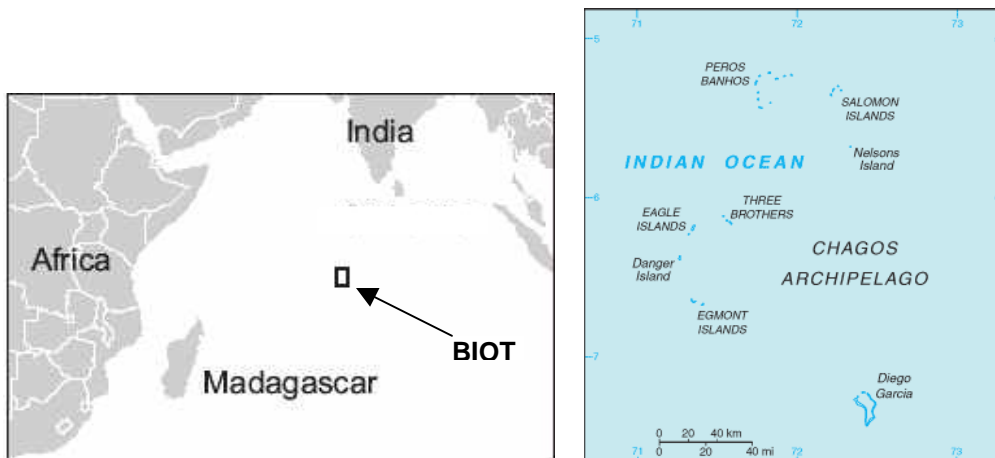
BRITISH INDIAN OCEAN TERRITORY

0. Summary

The British Indian Ocean Territory is situated in the middle of the Indian Ocean and only one of the 67 islands is inhabited: Diego Garcia, leased to the US military. The territory used to be inhabited but the population was relocated and the whole territory is now a restricted military area. There are some nature reserves. Expeditions have taken place to assess the state of, in particular, the bird colonies and coral reefs; both have suffered respectively from human interference and sea water temperature increases. Climate change will have a devastating effect on the islands as most are no more than 2 –4 m high and many have a concave topography.

1. Background information

The British Indian Ocean Territory is composed of 67 uninhabited islands (except for the military base at Diego Garcia) in the middle of the Indian Ocean, between Indonesia and Africa. The islands are part of 5 atolls (Chagos Bank, Peros Banhos, Salomon, Egmont and Diego Garcia). BIOT is on the southern part of the Laccadive- Maladive- Chagos ridge.



1.1 Key facts and statistics

Name of Territory	British Indian Ocean Territory		
Region	Indian Ocean		
Land area	60 km ²		
Maritime claims	EEZ: 544,000 km ² Territorial EEZ: 200 nm	sea: 3	nm
Population	3500 USA-UK military and contractors on Diego Garcia		
GDP/capita	Not applicable		

1.2 Constitution

The Chagos archipelago has been British territory since 1814 and was administered as a dependency of Mauritius. The islands remained British overseas territories when Mauritius gained independence and the British Indian Ocean Territory (BIOT) was established by an Order in Council on 8 November 1965. In 1966, the British Government purchased all privately-owned coconut plantations on the islands, closed them down and started the relocation of the population to Mauritius. Between 1967 and 1973 the entire population of around 1,500 was relocated as the archipelago was converted for military use. In 1972

Exchange Notes allowed for the construction of a naval communication facility on Diego Garcia. The current lease expires in 2016 with an option of a further 20 years.

BIOT's Commissioner, the highest administrator of the territory, is based at the Foreign and Commonwealth Office in London. The Commissioner is represented by a senior British naval officer stationed on Diego Garcia.

1.3 Physical geography

BIOT lies on the Chagos- Maldives- Laccadives ridge, a 2,500 km long chain of atolls with the Great Chagos Bank on its southern end, the world's largest atoll. Most of the Great Chagos Bank is submerged and the 67 individual islands can be grouped into five islanded atolls: the Chagos Bank, Peros Banhos, Salomon Atoll, Egmont, and Diego Garcia Atoll with the largest island, Diego Garcia.

The whole Chagos complex covers an area of around 250 by 400 km and is a limestone cap 1 - 2 km thick, resting on volcanic rock. The islands are located on atoll rims with elevations generally no greater than 3m. Two areas in Chagos have been tectonically uplifted to over 6 m.



Source: CORDIO, 1999. Map of Chagos Archipelago with islands and contour of the shallow submerged banks.



Source: Chagos Conservation Management Plan. Salomon atoll

Severe storms are sometimes experienced, especially in Diego Garcia, but cyclones are rare.

1.4 Flora and fauna

The islands are relatively young and remote so terrestrial biodiversity is low and many seabirds nest there. The most numerous breeding birds in the

Chagos Archipelago are the Red-footed Booby, the Brown Noddy and the Lesser Noddy. 90 bird species have been identified on the islands, and 16 have large breeding populations with more than 10,000 nests per site. Although BIOT has no endemic birds, ten sites qualify as Important Bird Area (IBA),⁸ The uninhabited islands (some of which have remained rat-free) offer an important refuge for declining seabird populations throughout the Indian Ocean.

Chagos has high marine diversity, with the 220 species of hard corals being among the highest recorded in the Indian Ocean. Nearly 800 species of fish and 400 molluscs have been identified, including 4 endemic species. Coral reefs were severely depleted during the 1998 coral bleaching event, which destroyed up to 80% of live coral cover to a depth of 40 m. In early 2004, the coral reefs that were recovering from 1998, suffered very extensive repeat bleaching. However, the peak water temperatures were reduced by cyclonic winds bringing heavy cloud cover and rain for a critical 10 days when

⁸ The Important Bird Area Programme is a global initiative coordinated by BirdLife International.

bleaching was clearly evident. Recent information suggests that the bleached corals in the lagoons of Diego Garcia have mostly recovered, with little mortality.⁹ Reefs on the outer slopes are also recovering but Sheppard *et al* concluded (2003) that mortality was near-total to 15 m deep in northern atolls, and to > 35 m in central and southern atolls. Some reef surfaces had 'dropped' 1.5 m due to the loss of dense coral thickets. Coral bioerosion was forming unconsolidated rubble. Juvenile corals were abundant, though mostly on eroding or unstable substrates, and were of less robust species. Reef fish abundance and diversity at 15 m depth remained high; species dependent on corals had however diminished.¹⁰ More recent evidence suggest further recovery of BIOT's coral reefs.

As for plants and trees, there are nearly 280 species of vascular or flowering plants, including ferns, but only 45 of these are native species. Fan flower and other shrubs like *Argusia argenta* are common, stabilising the soil and making nesting sites for seabirds. Coconut trees, planted as a crop, have replaced original forests. Small patches of hardwood forest remain on a number of the islands.

Two endemic subspecies of the hawk moth and two endemic subspecies of butterfly have been recorded. Green and hawksbill turtles are found, with about 300 females of each species nesting annually.

1.5 Demography, socio-economy

The first inhabitants of the archipelago arrived in the late 18th century. By the mid-20th century they numbered almost 2000, of mixed African and South Asian descent, working on plantations. There were villages, a school, a hospital, a church, a prison, a railway, docks and a copra plantation on Diego Garcia. The entire population, known as the Ilois (French for islanders), was relocated from the islands to Mauritius by the British Government between 1967 and 1971 to make way for a joint US-UK military base on Diego Garcia. The Ilois, who now live in Mauritius and the Seychelles have continually asserted their right to return to Diego Garcia, winning a legal victory in the British High Court in 2000. However, this judgement was overturned by an Order in Council in June 2004. On May 11, 2006 the British High Court ruled that this Order in Council was unlawful, and consequently that the Ilois were entitled to return to the Chagos Archipelago. However there has been an appeal against the judgement, with a hearing set for February 2007. Around 100 former inhabitants were allowed a "humanitarian" visit in 2006, jointly organised by HMG and the Government of Mauritius, partly to tend the graves of their ancestors.

