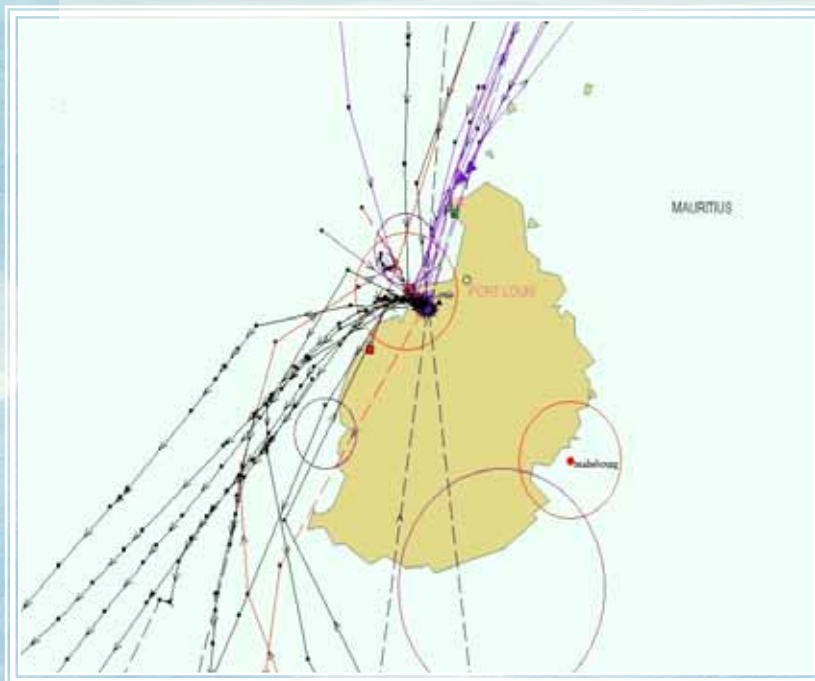




Ministry of Agro-Industry & Fisheries

Annual Report 2005 Fisheries



Tracking of vessels via the Vessel Monitoring System (VMS)

MINISTRY OF AGRO-INDUSTRY & FISHERIES

Fisheries Division

Annual Report 2005

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Vision

To increase the contribution of the fisheries sector in the national economy and to respond effectively to the needs of the Mauritian fishing industry through the provision of highest standard of expertise and professionalism in all its operations particularly in transforming Mauritius into a sea food hub.

Mission

To be the driving force for ensuring the sustainable development and management of fisheries resources, conservation and protection of living aquatic resources and the marine environment in the maritime zones of Mauritius for continued socio-economic benefits to stakeholders.

Objectives

To carry out research for the sustainable development and management of fisheries resources, protect fishery resources and marine ecosystems, conserve marine biodiversity, train fishers, increase awareness among the public in general on fisheries management and conservation of marine living resources, maintain an adequate supply of fish for the population, give the necessary support for the development of the seafood hub and strengthen regional and international cooperation in fisheries.

Foreword

It is my great pleasure to be associated with the Annual Report of the Fisheries Division for the year 2005. This report illustrates the ongoing activities of the Fisheries Division and the performance of the Fisheries Sector within the overall economy.

The country is now at the cross roads of developing new pillars of the economy for sustained growth in order to face the new challenges of the World Trade Organisation rules for greater liberalisation. The development of Mauritius as a world class Seafood Hub is being pursued with vigour.

Mauritius handled some 100,000 tonnes of the fish of the South West Indian Ocean (SWIO) with establishments such as Princes Tuna (Mauritius), Thon des Mascareignes and Pelagic Process being fully involved in tuna processing activities for export to the EU markets. Port Louis also attracted some 725 fishing vessels for transshipment and bunkering purposes. Some 215 licences were issued to foreign fishing vessels to operate in our Exclusive Economic Zone. A one stop shop service exclusively dedicated to the seafood industry has been set up to facilitate administrative and operational clearances in respect of landing, transshipment, import and export of fish and fish products and departure of fishing vessels.

The success story of Ferme Marine de Mahebourg culturing red drum in high tech floating cages with a potential annual harvest of 1000 tonnes set the stage for a project proposal for the development of a master plan for aquaculture.

Good management practices are sine-qua non for the sustainability of fisheries. In this respect, Mauritius is assuming its responsibilities both as a flag and a port state and is cooperating with regional and international fisheries bodies for proper management of fisheries resources. The implementation of the Stock Assessment of the St Brandon and Associated Banks Fishery with the assistance of FAO and the development of the South West Indian Ocean Fisheries Projects were pursued. In addition, the Fisheries Division collaborated with the Mauritius Research Council (MRC) in the preparation of the project document for the Land Based Oceanic Industry.

Mauritius has since June 2005, set up a Vessel Monitoring System (VMS) at the Albion Fisheries Research Centre for the monitoring of the fishing activities of all licensed fishing vessels. Mauritius is also participating in the Regional Pilot Project for Monitoring, Control and Surveillance being implemented by the Indian Ocean Commission. Enhanced collaboration and cooperation among IOC states will no doubt bring a synergy of efforts and contribute in a significant way to address the problems of IUU fishing in the region.

Over the years, the country has had to face new challenges and situations as fisheries is a fast evolving sector and is expected to become a dynamic and important pillar of the Mauritian Economy. In order to comply with our international obligations, the new management environment in which fishing activities are subject particularly the combat of IUU fishing, a new Fisheries and Marine Resources Bill is presently being worked out.

In line with the Government Policy to democratise access to fisheries resources, preliminary work started for the establishment of a Fisherman Investment Trust (FIT) to empower fishers with a fishing entitlement through a quota for fishing around St Brandon and on the banks.

I would like to avail myself of this opportunity to highlight the fact that the timely preparation of this report is due to the devotion and commitment of the entire staff of the Fisheries Division. I thank them for their continued support in helping in orienting our fisheries sector towards maximization of its contribution to economic growth.

**(N. Boodhoo)Mrs
Permanent Secretary
Ministry of Agro Industry & Fisheries
(Fisheries Division)**

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Executive Summary

Fish production was 947 tonnes in the artisanal sector, 1 868 tonnes from the outer banks and 214 tonnes from the FAD fishery.

During the year 214 fishing licences were issued to foreign fishing vessels and 29 to Mauritian vessels to operate in Mauritius waters. A total of 707 fishing vessels called at Port Louis for transshipment, bunkering, dry-docking, provisions and changing of crew.

A Vessel Monitoring System (VMS) was set up in February. The VMS network includes five workstations, three located at the Fisheries Monitoring Centre (FMC), one at the National Coast Guard (NCG) Headquarters and one at the NCG Maritime Air Squadron (Plaisance). Twenty local fishing vessels were fitted with mini-C transponders. All fishing vessels that are licensed to fish in Mauritius waters are required to transmit data to the FMC while operating in the waters of Mauritius.

Sea ranching was continued through the release of 280 000 sea bream fry at Albion, Ferney and Tamarin. Trials on two species of sea cucumbers were continued for sexual and asexual reproduction. A survey was carried out with a view to assess the status of government-owned barachois. The extension service provided advice on aquaculture techniques to fish farmers.

The TOR for a study for a masterplan on marine aquaculture development in the lagoon and outer lagoon of Mauritius while taking into account the effect of introduction of new species, the impact on the environment and user conflicts among others was developed.

The long term monitoring of the coral reef ecosystem and water quality was continued at the established sites around the island. The four ex-sand mining sites were monitored in July 2005 and regeneration of the marine ecosystem was observed, *viz* colonization of the sandy bottom by rhizoids of seagrasses and macroalgae species, increase in fish population, coral recruitment and occurrence of invertebrates.

The Fisheries Training and Extension Centre (FiTEC) dispensed training courses to 71 trainee fishers from the regions of Grand River South East, Port-Louis and La Preneuse/Case Noyale/Baie du Cap and 53 registered fishers from Souillac/Riambel/Baie du Cap. Six sensitisation campaigns on the various activities, facilities and assistance provided to artisanal fishers by the Ministry were conducted at Vieux

Grand Port, Trou d'Eau Douce, Grand Sable/Petit Sable, Grand Baie/Pointe aux Cannoniers, Tamarin and Melville/Grand Gaube. A total of 634 fishers were thus sensitized.

Officers of the Fisheries Protection Service posted at the Blue Bay Marine Park Patrol and Visitors' Centre were assisted by the officers of the National Coast Guard, "Police de l'Environnement" and "Police du Tourisme" to carry out surveillance and to control permissible activities such as glass-bottom boating, snorkelling, diving, water-skiing, swimming and fishing in the park. During the year, 127 permits were issued to the different users of the park.

The Fisheries Division participated actively in the preparation of the Project Appraisal Document of the South West Indian Ocean Fisheries Project (SWIOFP), a regional research project estimated to cost around US\$ 35M. The project would be funded by the GEF (Global Environment Facility)/World Bank, and other donor countries.

The Fisheries Division was actively involved in the preparation of a proposed Land Based Ocean Industry project document. The activity which is being steered by the Mauritius Research Council is expected to use cold seawater extracted from over 1 000m depths in the production of bottled drinking water and pharmaceuticals, aquaculture and air conditioning.

Discussions were started on the starting up of a Fishermen Investment Trust. The Trust, through fishing entitlements, is expected to exploit and manage the resources around St Brandon, Agalega and the associated banks and will target artisanal and banks fishermen and ex-sand miners. A task force was set up to work on the modalities of setting up the Trust.

1. FISHERIES RESEARCH

1.1 Coastal (artisanal) fishery

Data were collected on catch, effort, fish species and gear type at 20 to 25 fish landing stations monthly. Compared to previous years, there has been a slight decline in fish landing which may be due to a decrease in fishing effort and to movement of fishers to the Fish Aggregating Devices (FADs) associated fishery.

1.1.1 Catch, effort and catch per fisherman day (CPFD)

Total fresh fish production was 947 tonnes. Catch, fisherman days and catch per fisherman day (CPFD) for the period 2001-2005 are presented in table 1.1 and figure 1.1.

Table 1.1: Catch, fisherman days and CPFD

Year	Catch (t)			Fisherman days			CPFD (kg)		
	L	OL	Total	L	OL	Total	L	OL	M
2001	579	496	1 075	144 927	93 744	238 671	4.0	5.3	4.5
2002	704	598	1 302	192 116	108 708	300 824	3.7	5.5	4.3
2003	704	462	1 166	189 988	83 362	273 350	3.7	5.5	4.3
2004	699	344	1 043	195 087	68 516	263 603	3.6	5.0	4.2
2005	545	402	947	153 771	77 429	231 200	3.5	5.2	4.1

L=lagoon, OL= off-lagoon, M= mean, CPFD= catch per fisherman day

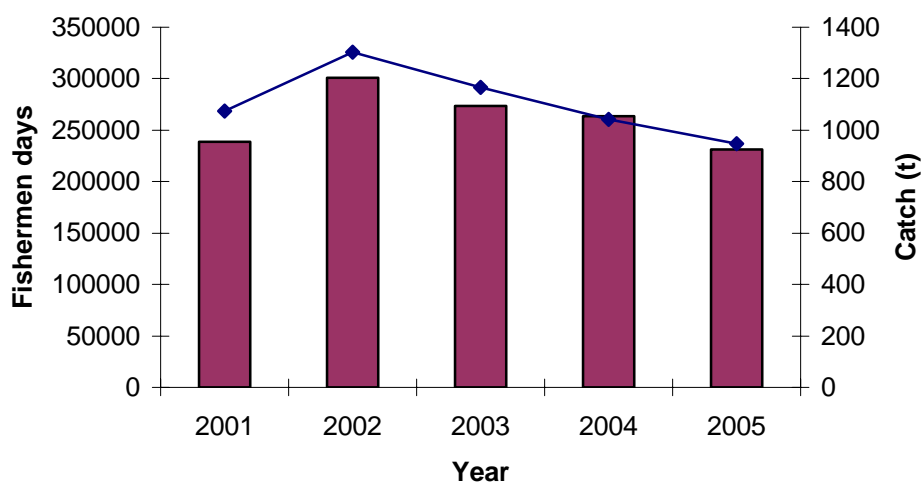


Figure 1.1: Fishermen days and total catch (t)

1.1.2 Monthly landings

With the opening of the net fishery the monthly landings peaked in the month of March. The catch during the closed season amounted to 363 tonnes representing 38% of the annual production of 947 tonnes. The monthly production of fresh fish in the lagoon and off-lagoon, value of catch, effort and catch per fisherman day are presented in table 1.2.

Table 1.2: Monthly estimates of catch with value, effort and catch per fisherman day

Month	Catch (t)			Value (MR)	Fisherman days	CPFD (kg)		
	L	OL	Total			L	OL	Mean
January	33	28	61	7.0	16 621	3.1	4.8	3.7
February	28	26	54	6.4	15 842	2.7	4.7	3.4
March	63	46	109	11.7	14 931	6.0	10.5	7.3
April	53	42	95	10.7	23 838	3.9	4.0	4.0
May	46	38	84	8.9	19 814	3.3	6.5	4.3
June	56	36	92	10.6	21 836	3.7	5.5	4.2
July	51	32	83	9.9	26 199	2.8	3.9	3.1
August	41	12	53	5.5	17 657	2.8	4.0	3.0
September	39	29	68	7.9	20 291	2.8	4.6	3.4
October	27	23	50	6.1	15 922	2.5	4.4	3.1
November	35	47	82	9.3	19 915	3.0	5.7	4.1
December	73	43	116	14.0	18 334	7.0	5.5	6.3
Total	544	402	947	108.0	231 200			

MR = million rupees; L=lagoon; OL= off-lagoon

1.1.3 Catch by gear

Eighteen large nets and five gill nets were operational during the year. Other gears used were basket traps, hook and lines and harpoons. The catch by gear is presented in table 1.3.

Table 1.3: Annual catch (kg) by gear

Year	Line	BT	BTL	LN	GN	H/OF	Total
2001	368 434	357 500	59 134	172 931	11 376	105 904	1 075 279
2002	429 289	450 829	91 787	183 405	25 271	121 095	1 301 676
2003	373 439	492 561	17 539	160 636	13 585	108 103	1 165 863
2004	285 832	425 327	54 874	168 069	11 300	97 402	1 042 804
2005	288 818	433 832	16 786	121 521	8 196	78 165	947 318

BT = basket trap; BT/L = basket trap and line; LN = large net; GN = gill net; H = harpoon, OF= on foot

1.1.4 Fishermen

2 174 were operating regularly during the year. The number of fishers by gear type for the past five years is presented in table 1.4.

Table 1.4: Number of fishers by gear type

Year	BT	L/H/OF	BT/L	LN	GN	Total
2001	519	678	610	180	27	2 114
2002	501	734	600	165	28	2 028
2003	473	749	670	177	17	2 086
2004	445	896	736	159	20	2 256
2005	493	789	689	189	14	2 174

BT = basket trap; L/H/OF= line, harpoon, on foot; BT/L = basket trap and line,
LN = large net; GN = gill net

1.1.5 Boats

The number of active fishing boats was 1 474 indicating a decrease of 22% compared to 2004. The engine capacity of the motors used by the artisanal fishers ranged from 8 to 25 HP. The number of active fishing boats with mode of propulsion is presented in table 1.5.

Table 1.5: Number of active fishing boats

Year	Oars and sails	Outboard motors	Inboard motors	Total
2001	117	1 015	36	1 168
2002	103	1 122	35	1 260
2003	95	1 160	45	1 300
2004	110	1 630	158	1 898
2005	212	1 211	51	1 474

1.1.6 Price of fish

The price of fresh fish at consumer level in 2005 is shown in table 1.6.

Table 1.6: Yearly average retail price of fresh fish (Rs/kg)

Fish	2001	2002	2003	2004	2005
<i>Homard</i>	475	475	480	495	515
Crabe & crevette	270	295	285	275	290
Vieille rouge	180	185	180	190	215
Vacoas, sacré chien	145	150	150	160	160
Capitaine	140	145	140	155	170
Dame berri	130	135	130	140	150
Octopus	100	100	100	105	125
Carangue	100	110	100	115	115
Cordonnier	85	85	90	100	105
Rouget, tuna	80	80	85	90	95
Mullet voilé	75	75	80	85	95
Bordemar	80	80	85	100	95
Licorne	85	95	95	100	115

Cateau	65	70	75	75	70
Shark	35	35	55	45	45

1.2 Banks fishery

Seven vessels were engaged in fishing activities in the shallow waters of the Saya de Malha, Nazareth and Albatross banks, effecting 18 trips. Table 1.7 gives the particulars of the fleet.

Table 1.7: Particulars of the fishing fleet

Vessel	LOA	GRT	Hold (t)	Crew	Fishers	Joined in
Sea Quest	19.8	59.0	20.0	8	7	2004
Talbot IV	44	317	176	28	57	1989
Noor Star 2	51	300	200	18	54	1992
l'Espoir	50	299	400	33	65	1993
Shandrani	55	398	300	35	60	1994
Hoi Siong 5	45	315	180	20	72	1996
Shandrani 2	42	449	130	30	45	2002

LOA: Length overall; GRT: Gross registered tonnage

1.2.1 Production of frozen fish

A total of 1 645 tonnes of frozen fish comprising mainly Lethrinidae species was landed. The annual catch has been decreasing over the past years; however, a sharp decline in catch was observed in 2005. The decline was mainly due to a reduced number of trips arising from a decision relating to the storage of fuel onboard fishing vessels. Table 1.8 shows the annual catch from the different fishing areas and table 1.9 shows the fishing effort and catch.

Table 1.8: Annual production (t) of frozen fish by fishing area

Year	No. of vessels	Saya de Malha	Nazareth	St. Brandon	Chagos	Albatross	Total catch
2001	11	1 283	1 366	332	228	202	3 411
2002	10	2 090	918	0	223	55	3 286
2003	9	2 354	468	0	235	37	3 094
2004	8	1 686	855	0	117	21	2 679
2005	7	1 028	578	3	0	36	1 645

Table 1.9: Fishing effort and catch from the fishing areas

Fishing areas	Fishing days	Bad weather days	Effort (Fisherman days)	Catch (t)	CPFD (kg)	% Total catch
Saya de Malha	311	93	12 663	1 028	81.2	62.5
Nazareth	154	39	7 675	578	75.2	35.1
Albatross	12	2	548	36	65.5	2.2
St. Brandon	-	-	-	3	-	0.2
Total	477	134	20 886	1 645	78.6 (Av.)	

1.2.2 Catch and effort data from the Nazareth and Saya de Malha banks

The effort, catch and catch per fisherman day (CPFD) for the Nazareth and Saya de Malha banks are given in table 1.10

Table 1.10: Catch (t), effort (fisherman days) and CPFD (kg) in the fishery

Year	Nazareth bank			Saya de Malha bank		
	Effort	Catch	CPFD	Effort	Catch	CPFD
2001	13 773	1 359	98.8	10 340	1 053	101.0
2002	9 837	918	93.3	25 083	2 090	83.3
2003	6 426	468	72.9	29 371	2 354	80.1
2004	10 154	855	84.2	23 729	1 686	71.0

2005	7 675	578	75.2	12 663	1 028	81.2
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The catch per fisherman day (CPFD) for the year was 75.2 and 81.2 kg on the Nazareth and Saya de Malha banks respectively.

1.2.3 Length frequency distribution of *Lethrinus mahsena*

Length frequency data for the major species of fish, *Lethrinus mahsena*, were collected during unloading at Port Louis. The number of fish sampled from the Nazareth and Saya de Malha banks was 1 588 and 1 984 and their length ranged from 240 to 620 mm and 240 to 570 mm, respectively. The length frequency distributions are shown in figures 1.2 and 1.3.