An income is gained by selling fishing rights and postage stamps. There are licensed fisheries, notably for offshore tuna fishing, and a licensed reef fishery operated by Mauritian fishermen who visit the reefs for a few months each year. There is no other human or economic activity (except the military base) on the islands. There are more than 2,000 troops, anchorage for 30 warships and a satellite tracking station on Diego Garcia.

2. Main environmental challenges

Climate change

Climate change is effectively the greatest challenge for the BIOT, and in particular the expected rise in sea-level. The maximum elevation of the islands in the northern atolls of Egmont, and the Great Chagos Bank is only 1-2 metres in most cases. Some higher dunes exist in Diego Garcia. These maximum elevations are often on relatively narrow island perimeters; most islands have a central depression which dips near to sea level or even below it. Island erosion is not likely to be a gradual attrition of the island edge. In Chagos, erosion of the rim, which effectively serves as a dike defending the central parts, will probably lead to breaching and flooding. It is not possible to estimate the timing and rates of erosion of island rims. But this process is likely to lead to the eventual disappearance of islands from the archipelago, with devastating effects on bird populations. Changes in sea temperature have affected reefs in the past.

⁹ Coral reefs report 2004.

¹⁰ Sheppard et al (2002)

The most important natural values on the islands are the birds and the coral reefs.

Seabirds

The seabird colonies were devastated by the activities of the inhabitants who removed local vegetation for coconut plantations and thereby destroyed habitats for bird breeding. They were preyed on by invasive species such as rats and cats. Since the departure of humans, the uninhabited islands are reverting to their natural vegetation, and offer an important refuge for declining seabird populations throughout the Indian Ocean such as the Red-footed Booby, Brown Noddy and Lesser Noddy, particularly on rodent-free islands. (Sanders, 2006).

Coral reefs

The reefs of the Chagos archipelago were once among the richest and least affected by man in the Indian Ocean, but they have been severely affected by variations in seawater temperature. The coral on the seaward reefs of the 6 Chagos atolls suffered from a sharp rise in surface seawater temperature in 1998. Between February and June 1998, temperatures were reported to be around 4–6°C above normal, followed by much cooler than normal temperatures (Cordio, 1999). These two events caused extensive coral bleaching and widespread mortality. In 1996, an average of about 75% of the substrate was live coral and soft coral while in 1999 a survey showed that only about 12% of the substrate on the seaward reefs was live coral. Up to 40% was identified as dead coral, and 40% as unidentifiable dead substrate, much of which is almost certainly severely eroded, dead coral. Lagoons contained greater amounts of living coral (Cordio, 1999).

Analysis by Sheppard et al 3 years after the 1998 events, shows mortality was near-total to 15 m deep in northern atolls and to > 35 m in central and southern atolls. Juvenile corals were abundant, though mostly on eroding or unstable substrates, and were of less robust species. Reef fish abundance and diversity at 15 m depth remained high; but species dependent on corals had diminished, while some herbivores and detritivores had increased.¹¹

The 2006 Chagos research expedition has monitored how the region's reefs have recovered from this mortality event, as well as other, smaller bleaching episodes that have occurred since 1998. In the absence of human impacts, the Chagos reefs are reported to have recovered remarkably well, with many sites regaining their status as thriving reef communities. Some sites however, have been unable to recover from bleaching stress, and others still show evidence of repeated bleaching and mortality events in more recent years.¹²

3. Environmental policies and institutions

3.1 Institutional structure, manpower and budgets

The BIOT Commissioner, based at the Foreign and Commonwealth Office (FCO) in London, has responsibility for environmental issues and may make regulations to declare any island or part thereof a 'Strict Nature Reserve' or 'Special Reserve'. A Conservation Adviser advises on matters related to environmental protection and conservation.

The responsibility for implementing conservation measures lies with the UK representative stationed on Diego Garcia. The British Royal Navy, including the Royal Marines, act as Customs officials and fishery protection staff and police the outer islands.

The Marine Resources Assessment Group (MRAG Ltd.) manages the fisheries on behalf of the BIOT Administration in the FCO. MRAG and the BIOT authorities prepare summaries outlining both management activities and an assessment of sustainability of fishing within the BIOT inshore fisheries.

¹¹ Sheppard et al (2002),

¹² Blue Ventures website http://www.blueventures.org/newsrecent_chagos.htm

The Chagos Conservation Trust also plays a role in researching and protecting the islands.

3.2 Mechanisms for integrating environment into development

The 1972 Exchange of Letters with the USA for the management of the military area at Diego Garcia, includes a provision that the USA Environmental Protection Agency (EPA) norms apply to Diego Garcia. Despite this, a large area of the seaward coral reef has been dredged for use as construction material or landfill and concrete has been used for shoreline protection.



Source: Sheppard, 2003. Man-made shoreline protection



Source: Sheppard, 2003. US base and dredging of coral reefs for use as construction material on Diego Garcia

3.3 Environmental strategy and policy

The BIOT Commissioner has the power to make regulations and establish nature reserve areas. BIOT has signed an Environment Charter with the UK Government in which it agrees *inter alia* to integrate environmental management into the administration of the island.

BIOT is treated as though it were a World Heritage site; it also adheres to a number of International conventions.

Because of its military status, the whole of the BIOT is a *de facto* restricted / protected area. Diego Garcia has a Nature Reserve Area and a (more closely controlled) Strict Conservation Area. Environmental policy of the US Navy (OPNAVINST 5090.1) applies to Diego Garcia.

There are also Strict Nature Reserves on several of the outer islands and their territorial seas and internal waters, to which access is generally prohibited. When access is authorised (exceptionally), various activities are prohibited unless specifically licensed.

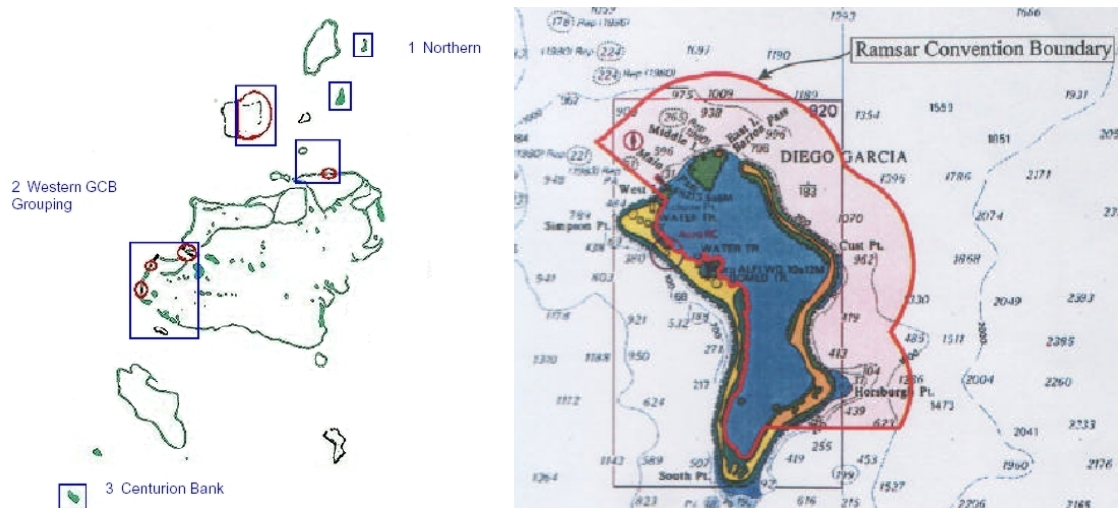
Policy documents/ Plans

The BIOT Conservation Policy Statement (of October 1997) specifies that the Territory will be treated in accordance with the requirements of the World Heritage Convention, subject only to defence requirements.

The island of Diego Garcia has an environmental management plan.

In 2003 a draft management plan was made for the whole archipelago. The Chagos Conservation Management Plan (Sheppard, 2003), drawn up for the territory's administration at the request of the FCO, attempts a comprehensive response to the various challenges facing BIOT. It proposes a set of actions that are aimed at achieving the conservation of the archipelago as a whole by giving full protected status

to 30% of the territory. The plan stresses that the present situation, with a lack of human interference, favours the establishment of protected areas on land and sea. The blue areas in the picture below are identified in the plan as needing full conservation status. The red ones are already reserves.



Left: proposed areas to be protected (blue) and existing ones (red). Right: Proposed Ramsar convention protected area around Diego Garcia. Source: Sheppard *et al.* (2003).

The plan is based on what it calls a fire-fighting and flexible approach, and proposes the establishment of a scientific advisory group and a programme of regular erosion monitoring and 'rapid managerial response', as well as a 'practical mechanism for data gathering'.

It is possible that this plan may be too little, too late: too little because, as the plan itself says, the damage from the expected sea level rise and more frequent storms will be dramatic, too late because studies of the state of the seaward coral reefs after the 1998 El Niño and La Niña events indicated extensive damage of the seaward corals have almost all disappeared already. However, the plan tackles the fact that the Chagos coral reefs are said to be the best conserved in the South Asian Region (because of their remoteness and low population pressure) but they are probably also among the most threatened by climate change.¹³

3.4 Policy instruments

The following items of legislation exist for BIOT:

Item of legislation	Comments or details
Green Turtles Protection Regulations 1968	Prohibits killing, destruction of eggs and trade.
The Protection and Preservation of Wild Life Ordinance 1970 (Ordinance No. 1 of 1970)	Makes it an offence for anyone to enter a nature reserve, or to carry out various specified activities there, without the written permission of the BIOT Government. Strict Nature Reserves: the Three Brothers and Resurgent Islands, Danger Island, Cow Island, Nelson Island and some islands in the Peros Banhos atoll.
The Wild Life Protection Regulations 1984	Most types of animal are protected. Prohibits destruction, damage, or taking of birds' nests and eggs, or turtles' eggs, and disturbance of nesting or dependent young birds. Also prohibits taking of any animal, specified seashell, coral or specified flora. (No species yet specified in legislation.)

¹³ Coral Reefs report 2004.

Item of legislation	Comments or details
Imports and Exports Control Ordinance 1984	Implements CITES, applies to Green Turtles
Fishery Limits Ordinance 1991 and Commercial Fisheries (Conservation and Management) Ordinance 1991	Create a 200-mile Fishery Management Conservation Zone and a fisheries regime covering all BIOT fishing waters. Fishing only permissible with a licence. Tuna fishing is prohibited within 12 nm of land. Inshore fishing for demersal species is restricted.
The Diego Garcia Conservation (Restricted Area) Ordinance 1994 (Ordinance No. 6 of 1994)	Makes Diego Garcia a restricted area (i.e. an area into which entry other than on official business is forbidden except if authorised by permit). The restricted area has been further divided into a Nature Reserve Area and a (more closely controlled) Strict Conservation Area. The latter includes the islets at the mouth of the Diego Garcia lagoon.

3.5 Monitoring

Routine monitoring, fisheries research and resource evaluations have been undertaken on fish stocks through catch and logbook monitoring and observer programmes since the current fisheries management regime in BIOT was introduced in 1991 (JNCC, 1999). There is also an annual environmental inspection which includes some monitoring of coral reefs and reef fishes, but no monitoring of seabirds. Sewage discharges to water and ground water extraction are monitored. As part of the regional tsunami warning system, there is an early warning system for disasters.

3.6 Enforcement

Enforcement of conservation measures, such as for the existing bird sanctuaries, is the responsibility of the senior UK representative stationed on Diego Garcia in his role as Magistrate. The fisheries patrol vessels of MRAG (with 2 senior Fisheries Protection Officers on rotation) can act against illegal fishing and have done so 6 times in the last 2 years. The United States Navy Officer in command of the Facility on Diego Garcia has responsibility for the implementation of US naval policy concerning the environment at the base.

3.7 Conclusion on the administrative and political setting

Environmental policies are the responsibility of the BIOT Commissioner stationed in the London and his representative at the naval base in Diego Garcia. As the territory is a military base, its whole area is restricted and access is only allowed by permit. Periodic assessment and monitoring of the environment by independent experts is difficult, in particular on Diego Garcia and the US base.

4. International cooperation

4.1 Cooperation with UK

- A few assessments and studies of biodiversity have been funded by the British Foreign and Commonwealth Office. See for example Barnett *et al.* (1996) and Sheppard (1999).
- The Chagos Conservation Management Plan (Sheppard *et al.*, 2003) was funded by the FCO.
- The UK ministry of Defence funded three expeditions in the 1970s, see for example Bellamy (1975) and Baldwin (1975).

4.2 Cooperation with the EU

The Council Decision on the association of OCTs with the EU, which governs EU-OCT relations, supports co-operation and development projects. BIOT has not yet requested funding from the EDF because as an unpopulated Territory, BIOT is not included in the list of recipients of the EDF. Such finance is designed to support economic and social development in populated territories.

4.3 Other international cooperation and Multilateral Environmental Agreements (MEAs)

BIOT is included under the UK ratification of:

MEA	Date extended	Date effective	Comments
Convention on the International Trade in Endangered Species of Wild Fauna and Flora (CITES)	2-8-1976	31-10-1976	Implemented by the Green Turtles Protection Regulations 1968 and, more generally, through the Imports and Exports Control Ordinance 1984
The Convention on the Conservation of Migratory Species of Wild Animals (Bonn Convention)	23-7-1985	1-10-1985	
CMS - Indian Ocean Turtle MOU	25-03-02	-	
London Convention on Prevention of Marine Pollution by Dumping of Wastes and Other Matter	17-11-1975	17-12-1975	
The Convention on Wetlands of International Importance (Ramsar)	7-09-1998	8-1-1999	The island of Diego Garcia has been designated a Ramsar site.
Convention concerning the Protection of the World Cultural and Natural Heritage (World Heritage)			The World Heritage quality of the territory is recognised in the BIOT Conservation Policy Statement (October 1997) which specifies that BIOT will be treated as a WH site, subject only to defence requirements.

4.4 Other funding by international community for environmental and environment-related projects

None known

4.5 Other international cooperation on the environment (or environmentally sensitive sectors)

There have been a number of British scientific expeditions to BIOT in recent years.

5. Recommendations on future cooperation between EC and BIOT

The British Indian Ocean Territory (BIOT) are remote and although a few important studies have been made, conclusions on the state of the environment are difficult to make because of restricted access and the military presence. Uncertainties remain about the status and future of important bird colonies and coral reefs, and about the return of the former inhabitants, but the impact of climate change will be devastating given the low altitude and concave profile of many islands.

Since the territory lacks a permanent population, BIOT does not receive a financial allocations from the EU under the EDF.