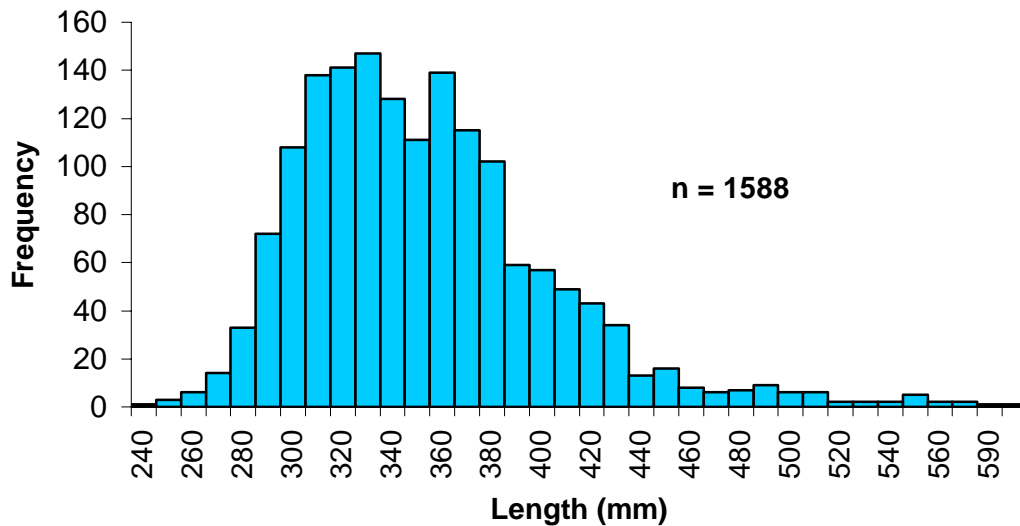


Figure 1.2: Length frequency of *Lethrinus mahsena* from the Nazareth bank

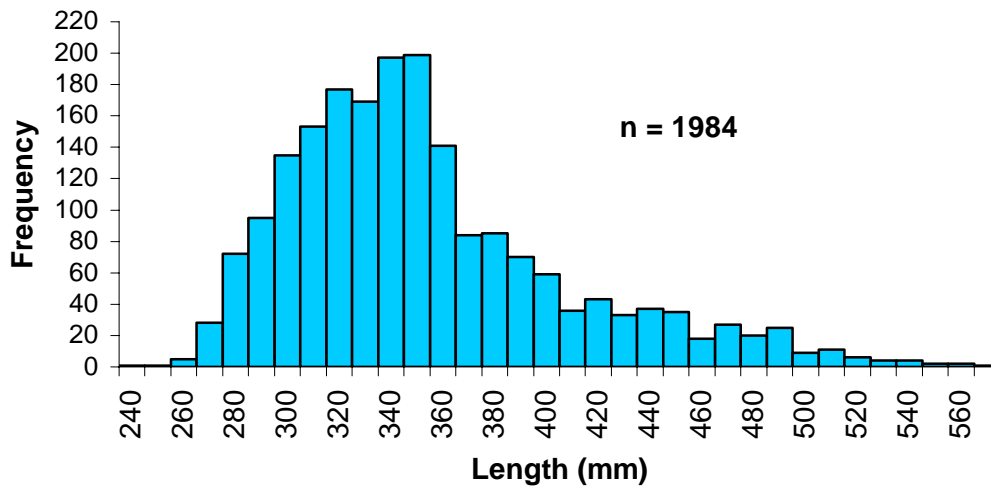


Figure 1.3: Length frequency of *Lethrinus mahsena* from the Saya de Malha bank

1.2.4 Fishing in the waters of the Chagos Archipelago

No fishing vessel was engaged in fishing activities on the Chagos Archipelago bank. Details on the catch and effort for the past five years are given in table 1.11.

Table 1.11: Details of fishing trips to the Chagos Archipelago

Year	No. of trips	No. of vessels	Fishing days	Bad weather days	Catch (t)	Fisherman days	CPFD (kg)
2001	5	3	62	12	191	3 246	58.8
2002	2	2	73	35	223	3 937	56.6
2003	2	2	77	40	235	4 068	57.7
2004	2	2	34	26	117	1 761	66.4
2005	Nil				Nil		

1.3 St. Brandon fishery

The catch from the St. Brandon fishery comprised mainly frozen fish, chilled fish, lobster and salted fish. Vessels La Derive and Eliza licensed to transport fish caught by fishers based at St. Brandon made a total of 46 trips and landed chilled and salted fish. Vessel l’Espoir made three trips and landed mainly frozen fish. The different products landed from St. Brandon are presented in table 1.12. A total of 343.6 tonnes of produce comprising 171 tonnes of frozen fish, 132.6 tonnes of chilled fish, 35.4 tonnes of salted fish and 4.6 tonnes of octopus was unloaded at Port-Louis during 2005.

Table 1.12: St. Brandon inshore fishery production (tonnes)

Frozen fish	Chilled fish	Salted fish	Octopus	Total
171.0	132.6	35.4	4.6	343.6

1.3.1 Sampling of fish at St. Brandon

Sampling of the two main fish species *Lethrinus mahsena* and *L. nebulosus* was carried out during a field visit at St. Brandon in March. Length-weight data of 1 596 *L. mahsena* and 787 *L. nebulosus* were collected. The lengths varied from 210 to 650mm and from 220 to 650mm respectively while the weight ranged from 300 to 3 650g and from 400 to 3 900g respectively. The weights of fish below 350mm could not be obtained as these were already gutted at sea. In addition, gonads were collected for further analysis ashore.

Figures 1.4 and 1.5 show the length-weight relationships of the two species of fish while figures 1.6 and 1.7 show their length frequencies.