Recommendations:

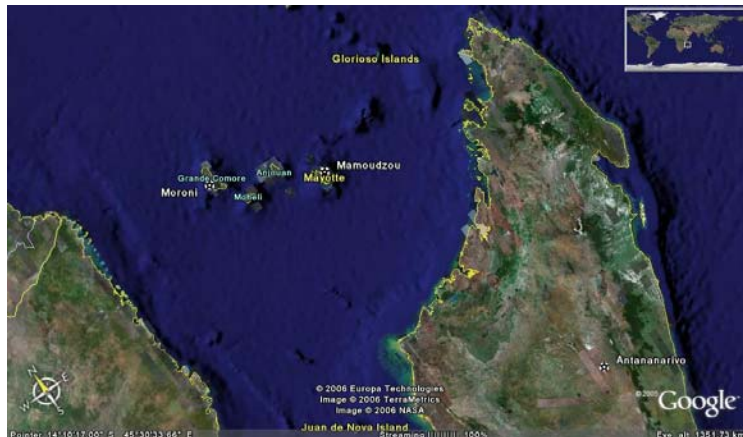
1. More international coordination of design and results of expeditions
2. Periodic reports on the environmental status on the US naval base.
3. Continued monitoring and research

ANNEX B: ENVIRONMENTAL PROFILE -

MAYOTTE

0. Summary

Mayotte is a French departmental community¹⁴ situated in the Indian Ocean between Madagascar and Mozambique, surrounded by barrier reefs and one of the largest lagoons in the world. It has been plagued by lack of water, waste problems, deforestation and a gradual sedimentation of the lagoon for the last 15 years. French and EU funds have been allocated to these problems. The administrative and political transition that is taking place in Mayotte, whereby the community has gained increased executive powers and may become a French department by 2010, makes a coordinated and efficient approach to all these environmental problems a challenge.



Mayotte and the Comoros islands (Google)



Mayotte with its reefs (source: Powerpoint presentation, General Council Mayotte)

1. Background information

1.1 Key facts and statistics

Name of Territory	Mayotte
Region	Indian Ocean
Land area	375 km ²
Maritime claims	EEZ: 73,600 km ² Territorial sea: 12 nm
Population	160,000 (2002); 201,000 (est. 2006) population density 438 / km ²
GDP/capita	€2200 (est. 2003 CIA)
Literacy rate	86%
Unemployment rate	approx. 30%
% below poverty line	26 % (1995)

1.2 Constitution

Mayotte has changed political status many times. A Malagashi sultan gave Mayotte to France in 1843. In 1896 Mayotte and the other Comoros islands were brought under the administration of Reunion, and in 1912 linked to Madagascar. Madagascar became independent from France in 1960 and the Comoros islands in 1975. Mayotte chose to become a French Overseas Territory in 1976. In 2001 a new agreement was signed with France, whereby Mayotte became a departmental community. A gradual transition of power is taking place, from France and its local representative (the Prefect) to the locally elected General Council and its president. In 2010 Mayotte may become a department of France.

Since the 15th century the main religion on the island has been Islam and France allows local practices which accord with Sharia law. Civil law is increasingly practised, however. Polygamy has become less widespread. Mayotte may become an EU outermost region of the European Union.

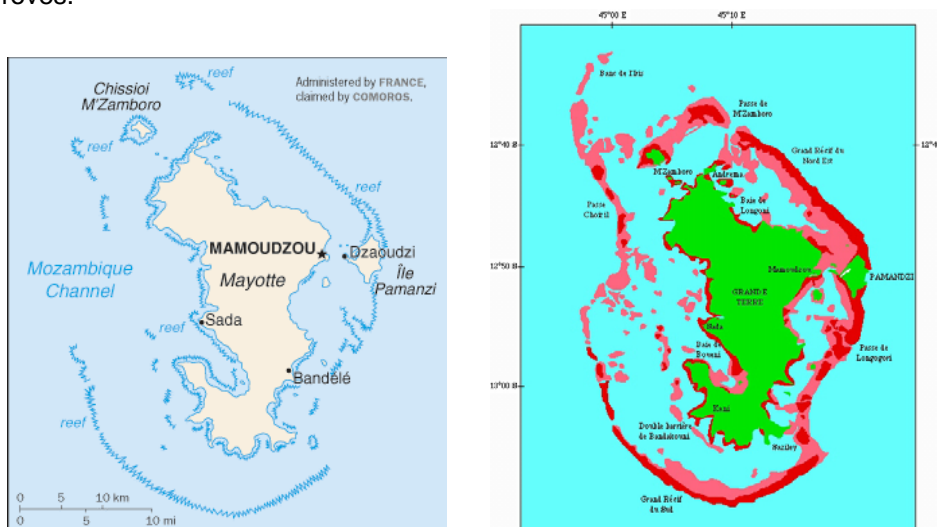
¹⁴ *collectivité départementale*

1.3 Physical geography

Mayotte is part of the Comoros archipelago in the Indian Ocean, between Mozambique and Madagascar off the east coast of Africa. The capital is Mamoutzou. The territory of Mayotte is composed of two volcanic islands, Mayotte (Grande Terre), Pamani (Petite Terre), surrounded by some 30 smaller islands. Two of these are M'Zamboro (north) and Mbouzi (east). Mayotte has five peaks. The highest point is Mount Benara (660m high), an extinct volcano. Between the peaks are undulating hills and deep ravines. The human settlements are in the narrow flat coastal fringe.

The weather is tropical, hot and humid with the rainy and cyclone season from November to May, the dry season being cooler. Lush primary forests cover part of the island. Some 15% of the island (5600 ha) is forest reserves. 11,000 ha of land is used for agriculture, 33% of the surface area.

A lagoon of 1500 km² surrounds Mayotte. There are fringing reefs but in some places also a double reef, a rare phenomenon. The coastline of Mayotte is 185 km long, with 570 km² of reefs and 7 km² of mangroves.

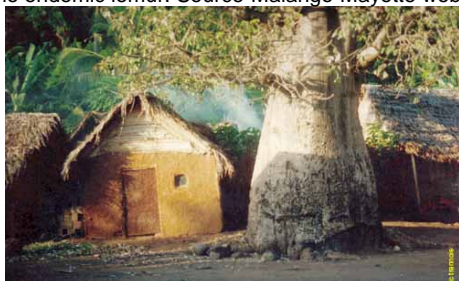


1.4 Flora and fauna



The endemic lemur. Source Malango-Mayotte website

In the large lagoon, whales and their calves can be seen from July to October, turtles nest on the beaches and dolphins play around the ships. Marine fauna have suffered several times from the El Niño phenomenon. Many of the fruit bats and lizards are endemic. There are 35 species of birds (e.g. the colibris); 2 are endemic. The endemic lemur lives in the 20,000 ha of forest that remain. Primary forests are still present, partly in forest reserves. There is also teak, mahogany, eucalyptus and bamboo. The island also has coconut, vanilla, tamarind, mango and baobab trees.



The baobab (monkey bread) tree.
Source Malango-Mayotte website

1.5 Demography, socio-economy

Mayotte has a population of 200,000 with a high density of 438 inhabitants per km². Almost 100% of the population is Muslim. Mahorian (a Swahili dialect) is spoken and only 35% speak the official language, French. Population growth is high at 4%, including (illegal) immigrants from the other Comoros islands.

Agriculture and fisheries are the economic and social basis of Mayotte. There are no national accounts so an exact quantification of these activities is not possible, but according to the French Overseas ministry, there are some 16,000 agricultural properties, giving an income to 55% of all households. 75% of agricultural land is given over to cultivation of cassava and coconut. The export of vanilla has declined and the main exports now are aromatic oils made from the yellow flowers of ylang-ylang and fish from aquaculture. Aquaculture started in 1999 and in 2002 fish exports totalled 120 tons (total production 180 tons).

There are 2300 fishers. In 2002 the catch totalled 2100 tons, mostly in the lagoon. The EEZ is rich in resources but is unsuitable for the local artisanal fishing fleet.

2 Main environmental challenges

Challenge 1 Climate Change SEVERE

Climate change poses three main threats to Mayotte, i.e. the rise in sea-level, increasing water temperature and increased incidence and intensity of storms and cyclones.

Rising sea-level means that the narrow, low-lying coastal areas of the territory which are densely populated will suffer increasing erosion, temporary flooding, and in some cases permanent inundation. This will lead to damage to property and infrastructure and economic loss. In the longer term there will be major social upheavals, with people having to retreat from low-lying areas and move uphill.