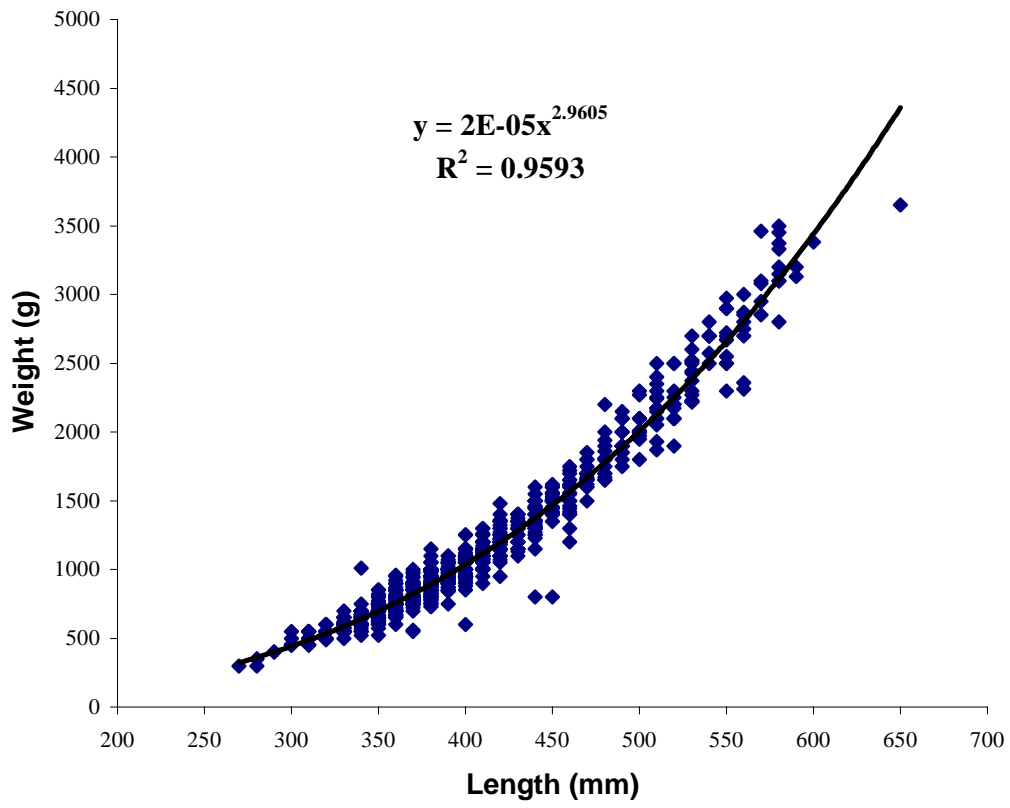


Figure 1.4: Length-weight relationship for *L. mahsena*

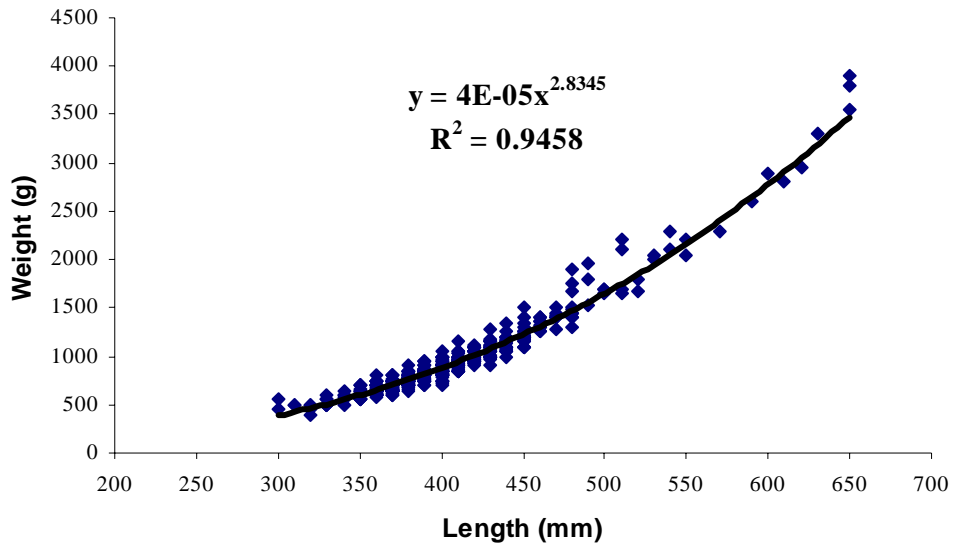


Figure 1.5: Length-weight relationship for *L. nebulosus*

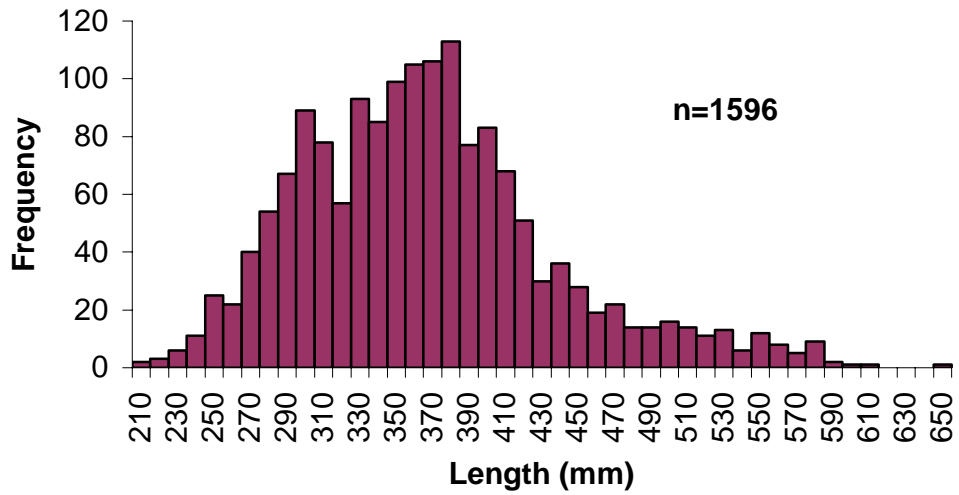


Figure 1.6: Length frequency of *L. mahsena* from St. Brandon

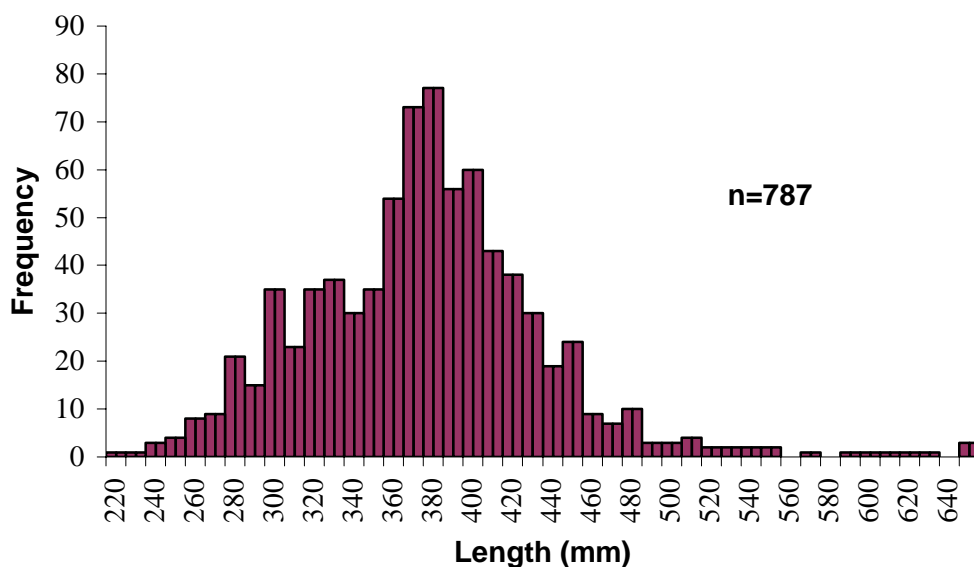


Figure 1.7: Length frequency of *L. nebulosus* from St. Brandon

The lengths of *L. mahsena* varied from 210mm to 650mm with most of the fish in the range of 350 and 390mm whilst those for *L. nebulosus* ranged from 220mm to 650mm with the majority lying between 360 and 420mm.

1.3.2 Stock assessment and fishery management of the St Brandon plateau and associated banks fisheries

The study on the stock assessment and fishery management of the St. Brandon plateau and associated banks fisheries was pursued. In that context length and weight frequency data were collected upon the arrival of fishing vessels from the different banks. Moreover a field survey was conducted at St Brandon for fish sampling and collection of biological data on the two main fish species (sub-section 1.3.1).

Under the project, a consultant in fish handling and marketing effected a visit in November to assess fish quality, handling and processing. He visited St. Brandon, fish landing stations, municipal markets, cold stores, fish processing plants, retail outlets and the unloading facilities in the harbour.

The terms of reference for an acoustic survey to determine the presence and the abundance of fishery resources on the slope of the shelf southeast of St. Brandon was prepared. The survey would be conducted in 2006.

Reports on the most common fish species namely, *L. mahsena* (dame berri), *L. nebulosus* (capitaine), *Scarus ghobban* (cateurs), *Siganus sutor* (cordonnier) found on the banks as well as reports for the two fishing seasons starting from September 2003 to August 2004 and September 2004 to August 2005 for the Nazareth, Saya de Malha, Albatross, Soudan, Hawkins and Chagos banks were prepared.

1.4 The semi-industrial demersal chilled fish fishery

Fifteen semi-industrial vessels operated on the Saya de Malha, Albatross, Soudan, Nazareth and Hawkins banks undertaking 126 trips of an average duration of 12 days. They landed 223 tonnes of fish.

Particulars of the vessels are given in table 1.13 and the species compositions of the catch by fishing area are in table 1.14. The annual production of chilled fish from St. Brandon and the semi-industrial chilled fish fishery for the past years is presented in table 1.15.

Table 1.13: Particulars of vessels operating in the semi-industrial chilled fish fishery

Vessel	LOA (m)	GRT (t)	Fish hold (t)	Crew	No of fishers	Joined in
King Fish I	17.0	14.5	5.5	2	10	1996
King Fish II	21.0	14.5	10.0	4	11	1998
King Fish IV	15.0	24.0	6.0	2	4	2002
King Fish V	15.1	14.8	5.8	2	8	2004
King Fish VI	13.1	11.0	3.5	2	3	2005
Coryphaena	12.0	8.5	2.5	2	4	1999
Dai Fah 1	17.0	14.0	14.0	2	4	2002
Kervor 1	14.6	15.0	5.0	2	4	2005
Nathali	13.2	40.0	8.0	2	3	2005
Sea Quest	19.8	59.0	20.0	8	7	2004
St. Mathilde	14.1	45.2	9.0	2	4	2004
Roshan	14.0	14.0	7.0	1	5	2002
Quo Vadis 1	12.0	26.9	4.0	2	4	2003
Ouma	14.0	17.5	9.0	2	6	2005
Kishan	12.0	15.0	8.0	2	4	2001

Table 1.14: Catch (kg) by species and fishing area

Fishing area	Lethrinids	Snappers	Groupers	Tuna and others	Total
Albatross	98 583	14 585	9 566	3 875	126 609
Soudan	3 383	1 369	215	1 051	6 018
Hawkins	1 820	1 010	300	380	3 510
Saya de Malha	16 217	31 447	2 736	3 675	54 075
Nazareth	23 777	5 980	1 229	1 242	32 228
Others	400	50	100	0	550
Total	144 180	54 441	14 146	10 223	222 990

Table 1.15: Total demersal chilled fish production from banks (tonnes)

Year	2001	2002	2003	2004	2005
Catch	184	204	234	284	356

The catch, fishing days, effort (fisherman days) and catch per fisherman day (CPFD) in the different fishing areas are presented in table 1.16.

Table 1.16: Catch, effort and CPFD of chilled fish by banks

Banks	Catch (kg)	Fishing days	Fisherman days	CPFD (kg)
Albatross	126 609	401	2 561	49.4
Soudan	6 018	20	118	51.0
Hawkins	3 510	18	103	34.1
Saya de Malha	54 075	99	628	86.1
Nazareth	32 228	80	443	72.7
Others	550	2	10	55.0

1.5 Ecotoxicology

1.5.1 Mongoose bioassay

Toxicity tests for the presence of ciguatoxin were conducted on fish specimens received from the Fisheries Protection Service, Health Offices and fishing vessels. Of the eighteen fish specimens tested by mongoose bioassay, four were highly toxic, two were moderately toxic, one slightly toxic and eleven were non toxic. The particulars are given in table 1.17.

Table 1.17: Details of toxic fish specimens

Common name	Scientific name	Length (cm)	Weight (g)	Origin	Results
Bourgeois	Lutjanus sebae	74.0	9 100	Nazareth	Highly toxic
Carangue	Carangoides plagiotaenia	62.0	3 900	Nazareth	Highly toxic
Vara vara	Lutjanus bohar	65.0	5 300	Nazareth	Highly toxic
Vara vara	Lutjanus bohar	61.5	4 500	Nazareth	Highly toxic

Vara vara	Lutjanus bohar	61.0	4 300	Nazareth	Moderately toxic
Vara vara	Lutjanus bohar	63.5	4 700	Nazareth	Moderately toxic
Vara vara	Lutjanus bohar	64.3	5 000	Nazareth	Slightly toxic

1.5.2 Mouse Bioassay

Three fish specimens, comprising two varavara and one carangue, found to be toxic via the mongoose bioassay were used for extraction of ciguatoxin. The extracts were tested through the mouse assay in duplicates using six mice of weight ranging between 18 and 24g. The control mouse was injected with Tween-60 and 9% saline solution. The six test mice died within 24 hours.

1.5.3 Harmful marine microalgae

Sampling of harmful marine microalgae continued at the established sites, Albion, Blue Bay, Le Morne and Trou aux Biches. As from April, sampling of microalgae was monitored on a quarterly basis.

Gambierdiscus toxicus was observed only in March at Blue Bay in very low numbers; *Coolia* sp. was not present during the year. *Prorocentrum lima* was found to be present in high numbers at Blue Bay and low at Trou aux Biches. *Ostreopsis* sp. was high at Albion in February but decreased thereafter. *Amphidinium* sp. and *Synophysis* sp. were present in very low numbers throughout the year. The densities of dinoflagellates at the sampling sites are shown in table 1.18.

Table 1.18: Density of dinoflagellates at Albion, Blue Bay, Le Morne and Trou aux Biches (cell count/ml)

Species	Albion	Blue Bay	Le Morne	Trou aux Biches
<i>Gambierdiscus</i> sp.	1	1	0	0

<i>Ostreopsis</i> sp.	77	7	5	6
<i>Prorocentrum lima</i>	25	94	26	1
<i>Prorocentrum concavum</i>	9	4	4	3
<i>Prorocentrum</i> sp.	4	8	3	1
<i>Amphidinium</i> sp.	0	3	1	0
<i>Synophysis</i> sp.	0	3	2	2

1.6 Study on the biology of mullidae (rougets) and scaridae (cateaux)

Collection of biological data on mullidae and scaridae was ongoing for the determination of the length-weight relationship, age and growth parameters, maturity and fecundity, spawning season, food and feeding habits and the standing stock in coastal waters.

A total of 2 621 rougets and 725 cateaux was sampled at Grand Gaube, Poudre d'Or, Pointe aux Piments, Camps des Pêcheurs, Mahebourg, La Gaulette and Le Morne. Tables 1.19 and 1.20 give particulars of the fish sampled.

Table 1.19: Particulars of scaridae sampled

Scaridae	No.	Length (mm)	Weight (g)
<i>Leptoscarus vaigiensis</i>	449	147-338	40-540
<i>Scarus ghobban</i>	139	139-507	50-2 250
<i>Scarus psittacus</i>	19	145-230	60-190
<i>Scarus russelii</i>	90	155-442	80-1630
<i>Scarus scaber</i>	26	181-266	110-300
<i>Scarus sordidus</i>	1	198	120
<i>Calatomus carolinus</i>	1	182	110

Table 1.20: Particulars of mullidae sampled

Mullidae	No.	Length (mm)	Weight (g)
<i>Mulloides flavolineatus</i>	2 018	158-394	30-600
<i>Mulloides vanicolensis</i>	103	172-402	60-720
<i>Mulloides pfligeri</i>	2	304-330	400-460
<i>Parupeneus barberinus</i>	239	153-380	40-660
<i>Parupeneus ciliatus</i>	144	161-295	50-360
<i>Parupeneus cyclostomus</i>	17	165-267	50-270

<i>Parupeneus bifasciatus</i>	13	190-350	70-780
<i>Parupeneus rubicens</i>	3	317-363	380-580
<i>Parupeneus macronema</i>	2	222-252	120-170
<i>Parupeneus pleurostigma</i>	1	178	60
<i>Upeneus vittatus</i>	79	187-440	80-890

A total of 266 fish specimens were dissected in the laboratory for sex determination, sexual maturity staging, and food and feeding habits. Sexual maturity stages revealed that the spawning season of mullidae is between November and June. mullidae stomach contents consisted mainly of worms, small crabs, shrimps, bivalves, digested matter and sand particles.

Two spawning periods were observed for the scaridae, in June/July and November/December/January. Only digested matter was found in the stomachs of the scaridae.

2. MARINE SCIENCE

2.1 Coastal ecosystem research

2.1.1 Long-term monitoring of coral reef ecosystem

The long-term monitoring of coral reefs was continued at the established sites; Albion, Pointe aux Sables, Trou aux Biches, Anse la Raie, Poudre d'Or, Trou d'Eau Douce, Bambous Virieux, Bel Ombre, Baie du Tombeau, Le Goulet, Ile aux Benitiers and Belle Mare. Data on substrate cover were collected using the Line Intercept Transect (LIT) method. Data on coral cover were recorded to the species level. The data were processed by the CO.RE.MO software; the average percentage cover of substrate is shown in table 2.1 and the abundance of fish, sea urchins and sea cucumbers is at table 2.2.

Temporal changes in benthic communities and fish abundance are presented at figures 2.1 and 2.2 respectively for the back reef station at Trou aux Biches.

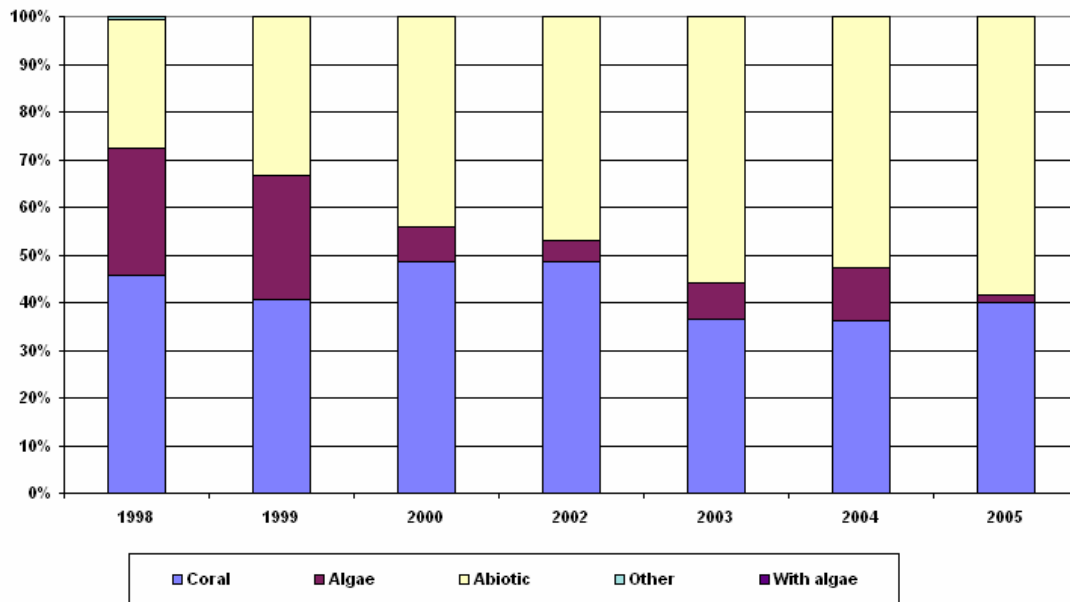


Figure 2.1: Temporal changes in benthic communities at Trou aux Biches (back reef)

Branching and tabular corals dominated the sea bottom at the back reef station. The dominant coral species recorded were *Acropora nobilis*, *A. microthalma*, *A. cytherea* and *A. formosa*. Other coral species recorded were *Porites lutea* and *Porites sp.* The live coral cover ranged from 45% in 1998 to 40% in 2005.

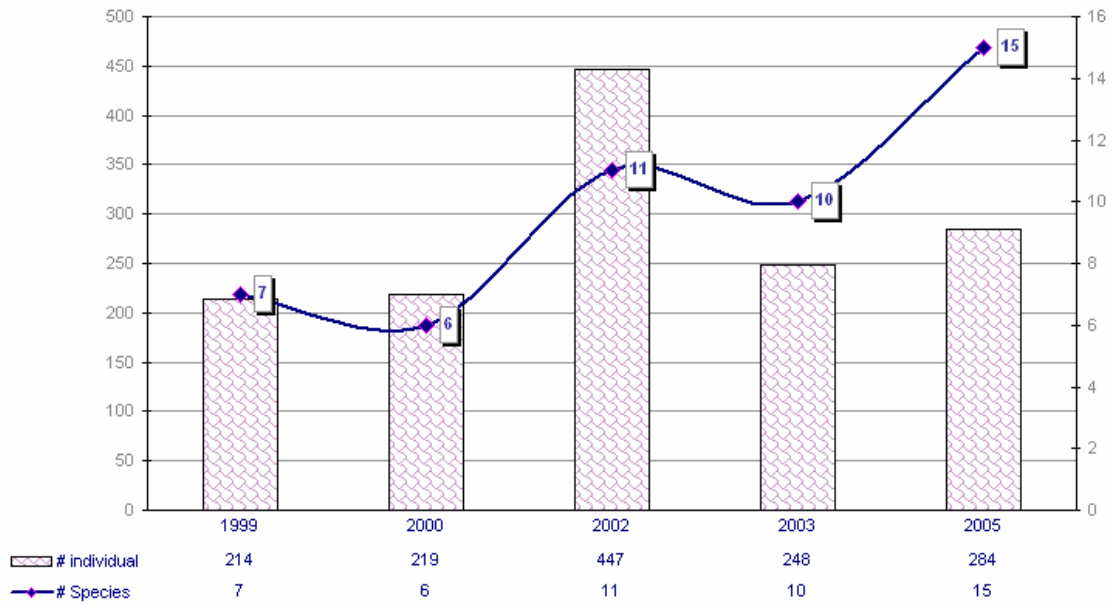


Figure 2.2: Abundance of fish at Trou aux Biches (back reef)

Fish were abundant at the station and were mainly from families pomacentridae, scaridae, acanthuridae, chaetodontidae, zaclidae and mullidae. The territorial fish species most commonly noted were the *Stegastes lividus*, *S. limbatus* and *S. nigricans*. Other species recorded were *Labroides* sp., *Chromis viridis*, *Ctenochaetus striatus*, *Dascyllus aruanus*, *Chaetodon trifascialis*, *Halichoeres scapularis*, *Zanclus cornutus*, *Abudefduf sexfasciatus*, *Thalassoma hardwicke*, *Scarus ghobban*, *Scarus sordidus* and *Parupeneus* sp. Thus, fifteen different species of fish were observed at the station.