Sea-level rise is not a major threat in itself to coral reefs, but in combination with increases in atmospheric CO₂ it may become a problem, causing a reduction in the rate of calcification of coral skeletons, and could therefore seriously threaten coral reef ecosystems. If predicted increases in sea level (15 - 95 cm by 2100) occur in combination with increased CO₂ levels, coral reef growth may not be able to keep pace with sea level rise.

Rising sea temperature will cause bleaching and death of coral reefs. There have already been two episodes of bleaching in Mayotte. Almost 40% of the fringing reefs were affected by bleaching due to warmer water in 1982-3, suffering degradation and in some cases dieback.. Also associated with El Niño was a coral bleaching episode in 1998 with a mortality rate of 90% in some places on the outer slopes. Recovery is taking place, particularly on the inshore slopes. However as sea temperature rises more permanently, bleaching and death of coral is likely to be more severe and irreversible.

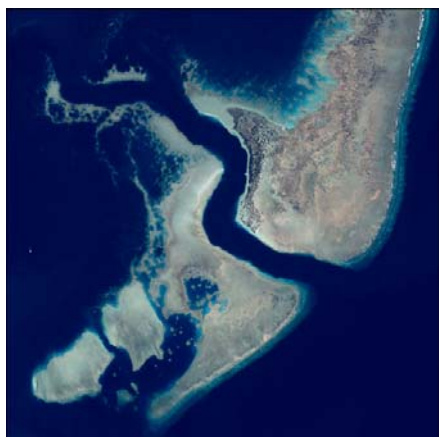
Nor is increased incidence and intensity of typhoons a cause for equanimity. These will cause increased damage to crops, buildings and infrastructure, and will also reinforce some of the effects already mentioned: damage to coral reefs from rough seas, beach erosion, etc.

Challenge 2 Multiple threats to lagoon and coral reefs SEVERE

The lagoon and fringing reefs are being subjected to a number of threats additional to those due to climate change:

- Untreated sewage and other wastewater is being pumped into the lagoon, causing health threats to bathers, eutrophication and algal blooms which are directly harmful to coral and detracting from the amenity of the lagoon for the population and for tourists.
- Economic activities such as agriculture and fishing are also contributing to the degradation. Traditional agricultural practices like burning after harvest dry out and erode the soil, which washes down the slopes with the rain. This causes mudslides, sedimentation and turbidity in the lagoon, which is detrimental to the living organisms there (particularly coral, but also fish, turtles).
- Tourism, with an estimated 30,000 visitors per year, is also affecting the life in the lagoon, partly because of diving, but also because of the resulting increase in untreated waste water that flows into the lagoon from tourist establishments, causing bacteriological contamination.

- The coral is also being damaged by the crown-of-thorns starfish. The starfish has been affecting the reefs since 1983, but a bounty system stimulated collection by fishermen; in 1998, 8,000 starfish were collected.



The "S" passage in the fringing reef on the east side of the lagoon. Source: NASA

Mayotte's reefs are relatively well studied. According to Reefbase, its entire coral reef system is at risk of being destroyed for the reasons mentioned above, let alone the rise in water temperature mentioned earlier.

There are however two coastal reserve areas, managed and owned by the French *Conservatoire du Littoral* which has had protected areas on Mayotte since 1995: Moya beaches and the cliffs of Papani, on Petite Terre and Saziley in the south of Mayotte (3500 ha, most of which is lagoon and coral reefs. An opening in the reef, linking the lagoon to the open sea on the East coast, called the S Passage (or Longogori pass) is also a protected area (400 ha) and it is forbidden to fish, collect living organisms or anchor there. Scuba diving is allowed and a mud bank has been created for mooring. Together, these three reserves cover only 2% of the lagoon area.

Challenge 3 Solid waste SEVERE

Waste presents major problems on Mayotte. Waste arisings, currently about 100,000 tons per year, are increasing, but much waste is not being collected. The three landfills on the territory are insalubrious and full, and very little is known about the environmental impacts of these landfills. Some waste is being dumped into rivers. There is no selective waste collection or formal recycling.

Inappropriate waste management can impact on the health of the population and on the environment. Waste is therefore a priority issue in the bilateral agreements between Mayotte and France (*Contrat de Plan, Development Convention, Cities Agreement*) signed in the 1990s. Waste was included in the 8th EDF.

Other environmental problems on Mayotte include:

- Water - water resources are scarce on the islands, the distribution network is only of modest size, some of the few small rivers are used as waste dumps. There is only one desalination plant, at Labattoir, Water is a priority in the current funding agreements with the EU (9th EDF).
- Mangroves are also disappearing due to development (one-quarter since 1987).

3. Environmental policies and institutions

3.1 Institutional structure, manpower and budgets

As the territory is in transition, following the agreement with France in 2001 and legislation in 2002 which increased the powers of the General Council and the locally elected government, several different services deal with the environment.

An Environmental Department¹⁵ was created in 1989 and placed under direct authority of the Secretary General of the Prefect. Its main task is drafting policies and coordinating action for the environment in Mayotte. It liaises with all other administrative departments (including the French Ministry of Ecology) and NGOs dealing with the environment, and produces information and awareness-raising materials. It deals

¹⁵ Délégation à l'Environnement

with EIAs, waste problems, domestic and industrial pollution. Water and other natural resources are dealt with by other services.

The Directorate for Agriculture and Forests (DAF)¹⁶ was created in 1977 and became a decentralised service of the French ministry dealing with agriculture, fisheries and the environment in 1995.

A Fisheries and Environment Department (SPEM)¹⁷ was created for the marine environment in the lagoon. SPEM undertakes studies of the lagoon, physical planning of the territory, chooses protected areas, and carries out awareness-raising activities. It has a Lagoon Policing Service which enforces environmental regulations in the lagoon, in particular in the protected areas (e.g. Saziley, the S passage). It is also responsible for making censuses of marine species (birds, mammals, fish) and disseminates information to the public and fishermen. It had a staff of 6 (in 2004) and two boats, which do two or three rounds per week.

An Environment and Forests Department (SEF)¹⁸ combats erosion, and is responsible for mangroves and the turtle population. This service undertook an inventory and description of the island's natural and native vegetation in 1995-1997, together with French and Reunion researchers.

There is also an Indian Ocean Policing Service which is the responsibility of the Prefect of Reunion. It has 6 guards, 2 of whom come into Mayotte territorial waters every 2 months. When on duty there, they report to the Mayotte authorities.

Finally there is a Consultative Commission for the Environment and Protection of the National Heritage. It was created in 1996 and advises the Prefect (every 3 months) on all matters that might have an impact on the environment, e.g. new infrastructure, and also on funding allocation. The Prefect presides at the meetings and the President of the General Council is vice chairman. Members come from several administrative departments, and include elected members, NGOs, scientists and experts.

3.2 Mechanisms for integrating environment into development

The Sustainable Development Plan integrates the environment into the different sectors. Also the Consultative Commission for the Environment provides horizontal linkages with other sectors.

3.3 Environmental strategy and policy

There are several policy papers on environmental issues in Mayotte. Some are general, for example the Sustainable Development Plan¹⁹, others are more specific like the policies for forestry, urban development and tourism. Many (other) plans have been agreed with France (see paragraph 4.1) and with the EU (see paragraph 4.2).

The Sustainable Development Plan was prepared by the General Council and involved a consultative process. The plan has however not yet been approved by France. The plan provides guidelines for all actions, including EDF funding. It looks ahead 15 years and the main concerns are

- population growth
- education
- water
- waste
- maintaining forestry ecosystems
- nature conservation, in particular the lagoon
- planning the rapid increase in the numbers of cars

¹⁶ La Direction de l'Agriculture et de la Forêt

¹⁷ Service de la Pêche et de l'Environnement Marin

¹⁸ Service de l'Environnement et de la Forêt

¹⁹ Plan d'Aménagement et de Développement Durable (PADD)

- making the economy more dynamic.