Table 2.1: Average percentage cover of substrate at monitoring stations

Site	Stations	Year	Coral	Algae	Abiotic	Others
Baie du Tombeau	back reef	2004	58	7	35	N.O

		2005	64	2	34	N.O
Le Goulet	fore reef	2004	74	2	21	3
		2005	-	-	-	-
Ile aux Benitiers	fore reef	2004	23	1	72	4
		2005	26	1	71	2
	back reef	2004	22	13	65	N.O
		2005	7	2	92	N.O
	shore reef	2004	18	8	74	N.O
		2005	15	0	85	N.O
Bel Ombre	back reef	2004	51	28	30	1
		2005	24	42	34	N.O
	shore reef	2004	52	8	40	N.O
		2005	48	4	48	N.O
Bambous Virieux	back reef	2004	56	10	34	N.O
		2005	48	14	37	1
	shore reef	2004	35	40	25	N.O
		2005	35	49	16	N.O
Trou d'Eau Douce	back reef	2004	37	27	36	N.O
		2005	32	34	34	N.O
	shore reef	2004	60	2	38	N.O
		2005	59	2	36	3
Anse La Raie	back reef	2004	59	27	14	N.O
		2005	37	27	36	N.O
	shore reef	2004	71	13	6	N.O
		2005	75	5	20	N.O
Trou aux Biches	fore reef	2004	33	5	60	2
		2005	28	6	64	2
	back reef	2004	37	7	56	N.O
		2005	40	2	58	N.O
Pointe aux Sables	fore reef	2004	15	1	84	N.O
		2005	11	1	88	N.O
	back reef	2004	39	6	53	2
		2005	-	-	-	-
Albion	fore reef	2004	30	4	64	2
		2005	27	2	68	3
	back reef	2004	22	36	42	N.O
		2005	19	22	59	N.O
Poudre d'Or (Site I)	back reef	2004	57	30	13	N.O
		2005	40	40	19	1
Poudre d'Or (Site II)	back reef	2004	30	12	58	N.O
		2005	29	2	63	6
Belle Mare (Site I)	back reef	2004	53	9	39	N.O
		2005	50	36	14	N.O
Belle Mare (Site II)	back reef	2004	50	9	42	N.O
		2005	64	4	32	N.O

N.O: Not observed Others: sponges, crown of thorns, soft corals, giant clams

Table 2.2: Abundance of fish, sea urchins and sea cucumber

SITE	Type of reef	Year	Pomacentridae & Chaetodontidae	Acanthuridae	Labridae	Scaridae	Sea cucumber	Sea urchins
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Baie du Tombeau	back reef	2004	XXXX	X	N/O	N/O	N/O	N/O
		2005	XXXX	X	N/O	N/O	N/O	XX
Le Goulet	fore reef	2004	XXXX	XX	X	N/O	XX	N/O
		2005	XXXX	XX	X	X	XX	X
Ile aux Benitiers	fore reef	2004	X	XX	X	XX	N/O	XXXX
		2005	XX	XX	XX	N/O	N/O	XXXX
	back reef	2004	XXXX	XX	XX	XX	N/O	N/O
2005		XXXX	XX	XX	N/O	X	X	
shore reef	2004	XXX	XX	XX	XXX	X	X	
	2005	XX	N/O	XX	N/O	N/O	N/O	
Bel Ombre	back reef	2004	XXXX	N/O	X	X	XX	XXX
		2005	XXXX	X	XX	XX	N/O	N/O
shore reef	2004	XXXX	XX	XX	XX	XX	XX	X
	2005	XX	X	X	X	N/O	N/O	
Bambous Virieux	back reef	2004	XXXX	N/O	X	N/O	XX	XXXX
		2005	XXXX	N/O	X	N/O	XXXX	XXXX
shore reef	2004	XXX	XXX	XX	XXX	N/O	N/O	
	2005	XXX	XX	X	XX	N/O	X	
Trou d'Eau Douce	back reef	2004	XXXX	XXX	X	N/O	N/O	X
		2005	XXXX	XX	X	N/O	N/O	X
shore reef	2004	XXX	XX	N/O	N/O	N/O	N/O	
	2005	XXX	XX	X	XX	N/O	N/O	
Anse La Raie	back reef	2004	XXXX	X	X	N/O	N/O	N/O
		2005	XXXX	X	X	X	N/O	N/O
shore reef	2004	XXXX	X	N/O	N/O	N/O	N/O	
	2005	XXXX	N/O	N/O	N/O	N/O	N/O	
Trou aux Biches	fore reef	2004	XX	XXX	N/O	X	N/O	N/O
		2005	XX	X	X	XX	N/O	XXXX
back reef	2004	XXXX	XXX	X	X	X	X	
	2005	XXXX	XXX	X	N/O	N/O	N/O	
Pointe aux Sables	fore reef	2004	X	XX	N/O	N/O	N/O	XXXX
		2005	XX	XX	X	N/O	N/O	XXXX
back reef	2004	XX	N/O	XX	XX	N/O	XXXX	
	2005	XXXX	XX	X	XX	X	XXXX	
Albion	fore reef	2004	X	XX	X	XX	N/O	XXXX
		2005	X	XXXX	XX	N/O	N/O	XXXX
back reef	2004	XXXX	N/O	X	XX	XX	XXX	
	2005	XXXX	N/O	XX	N/O	N/O	XX	
Poudre d'Or (Site I)	back reef	2004	XXXX	X	X	X	N/O	N/O
		2005	XXXX	XX	X	N/O	N/O	N/O
Poudre d'Or (Site II)	back reef	2004	XXXX	X	N/O	N/O	N/O	XXXX
		2005	XXXX	XX	X	N/O	N/O	XXX
Belle Mare (Site I)	back reef	2004	XXXX	XX	XX	N/O	N/O	N/O
		2005	XXXX	XX	XX	N/O	N/O	N/O
Belle Mare (Site II)	back reef	2004	XXXX	XX	X	N/O	N/O	XX
		2005	XXXX	XX	X	N/O	N/O	XX

Legend: N/O – Not observed, X – 0-10, XX- 10-50, XXX – 50-100, XXXX - >100

At most of the monitoring stations, the family pomacentridae (damsel fish) and acanthuridae (surgeon fish) were dominant. The species of damsel fish recorded were *Stegastes lividus*, *Stegastes limbatus*, *Dascyllus aruanus*, *Chrysiptera unimaculata* and *Chromis viridis*. The surgeon fish were represented by *Ctenochaetus striatus* and *Acanthurus xanthopterus*. The family chaetodontidae (butterfly fish) and labridae (wrasses) were also commonly present. The family balistidae (trigger fish) was least represented and predators from families serranidae (*Epinephelus merra*) and lethrinidae (*Lethrinus sp.*) were rare. The abundance of fish in the fore reef of Albion and Ile aux Benitiers was relatively low compared to the other stations.

The dominant coral and fish species recorded at the monitoring sites are given in table 2.3.

Table 2.3: Dominant coral and fish species at monitoring sites

Sites	Dominant coral species	Dominant fish species
Albion	<i>Acropora formosa</i> , <i>A. nobilis</i> , <i>A. austera</i> , <i>Porites lutea</i> , <i>Porites</i> sp., <i>Acropora</i> sp., <i>Favites</i> sp.	<i>Stegastes lividus</i> , <i>Dascyllus aruanus</i> , <i>Stegastes nigricans</i> , <i>Parapeneus</i> sp., <i>Siganus</i> sp., <i>Labroides</i> sp., <i>Thalassoma genivittatum</i> , <i>Pomacentrus dimidiata</i> , <i>Scarus sordidus</i> , <i>Chaetodon</i> sp.
Pointe aux Sables	<i>Galaxea fascicularis</i> , <i>Porites lutea</i> , <i>A. digitifera</i> , <i>A. formosa</i> , <i>Acropora</i> spp., <i>A. robusta</i>	<i>Ctenochaetus striatus</i> , <i>Stegastes limbatus</i> , <i>Labroides</i> sp., <i>Scarus ghobban</i> , <i>Parapeneus</i> sp., <i>Thalassoma genivittatum</i> , <i>Scarus sordidus</i> , <i>Thalassoma hardwicke</i>
Baie du Tombeau	<i>Galaxea fascicularis</i> , <i>A. formosa</i> , <i>A. austera</i> , <i>Montipora</i> sp., <i>Pavona decussata</i> , <i>Pavona cactus</i> , <i>Porites lutea</i> , <i>Fungia</i> sp.	<i>Stegastes lividus</i> , <i>Dascyllus aruanus</i> , <i>Chromis viridis</i> , <i>Scarus ghobban</i> , <i>Scarus scaber</i> , <i>Zanclus cornutus</i>
Trou aux Biches	<i>Acropora formosa</i> , <i>A. cytherea</i> , <i>A. hyacinthus</i> , <i>Porites australensis</i> , <i>Porites lutea</i> , <i>Pocillopora verrucosa</i> , <i>A. nobilis</i>	<i>Stegastes lividus</i> , <i>Labroides</i> sp., <i>Chromis viridis</i> , <i>Ctenochaetus striatus</i> , <i>Dascyllus aruanus</i> , <i>Chaetodon trifascialis</i> , <i>Halichores scapularis</i> , <i>Scarus sordidus</i>
Anse la Raie	<i>Montipora aequituberculata</i> , <i>Montipora</i> sp, <i>Acropora formosa</i> , <i>Porites lutea</i> , <i>Pavona cactus</i> , <i>Pocillopora damicornis</i> , <i>Fungia repanda</i>	<i>Dascyllus aruanus</i> , <i>Stegastes lividus</i> , <i>Stegastes limbatus</i> , <i>Stegastes nigricans</i> , <i>Epinephelus merra</i> , <i>Thalassoma hardwicke</i> , <i>Abudefduf sexfasciatus</i>
Poudre d'Or	<i>Millepora</i> sp., <i>Acropora formosa</i> , <i>Acropora cytherea</i> , <i>Pocillopora damicornis</i> , <i>Fungia</i> sp., <i>Acropora aculeus</i> , <i>Pavona decussata</i>	<i>Scarus ghobban</i> , <i>Dascyllus aruanus</i> , <i>Chromis viridis</i> , <i>Ctenochaetus striatus</i> , <i>Stegastes nigricans</i> , <i>E. merra</i> , <i>Chaetodon</i> sp., <i>Thalassoma hardwicke</i>
Belle Mare	<i>Acropora formosa</i> , <i>A. nobilis</i> , <i>A. hyacinthus</i>	<i>Stegastes limbatus</i> , <i>Dascyllus aruanus</i> , <i>Scarus ghobban</i> , <i>Ctenochaetus striatus</i> , <i>Stegastes lividus</i> , <i>Scarus scaber</i>
Trou d'Eau Douce	<i>Acropora austera</i> , <i>Montipora</i> sp., <i>Pocillopora verrucosa</i> , <i>Fungia danae</i> , <i>Herpolitha limax</i> , <i>Acropora formosa</i> , <i>Pocillopora damicornis</i> , <i>Porites</i> sp., <i>Pavona cactus</i> , <i>Pavona decussata</i>	<i>Stegastes lividus</i> , <i>Stegastes limbatus</i> , <i>Labroides</i> sp., <i>Dascyllus aruanus</i> , <i>Ctenochaetus striatus</i> , <i>Halichores hortulanus</i> , <i>St. nigricans</i> , <i>Thalassoma hardwicke</i>
Bambous	<i>Acropora formosa</i> , <i>Pavona cactus</i> ,	<i>Stegastes lividus</i> , <i>Stegastes limbatus</i> , <i>Dascyllus</i>

Virieux	<i>Pavona decussata</i> , <i>Porites lutea</i> , <i>Porites australiensis</i> , <i>Pocillopora damicornis</i>	<i>aruanus</i> , <i>E.merra</i> , <i>Parapeneus sp.</i> , <i>Chromis viridis</i>
Bel Ombre	<i>Pavona decussata</i> , <i>Pavona cactus</i> , <i>Porites sp.</i> , <i>Fungia sp.</i> , <i>Acropora formosa</i> , <i>Pocillopora damicornis</i> , <i>Montipora sp.</i> , <i>Fungia repanda</i>	<i>Ctenochaetus striatus</i> , <i>Chrysiptera annulata</i> , <i>Dascyllus aruanus</i> , <i>Stegastes limbatus</i> , <i>Stegastes lividus</i> , <i>Zanclus cornutus</i> , <i>Chetodon trifascialis</i> , <i>Halichores scapularis</i>
Ile aux Benitiers	<i>Acropora cytherea</i> , <i>Acropora formosa</i> , <i>Acropora nobilis</i> , <i>A. intermedia</i> , <i>A. nasuta</i> , <i>A. austera</i> , <i>Pavona cactus</i> , <i>Fungia sp.</i> , <i>Pocillopora damicornis</i> , <i>Platygyra sp.</i> , <i>Favites sp.</i> , <i>Astreopora listeri</i>	<i>Stegastes lividus</i> , <i>Chrysiptera annulata</i> , <i>Stegastes limbatus</i> , <i>Siganus sutor</i> , <i>Scarus ghobban</i> , <i>Ctenochaetus striatus</i> , <i>Labroides sp.</i> , <i>Stegastes nigricans</i> , <i>Dascyllus aruanus</i> , <i>Zanclus cornutus</i> , <i>Thalassoma hardwicke</i> , <i>Thalassoma genivittatum</i> , <i>Halichores scapularis</i> , <i>E.merra</i>

2.1.2 *Ad hoc* ecosystem surveys

2.1.2.1 Survey at Poudre d'Or

Ecological surveys were conducted in the lagoon at Poudre d'Or in connection with pollution caused around the discharge point of the textile industry at Ile d'Ambre in July. This was a follow-up of the previous surveys conducted in 2003 and it was observed that there has been marked improvement in the water quality and reduction in the amount of sludge in the affected area. The mangrove stands were healthy and abundance of mullet fish was observed.

2.1.2.2 Monitoring of ex-sand mining sites

The four ex-sand mining sites, namely Grand Gaube, Poudre d'Or, Mahebourg and GRSE were monitored in July. The results indicated the regeneration of the marine ecosystem, *viz.* colonization of the sandy bottom by rhizoids of seagrasses and macroalgae species, increase in fish population, coral recruitment and occurrence of invertebrates. Figure 2.3 illustrates the regeneration of the ecosystem.

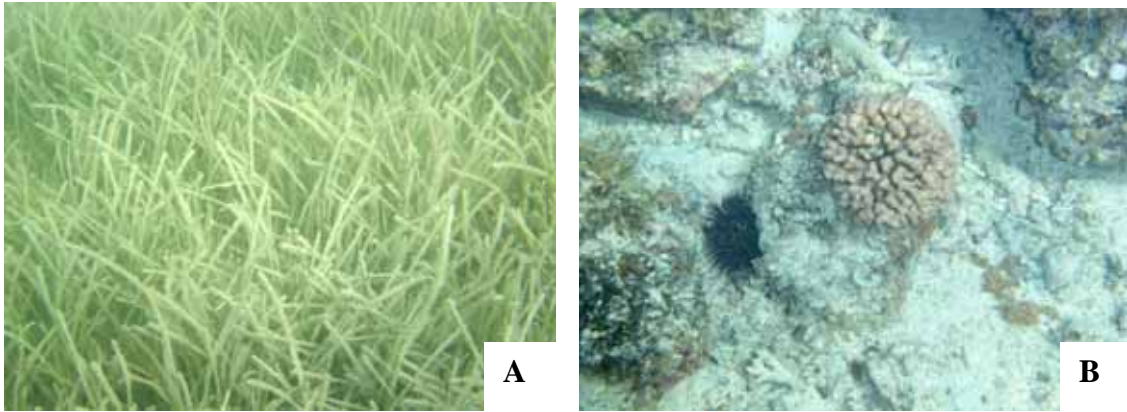


Figure 2.3: Regeneration of the ecosystem (A: Seagrass (*Syringodium isoetifolium*); B: Juvenile hard corals (*Pocillopora* sp.)

2.1.2.3 Survey on the occurrence of stonefish and other harmful marine organisms at selected public beaches

Following the fatal incidence of a stonefish sting in May 2003, surveys were carried out on occurrence of harmful marine organisms such as stonefish, sea urchins and cone shells at selected public beaches, namely Albion, Flic en Flac, Mon Choisy, Le Bouchon, Blue Bay, Peréybère and Trou aux Biches at three monthly intervals.



Stonefish

Scorpion fish

Lion fish

Figure 2.4: Different types of “laffes” encountered

The total number of harmful organisms recorded during the study comprised 77 laffes, 352 cones, 30 841 sea urchins and 74 pinna. The stonefish and scorpion fish were observed at different depths mainly on sandy, seagrass and macroalgae substrates, whereas lion fish were observed on sand, corals and rubble. Sea urchins were in high numbers at Trou aux Biches, Flic en Flac, Le Morne and Albion. Pinna were mainly found at Le Morne and Le Bouchon.

Results of the survey indicated that stonefish such as laffe laboue and laffe corail which are known to be the most dangerous species were found in low numbers and, therefore, do not pose a big threat to the public.

2.1.2.4 Montagne Jacquot Sewerage and Sanitation Project

The Waste Water Management Authority provided preliminary data on the status of the marine environment at the Montagne Jacquot sewerage outfall. Surveys were carried out to set up long term monitoring stations.

2.1.3 Regional Coral Reef Monitoring Project

The Regional Coral Reef Monitoring Project ended in July. Many activities were undertaken under the project:

- Acquisition of the CO.RE.MO. software and training in its use.
- Training on the Reefcheck methodology, a new technique for data collection with respect to coral reefs.
- Publication of data in the “Status of Coral Reefs of the World” by the Global Coral Reef Monitoring Network.
- Production of a pamphlet on coral reefs.
- Training of officers in SCUBA diving.
- Sensitization programme on the marine environment

2.1.4 Study on coral bleaching

The CORDIO, (Coral Reef Degradation in the Indian Ocean), project, allocated a sum of US\$ 18 000 for studies on coral bleaching in Mauritius. Two survey sites were selected, one at Belle Mare in the east and the other at Ile aux Benitiers in the west. Temperature data loggers were set at both sites. The results would be assessed at the end of the project in November 2006.

2.1.5 Mangrove propagation

Assistance was provided for mangrove propagation at Pointe Jérôme and Souillac, covering a total area of 1 000m² where 650 and 250 mangrove propagules were respectively planted by local social organisations.

2.1.6 Stranded marine mammals in the lagoon off the south-eastern coast of Mauritius



Figure 2.5: *Peponocephalia electra* (Melon headed whale)

Many marine mammals were found trapped in the lagoon of Vieux Grand Port in the south east of Mauritius from 16 February to 10 March. They were identified as the Melon Headed Whale (*Peponocephalia electra*) (figure 2.5). An operation involving NGOs and fishers was undertaken to drive the mammals into the open sea by using a sound wall (figure 2.6).

Unfortunately, prior to the operation several of the mammals died and 37 carcasses were found washed ashore. Post-mortem investigations concluded that the death of the marine mammals could have been due to stress.



Figure 2.6: Melon headed whales being driven out into high seas

2.2 Coastal water quality

2.2.1 Monitoring of chemical parameters

Monitoring of water quality was continued at the 65 established stations of the 14 sites around the island. An additional monitoring site, Belle Mare, was included and sampled twice during the

year at five established stations.

The sea state, weather conditions, conductivity, pH values and water temperature were recorded. A total of 4 340 samples collected were analysed for chemical oxygen demand (COD), nitrate-nitrogen (NO_3^- -N) and phosphate (PO_4^{3-}). The results of the analyses are shown in table 2.4.

Table 2.4: Results of water analyses

Site	Year	Nitrate-Nitrogen (mg/l)	Phosphate (mg/l)	Chemical Oxygen Demand (mg/l)
Ile aux Benitiers	2003	<0.1	<0.01 - 0.02	0.1 - 0.5
	2004	<0.1	0.01 - 0.02	0.1 - 0.8
	2005	<0.1	0.01 - 0.04	0.1 - 0.5
Bel Ombre	2003	<0.1	<0.01 - 0.08	0.1 - 1.5
	2004	<0.1	<0.01 - 0.05	0.1 - 0.8
	2005	<0.1	<0.01 - 0.07	0.1 - 0.9
Bambous Virieux	2003	<0.1	0.01 - 0.03	0.2 - 0.9
	2004	<0.1	<0.01 - 0.04	0.1 - 1.6
	2005	<0.1	0.01 - 0.03	0.1 - 1.0
Trou d'Eau Douce	2003	<0.1	0.01 - 0.03	0.1 - 0.5
	2004	<0.1	0.01 - 0.06	0.1 - 0.2
	2005	<0.1	<0.01 - 0.02	0.2 - 0.9
Anse la Raie	2003	<0.1	<0.01 - 0.01	0.2 - 0.4
	2004	<0.1	<0.01 - 0.05	0.1 - 0.5
	2005	<0.1	0.01 - 0.03	0.2 - 0.3
Trou aux Biches	2003	<0.1	<0.01 - 0.01	0.2 - 0.8
	2004	<0.1	<0.01 - 0.04	0.1 - 0.8
	2005	<0.1	<0.01 - 0.05	<0.1 - 0.5
Pointe aux Sables	2003	<0.1 - 0.1	<0.01 - 0.08	0.1 - 1.4
	2004	<0.1 - 0.1	<0.01 - 0.05	0.1 - 0.8
	2005	<0.1	0.01 - 0.06	0.1 - 0.8
Bain des Dames	2003	<0.1	<0.01 - 0.08	<0.1 - 1.2
	2004	<0.1	0.01 - 0.08	0.1 - 2.0
	2005	<0.1	0.01 - 0.08	<0.1 - 1.3
	2003	<0.1	<0.01	0.1 - 1.8
	2004	<0.1	<0.01-0.07	<0.1 - 1.4
	2005	<0.1	<0.01-0.07	<0.1 - 0.6
	2003	<0.1 - 0.1	<0.01 - 0.20	0.1 - 3.3
	2004	<0.1	<0.01 - 0.16	<0.1 - 1.6
	2005	<0.1	0.01 - 0.22	0.1 - 1.2
	2003	<0.1 - 0.2	<0.01 - 1.01	0.1 - 2.0
	2004	<0.1	<0.01 - 0.08	0.1 - 0.9