Forestry policy in the last decades has focused on protecting the lagoon from sedimentation as a result of soil erosion. Water retention is also an aim, as Mayotte has almost no rivers and rain water runs rapidly down the ravines into the lagoon.

The older 'Plan for Tourism 2000'²⁰ sought to protect the lagoon and proposed a plan for classifying beaches and other important sites. It proposed a management plan for the waterfront of Mamoutzou, lagoon sightseeing trips, scuba-diving opportunities, etc.

3.4 Policy instruments

The application of the French Rural code (in particular Book II on Nature Protection) was extended and adapted to Mayotte in 1991 and the legislative acts were adopted in 1997. These give the Mahorian authorities the right to act in 5 areas: protection of fauna and flora, hunting, freshwater fishing, conservation areas and nature parks.

There are fishing quotas in certain areas of the lagoon and in some parts of the territorial waters (since 1994) and there are also various restrictions on fishing methods, equipment and locations, species which can be taken (e.g. turtles), etc.

The French Water Law of 1992²¹ made water management plans obligatory for both urban and rural areas, including on Mayotte. As there was a "generally unhealthy situation"²² in Mayotte, France financed feasibility studies, including the option to introduce water pricing. Implementation of the first phase of the water plan started in 1997/98.

A policy study has been prepared about how the French laws on regional nature reserves can and/or should be transposed to Mayotte.²³

The intention to make a management plan for the lagoon was expressed in negotiations between the FFEM (the French Fund for Global environmental issues) and Mayotte. Such a plan would identify areas to be protected based on their value and (possible) functions. Some areas would be made nature reserves, others would have a mainly recreational or economic (sustainable fisheries, of tourism) function.

Considerable work has been done in the field of environmental education and awareness-raising:

- educational campaigns by the Lagoon Policing Service;
- a booklet on turtles;
- a special edition of the information bulletin of the General Council on the Environment
- a website is being produced with extensive environmental information.

Many NGOs actively support the environment in Mayotte and give information to the public. (List annexed).

3.5 Monitoring

In the 8th EDF a monitoring system was introduced for land use, in particular agricultural areas.

3.6 Enforcement

²⁰ Schéma de développement touristique à l'horizon 2000

²¹ Loi sur l'Eau

²² "Situation d'insalubrité générale".

²³ French ministry Overseas website, text 2004

The French Overseas Ministry considers that the efforts and funding to enforce the existing regulations are insufficient.²⁴ There are two inspectorates, one for the lagoon and one for the Indian Ocean.

3.7 Conclusion on the administrative and political setting

Despite the availability of funding from France and the EU, Mayotte has found it difficult to tackle its challenges on water shortage, waste and the rapid degradation of the lagoon. Its transitional status has probably not helped here. There are however several protected areas and species; this is partly because of initiative by French institutes such as *Conservatoire du Littoral* which have bought land and manage nature reserves. The Sustainable Development Plan has not yet been translated into legislation.

4. International cooperation

4.1 Cooperation with France

There are several funding agreements and mechanisms between France and Mayotte:

- The *Contrat de Plan*. The 12th plan between France and Mayotte for 2000-2004 provided €275 million, for projects to stimulate economic activity, for better education, and for water and waste improvement. It budgeted a further €430 million for building schools, social housing etc.
- The Convention for Social and Economic Development²⁵ is worth €115 million, for the period of 2003-2007, for water and planning for waste collection and treatment.²⁶
- A '*Fonds de Rattrapage*' (€5.5 mill) to alleviate poverty at local level.
- A *Contrat de Ville* (Cities Contract)²⁷ allocated €9.9 million and €8.7 million respectively for waste treatment in 70 villages and in the capital Mamoutzou.
- The regional cooperation fund²⁸, which promotes common projects between Mayotte, Reunion, the Comoros archipelago, Madagascar and Mozambique distributed €360,000 to projects in 2003.
- There is also scientific cooperation with French institutes. For example a group of experts, students and researchers has been studying the Mahorian lagoon and the Indian Ocean coasts for many years, including the taxonomy of species living in the lagoon and in the coral reefs, the management of fish resources, aquaculture, and risks to this environment.²⁹ There is also cooperation between the Oceanographic institute of Marseille and the fisheries and marine environment services of Mayotte within the framework of ACOR³⁰, French Association for Coral Reefs study.

4.2 Cooperation with the EU

The Council Decision on the association of OCTs with the EU, which governs EU-OCT relations, supports co-operation and development projects. Mayotte has been a beneficiary since the 4th EDF. Mayotte has obtained funding for a number of projects on water, electricity generation and distribution, waste (€10 mill. for 1996-2000) not yet all spent by 2004 due to indecision about waste treatment techniques and location. The 9th EDF (€15,2 million requested) focuses on rainwater management and reforestation.

²⁴ Website on Mayotte- Page "Les Réponses"

²⁵ Convention de Développement Economique et Social

²⁶ "Schéma global d'élimination des déchets"

²⁷ Contrat des Villes

²⁸ Fonds de Coopération Régionale

²⁹ Groupement d'Intérêt Scientifique "Environnement marin et scientifique de Mayotte"

³⁰ Association Française pour les Récifs Coralliens

4.3 Other international cooperation and Multilateral Environmental Agreements (MEAs)

The CITES, Ramsar and Bonn Conventions (important for turtles, Dugong and cetaceans) apply to Mayotte

4.4 Other international cooperation on the environment (or environmentally sensitive sectors)

The regional conventions, like the Nairobi Convention apply to Mayotte. In the Sodwana resolution signed in Natal (South Africa, 1995) all the SW countries of the Indian Ocean agreed on a cooperative strategy for marine turtles.

5. Recommendations on future cooperation between the EU and Mayotte

Mayotte is quite different from other French Territories, as it is the only departmental community, and may become a department and an 'outermost region' of the EU by 2010. It has many environmental problems, including water, waste, lagoon and fisheries management, deforestation, traditional agricultural practices, and of course climate change.

Recommendations:

- Systematic and effective action on cleaning up and protecting the lagoon
- Translate the Sustainable Development Plan into action plans, regulations and budgetary commitments
- Continue with rainwater catchment and other water management plans (with EFD).
- Speed up implementation of older waste projects (with France and EU)
- Continue regional cooperation and cooperation with French and other research institutes for undertaking surveys of flora and fauna, management plans and monitoring exercises.
- Learning from other OCTs in the areas of water and waste management: regulations, taxes, voluntary systems, monitoring and implementing systems, (e.g. ways of collecting empty beverage cans).

Appendix: List of NGOs in Mayotte (from French Overseas Ministry website, updated 2004).

• SEPANAM (*Société d'Etude, de Protection et d'Aménagement de la Nature à Mayotte*) created in 1977. Its priorities concern the lagoon for which it proposes, in a "chart for the lagoon", 10 emergency actions: protection of green turtles, stationary fish, shells, coral, beaches and mangroves. It carries out numerous awareness activities;

• *Les Amis de la Nature* (AdN), the most important, tries to federate associations, and disseminates information on the Mayotte environment;

• REMADEN (*Réseau Mahorais de la Défense de l'Environnement et de la Nature*), created in 1987, has the main objective of public awareness raising, especially for young people, on nature protection, through a very concrete and practical approach in villages;

• OK Corail, which shows a strong willingness to act in favour of the lagoon, ensures that children are informed and aware of marine ecology.

**ANNEX C: ENVIRONMENTAL PROFILE -
FRENCH ANTARCTIC AND AUSTRAL TERRITORIES**

0. Summary

The French Antarctic and Austral Territories are a French Overseas territory administered from Reunion Island. Some 300 researchers live and work temporarily in the territory. The main environmental challenge is to preserve the original biodiversity, threatened by introduced species (rats, rabbits, cats, herbivores and vegetation). Overfishing is another concern as this affects other species which depend on fish for their survival. The population of albatrosses and petrels has declined, as has that of krill and Patagonian toothfish. Local policies such as fishing quotas have been adopted and international agreements are respected. New proposals for funding submitted to the French ministries include plans for energy efficiency and clean vehicles.

1. Background information

The French Southern and Antarctic Lands are composed of two archipelagos (Crozet and Kerguelen), two volcanic islands (Amsterdam and St Paul) and part of Antarctica (Adelie Land). The islands are located in the Southern Indian Ocean, between Africa, Antarctica and Australia. The territory is uninhabited except for researchers who reside there temporarily. Access to the islands is only possible by boat from Reunion or from Tasmania (to Adelie). There are no ports or harbours, only offshore anchorages.



Left: Overview map of polar region between Australia and South Africa (source: French Biodiversity website)
Right: Archipelago of Kerguelen (source: TAAF official website)

1.1 Key facts and statistics

Name of Territory	French Antarctic and Austral territories
Region	Southern Indian Ocean and Antarctica
Land area	432,000 km ² (8,000 km ² islands plus 424,000 km ² Antarctica)
Maritime claims	EEZ: 1,750,000 km ² (200 nm) Territorial sea: 12 nm
Population	300 temporary residents
GDP (total revenues)	€ 15 million

1.2 Constitution

The territory is governed by a Senior Administrator³¹ (who since 2004 has had the status of Prefect), a Consultative Council³², a Scientific Committee and a Committee for the Polar Environment³³. Each of the

³¹ Administrateur supérieur

archipelagos is a separate district headed by a district chief, who has powers similar to those of a French mayor (including recording births and deaths and being a judicial police officer). The two islands of St Paul and Amsterdam together form the third district. Adelie Land, on Antarctica, is the fourth district.

The territory was claimed by France after it had proved useful as meteorological station in WW2. The islands became a French Special Overseas Territory in 1955. In 1972 the territory was associated with the EU, except for the fishing zone which was then established (1,750,000 km²). The Antarctic treaty of 1959 reserved the polar lands for scientific research only. Many countries do not recognize France's claim to Adelie. In 1996 the administrators of the territory were relocated (from Paris) to St Pierre on Reunion in the Indian Ocean (3000 km away).

1.3 Physical geography

The two northern islands, St Paul and Amsterdam, have a milder climate than the archipelagos. There is no ice or snow in winter but a constant westerly wind. Amsterdam is 58 km², with steep cliffs. A research base has been established there since 1950 (Martin de Vivies). St Paul is smaller (8 km²), with a central crater that has become a sea bay.



Left: St Paul island, an old volcano. Right: Alfred Faure base at Crozet (source: TAAF official site).

Crozet Archipelago has two groups of islands separated from each other by 100 km. There is almost no vegetation, winds blow at 100 km/ hour for one-third of the year and it rains 2500 mm per year. The mean temperature varies from 18° C in the summer to 5° C in the winter. The beaches are of black volcanic sand. The highest point is Mount Marion-Dufresne on Île de l'Est (1090 m). There are no longer glaciers.³⁴ On Possession island there is a research base (Alfred Faure).

Kerguelen is the largest (also volcanic) island (3400 km²) of the eponymous archipelago. The islands are estimated to be 40 million years old. Kerguelen has a highly irregular coastline with a number of peninsulas linked to the island by low, narrow isthmuses. Cook Glacier covers nearly one third of the island, and the abundant rainfall combined with glacial meltwater keeps numerous streams and lakes full of water. Peat marshes, lignite, and guano deposits are found on the island.³⁵ Strong cold winds (150-200 km/hour) beat the islands and there is almost no vegetation. The highest point is Mount Ross (1850 m). Due to the icy polar waters, the summers are cold and winters relatively mild. Since 1949 there has been a base at Morbihan Bay.

³² Conseil consultatif

³³ Comité de l'Environnement polaire

³⁴ <http://www.discoverfrance.net/Colonies/Crozet.shtml>

³⁵ <http://www.discoverfrance.net/Colonies/Kerguelen.shtml>



Source: TAAF website. Morbihan Bay, Kerguelen



Sea around Adelie

Adelie is subject to very low temperatures (-45 to 0°C), violent winds and hail. From March onwards the sea is covered with ice up to 2m thick. There is a research base on Petrels Island.

1.4 Flora and fauna

The islands were never attached to a continent and were remote from human settlements. They therefore have large pristine habitats with endemic species. But introduced species of animal and plant have been taking their toll on the native wildlife (see section 2.2).



Source: Wikipedia. Giant Petrel



Source: TAAF website. Cormorant

The vegetation and terrestrial fauna are not very varied, but there are enormous numbers of penguins and other birds living on the islands: albatross, petrels, cormorants. The beaches of Crozet are full of king penguins and elephant seals and giant albatross nests are found in Morbihan Bay. After they leave their nests, albatrosses roam the seas, not returning to land for 5 to 8 years at a time.

There are thirty species of bird on Kerguelen: penguins (rockhopper, gentoo, king), albatross, giant petrels, skuas, sheathbills and the Kerguelen tern. The black-browed albatross, grey-headed albatross and the light-mantled sooty albatross are all typical of Kerguelen. The Kerguelen terns fish in flocks of up to several hundred, and are long-distance travellers. Elephant seals and Kerguelen fur seals have come back to Kerguelen after near-extinction in the 19th century.

1.5 Demography, socio-economy

The population of the territory comprises some 300 civil servants, researchers and technicians who are temporary residents only, spread over the various bases, meteorological and geophysical stations.

Fishing is the main economic activity. French boats fish in territorial waters: 6 companies with 8 vessels (2004/5) have fishing permits. The Patagonian toothfish, spiny lobster, crayfish, krill and salmon are commercially valuable. The French navy patrols the zone and arrests poachers. There is also tourism as the *Marion Dufresne* (which visits the islands from Reunion 4 times/year) now takes passengers.

It is estimated that the territory receives about €15 million a year from these various activities.

2. Main environmental challenges

2.1 Overview of state of the environment

There are some causes for concern and some positive developments.

Causes of concern:

- Overfishing- In the past, foreign boats could buy licences to fish krill and Patagonian tooth fish in the seas of the Territories but because of overfishing, there are now quotas and fishing is restricted to a small number of licensees. Greenpeace has exposed illegal fishing of Patagonian toothfish on several occasions off the Kerguelen coast.
- Endemic species are disappearing because of introduced predators and invasive vegetation. The introduction of rats, rabbits, goats, reindeer and sheep has led to a decimation of other species. The endemic Kerguelen cabbage suffered from rabbits introduced by seal hunters. Rabbits strip vegetation causing erosion and desertification and destroy bird habitats. Rats kill small petrels. The cats introduced to deal with the rats also attacked the petrels. New grasses were introduced for the imported herbivores. Plant species have also been introduced unintentionally, perhaps on the shoes of researchers and tourists, and due to warmer weather.

Positive developments:

- There are very large colonies of penguins and other migratory birds.
- All animals on Adelie are protected (Washington Convention)
- New buildings need authorization.
- As the climate has been warming since the 1970s, new species have been able to adapt.

2.2 Main environmental challenges

Challenge 1 Threats to biodiversity SEVERE

Because of the long isolation of the islands they have developed many endemic species with no defence against predators or invasive plants. The introduction of new species has taken its toll and there are now several initiatives to avoid the introduction of further species by the passengers on the *Marion Dufresne*.

Programmes have been conducted to restore the original ecosystems by eradicating some of the introduced species such as cows on the island of Amsterdam, rabbits on 3 islands of Kerguelen, rats and rabbits on St Paul, and rats and mice on certain islands of Kerguelen.

Overfishing of krill, toothfish and lobster is a cause for concern. The Commission for the Conservation of Antarctic Marine Living Resources (CCAMLR) was set up under the Antarctic Treaty in response to concerns that an increase in krill catches in the Southern Ocean could have a serious effect on its population and on other marine life - birds, seals and fish - which depend on krill for food.

Albatrosses and petrels are among the most threatened birds in the world. Albatross and petrel populations are continuing to decline. The black-browed albatross, once one of the world's commonest albatrosses, has declined by more than 40% in the last 30 years. The Agreement on the Conservation of Albatrosses and Petrels (ACAP) notes that populations are affected by degradation and disturbance of their habitats, pollution, reduction of food resources, use and abandonment of non-selective fishing gear, and particularly by incidental mortality in commercial fishing activities.

Challenge 2 Climate Change MODERATE

Climate change is being extensively studied on Adelie Land in general, but the main direct emphasis is on the impact on the Antarctic ice-mass. Little is known about the effects on the fauna and flora of the territory.

Climate change is likely to produce long-term—perhaps irreversible—changes in the physical oceanography and ecology of the Southern Ocean. Projected reductions in sea-ice extent will alter under-ice biota and spring bloom in the sea-ice marginal zone and will cause profound impacts at all levels in the food chain, from algae to krill to the great whales. Marine mammals and birds, which have life histories that tie them to specific breeding sites, will be affected by shifts in their foraging habitats and migration of prey species. Warmer water will potentially intensify biological activity and growth rates of fish. Ultimately, this could lead to an increase in the catch of marketable fish, and retreat of sea ice will provide easier access to southern fisheries (IPCC, 2001).

3. Environmental policies and institutions

3.1 Institutional structure, manpower and budgets

The territory is managed by 40 civil servants based in Reunion. The legal, environmental and fisheries service has 5 full-time staff. The environmental tasks are:

- fish resource management;
- protection of species and areas;
- legislation on species;
- protection of Adelie Land in compliance with the Washington Convention (1959);
- appropriate response to climate change.

The authorities are advised by a Consultative Council (mostly researchers) and all decisions must be approved by the French Overseas Ministry. A Committee for the Polar Environment created by the French Ministry of Ecology and Sustainable Development advises on action plans, large projects and impact studies. It also keeps track of human activities and is consulted on emergency plans and inspection reports. The IUCN is consulted on environmental matters.

Fisheries management costs €450,000 per year (salaries of inspectors). Budgets of €50,000 and €30,000 per year is available for waste management and equipment respectively.

3.2 Mechanisms for integrating environment into development

Horizontal coordination is the responsibility of the Senior Administrator and Prefect.

3.3 Environmental strategy and policy

Policy documents/ Plans

Unlike other French territories, the territory has no *Contrat de Plan*³⁶ with France. But in practice there are a number of international and French regulations that apply in the territory, e.g. instructions on the action to be taken in the event of marine pollution (French POLMAR plans and procedures³⁷), on nature conservation (CCAMLR and ACAP (see section 3.4).

The fishing quotas, natural resources studies and rules regulating hunting and building are specific to the territory and protect the environment. There is also a waste management plan (adopted in 2003).

The programmes to limit the introduction of and eradicate alien species represent concrete measures to protect biodiversity.

³⁶ A contract containing a social, economic and environmental development plan for the territory

³⁷ www.polmar.com

3.4 Policy instruments

There are three types of legislation: Territorial, French and International.

Territorial:

- Arrêté of 22/12/99 on manipulation of species
- Arrêté of 30/07/1985 on access (for study) to protected areas
- Arrêté 2003-04 of 10 March 2003, which prohibits hunting
- Arrêté 2000-35 on new buildings and infrastructure
- Fishing quotas

For all these, permission is given by the Prefect. Fishing quotas are decided after agreement with the French Overseas Ministry and consultation with the National Museum for Natural History in Paris. Plans for buildings and infrastructure must have an EIA.

French laws:

The French Environmental Code (art. 640-1 to 640-3) on protection of fauna and flora was adapted by a Décret 2005-403 of 28 April 2005 on the Protection of the Environment in Antarctica³⁸.

International Agreements:

The following are in force in the territory:

Washington or Antarctic Treaty of 1959

This Treaty has a Madrid Protocol (1991). The Protocol designates Antarctica as a “natural reserve, devoted to peace and science”, and sets out basic principles and detailed, mandatory rules applicable to human activities in Antarctica, including the obligation to accord priority to scientific research. The Protocol prohibits all activities relating to Antarctic mineral resources, except for scientific research, and ensures that this prohibition cannot be amended by less than unanimous agreement for at least fifty years following entry into force of the Protocol. It also establishes the Committee for Environmental Protection of the Antarctic Treaty (CEP). CCAMLR was established under the Antarctic Treaty.

The Agreement on the conservation of Albatrosses and petrels (ACAP)

ACAP was developed under the Convention on the Conservation of Migratory Species of Wild Animals (CMS) of 1979. ACAP is the first multilateral agreement which seeks an integrated and holistic approach to albatross and petrel conservation throughout the Southern Hemisphere.

CITES or Washington Convention on trade in endangered species (1973)

3.5 Monitoring

Volunteers are placed on fishing boats to help researchers undertake studies biodiversity trends and amounts of biomass in the sea. The authorities work with the Emile Victor Polar Institute on these studies.

On Adelie water quality and other and other environmental parameters are monitored by the head of district in collaboration with the Emile Victor Polar Institute and MétéoFrance.

The regeneration of a small forest on the island of Amsterdam is being monitored.

A rapid alert system is being developed for tsunamis.

³⁸ Décret relatif à la protection de l'environnement en Antarctique et modifiant le code de l'environnement

3.6 Enforcement

The French Navy and TAAF officers patrol the seas and can fine poachers. The Prefect can stop building activities if an EIA has not been carried out or if the results are negative.

4. International cooperation

4.1 Cooperation with France

Most funding for research, personnel and equipment comes from France.

The French Ministry for Ecology and Sustainable Development is helping to protect endangered species, e.g. albatrosses on the island of Amsterdam. It also plans to fund a 600,000 ha nature reserve in the territory as part of a national biodiversity plan. The Polar Environment Committee reports to this Ministry. The request Ministry recently received a request for funding for energy conservation.

The Energy Agency (ADEME) has helped to make a waste audit. ADEME has also received a request for funding of clean vehicles.

The French Overseas Ministry is financing a study on incidental bird mortality from fishing.

The French IFREMER³⁹ institute for sea resources and the Institute for Natural Heritage (INPN)⁴⁰ both have researchers in the territory.

4.2 Cooperation with the EU

The Council Decision on the association of OCTs with the EU, which governs EU-OCT relations, supports co-operation and development projects. The French Southern and Antarctic Territories have been beneficiaries of the EDF for the ecological rehabilitation of St Paul island.

4.3 Other international cooperation and Multilateral Environmental Agreements (MEAs)

The Territory is party to the following agreements:

- Antarctic Treaty, its Madrid Protocol and the recommendations of CCAMLR;
- ACAP under CMS;
- CITES.

5. Recommendations for future cooperation between the EC and TAAF

The French Southern and Antarctic Territory is the most remote of all the French territories, situated in the southern part of the Indian Ocean and the Antarctic mainland. Environmental protection receives due attention through specific policies and adherence to French and international legislation. But there are specific problems related to overfishing and the introduction of predators and invasive species. According to the territorial administration, the following actions in favour of the environment should be continued or started:

- programmes to eradicate invasive species (cats, rats, rabbits);
- energy conservation;
- clean vehicles;
- clean-up of the old petroleum harbour at Kerguelen.

³⁹ L'Institut français de recherche pour l'exploitation de la mer, <http://www.ifremer.fr/francais/index.php>

⁴⁰ Inventaire National du patrimoine naturel (INPN), <http://www.inpn.mnhn.fr>

The French Antarctic and Austral Territories and the other Antarctic OCT (British Antarctic Territory) could provide an opportunity for the European Commission to get involved, either in global climate research of great importance (Antarctica is the major part of the Earth's cryosphere, crucial in the climate change equation), or in conservation of the important Antarctic fishery.