	2005	<0.1	0.01 - 0.08	0.1 - 0.5
	2003	<0.1 - 1.0	<0.01 - 0.20	0.1 - 6.9
	2004	<0.1	0.01 - 0.08	0.1 - 8.8
	2005	<0.1	0.01 - 0.08	<0.1 - 1.7
	2003	<0.1	0.01 - 0.04	0.1 - 1.3
	2004	<0.1	0.01 - 0.05	0.1 - 0.6
	2005	<0.1	0.01 - 0.05	0.1 - 0.7
Blue Bay	2003	<0.1	<0.01 - 0.03	0.1 - 0.6
	2004	<0.1	0.01 - 0.10	<0.1 - 0.4
	2005	<0.1	0.01 - 0.07	<0.1 - 0.6
Belle Mare	2005	<0.1	0.01 - 0.06	0.1 - 0.8

The results of water quality analyses were generally within the *Guidelines for Coastal Water Quality Requirements for various categories Govt. Notice No. 620 of 1999 (CWQG)*. The levels of nitrate were <0.1 mg/l while those of phosphate ranged from <0.01 to 0.08 mg/l; COD values were less than 1.8 mg/l at most of the sites. Phosphate values at one station at Blue Bay, two stations at Baie du Tombeau and one station at Poudre d'Or generally exceeded the *CWQG* limit due to the influx of fresh water.

2.2.2 Analysis for trace metals and pesticides

The levels of the trace metals copper, zinc and lead and the levels of three pesticides, atrazin, diuron and hexazinone were monitored at the eight established sites namely: Pointe Roches Noires, Grand River South East, Mahebourg, l'Escalier, Baie du Cap, Tamarin, Grand River North West and Rivière Lataniers to assess the water quality.

In all the samples analysed, no detectable levels of the trace metals were recorded. No pesticides were detected in the water samples as well.

2.2.3 Ad hoc water analysis and fish mortality

Water quality analyses were carried out on water samples collected at the ex-sand mining sites Grand Gaube, Poudre d'Or, Grand River South East and at the aquaculture farm at Pointe aux Feuilles. The results were all within the *CWQG* limits.

Twenty-eight analyses were carried out on samples of water related to cases of alleged pollution, aquaculture purposes and cases of fish mortality. Results showed that all the physico-chemical parameters were within the *CWQG* limits.

Reports on water quality monitoring submitted in relation to the aquaculture development project by “La Ferme Marine de Mahebourg” and construction of a golf course at Mamet-Medine Sugar Estate were examined for compliance.

A case of oil spill in Canal Dayot occurred in May. About 2 000 litres of oil overflowed from the Saint Louis power station and found its way into Canal Dayot. No fish kill was observed during the surveys carried out and the water quality parameters analysed were generally within the *CWQG* limits.

2.2.4 Independent Environmental Audit on Wastewater projects

Government has embarked on a National Sewage Programme which aims at improving sanitation in the country. The funding agencies have stressed the need for Government to set up a mechanism for the conduct of an independent audit on the environmental impact of the wastewater projects. In that context, a committee was set up to monitor analytical results and to ascertain that wastewater projects do not adversely affect the environment. AFRC would be one of the stakeholders involved in the monitoring of the lagoonal water quality at the three major effluent discharge outfalls namely: Pointe Moyenne, Montagne Jacquot and Baie du Tombeau.

2.2.5 Western Indian Ocean Laboratory (WIO-Lab) Project

AFRC is involved in the preparation of the “National Pollution Status Report” which forms part of the WIO-Lab Project aiming at intensifying the fight against marine pollution caused by land based activities and to determine the extent and magnitude of pollution of coastal waters in order to develop systems that will counter any damage. The project represents a strong partnership between the participating countries (Kenya, Tanzania, Mozambique, South Africa, Madagascar, Seychelles, Comoros and Mauritius). The Ministry of Environment and National Development

Unit is the focal point for the project and the National Environment Laboratory is the lead institution for the assessment and monitoring of water, sediment and biota quality.

2.3 Sea surface temperature (SST)

SST were recorded thrice daily at 07 00, 13 00 and 17 30 hours near the shore at the thirteen fisheries posts, at Blue Bay marine park and Albion. The average monthly temperature varied from 20.3°C in winter to 29.2°C in summer as shown in figure 2.7. The highest temperature was recorded in the northern region in January while the lowest temperature was recorded in the southern region in August.

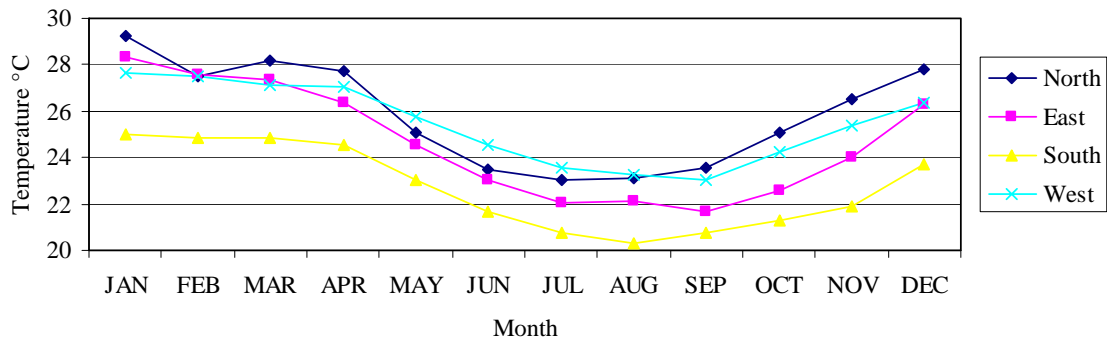


Figure 2.7: Average monthly sea surface temperature

2.4 Monitoring of coliform bacteria at public beaches

The levels of total coliform (TC) and faecal coliform (FC) in seawater at selected public beaches was monitored on a monthly basis. In addition to Flic en Flac, Albion, Pointe aux Sables, Trou aux Biches, Mon Choisy, Le Goulet, Grand Baie, La Cuvette and Blue Bay, two new sites namely Pereybere and Belle Mare were included in the monitoring programme as from April and June respectively. The Blue Bay and BalACLava marine parks were also sampled on two occasions during the year. Details of results are shown in table 2.5.

Table 2.5: Results of coliform analyses at the monitoring sites

Beach	Station No.	Average colony count per 100ml					
		2003		2004		2005	
		TC	FC	TC	FC	TC	FC
Flic en Flac	1	49	10	25	9	35	13
	2	19	8	23	4	28	10
	3	14	6	17	8	36	13
	4	25	9	37	10	24	11
	5	21	9	44	12	39	12
Trou aux Biches	1	30	7	19	4	45	12
	2	33	5	44	6	17	4
Mon Choisy	1	24	4	15	3	36	10
	2	40	4	26	4	46	15
	3	22	7	23	3	58	13
	4	70	17	10	2	90	19
Blue Bay	1	40	11	17	2	20	7
	2	41	9	38	8	19	5
	3	30	8	31	11	22	7
Albion	1	38	23	34	6	36	10

Pointe aux Sables	1	921	542	834	150	951	182
	2	11 745	7 452	302	90	519	105
	3	35	11	71	25	79	13
	4	207	30	244	56	275	90
Grand Baie	1	41	16	14	3	46	12
	2	41	17	16	4	60	15
	3	13	6	29	7	66	16
	4	25	11	127	25	152	75
	5	22	10	110	21	228	86
Le Goulet	1	146	42	5	1	44	9
Belle Mare	1					19	4
	2					18	5
	3	-	-	-	-	25	8
	4					10	3
	5					11	4
Pereybere	1					70	25
	2	-	-	-	-	109	37
	3					343	134
	4					150	49
Blue Bay marine park	1	ND	ND	2	ND	0	0
	2	ND	ND	3	1	3	0
	4	4	2	5	ND	14	3
Balaclava marine park	2	7	2	ND	ND	ND	ND
	3	ND	ND	ND	ND	ND	ND
	4	ND	ND	ND	ND	ND	ND
	6	29	7	7	1	ND	ND

ND: Not Detected

Note: *CWQG*: TC<1000 colonies/100ml, FC <200 colonies/100ml.

Results of water analyses showed that the levels of TC and FC at the selected beaches and the two marine parks were within the *CWQG* limits for primary contact (TC<1000 colonies/100ml and FC<200 colonies/100ml) except for two stations at Pointe aux Sables.

Data on the total and faecal coliform were provided to the Ministry of Environment and National Development Unit and the Beach Authority which are directly involved in public beach management.

3. AQUACULTURE

Aquaculture activities were geared towards the seed production of the silver sea bream, *Rhabdosargus sarba*, berri rouge, *Oreochromis* sp. of both the Malaysian and the St. Petersburg varieties and the giant freshwater prawn, *Macrobrachium rosenbergii*. Seed production of the giant tiger prawn, *Penaeus monodon*, using low cost technology was attempted. Culture trial of acclimatised shrimp juveniles to fresh water was carried out. Sexual reproduction of the two species of the sea cucumbers, *Holothuria atra* and *Bohadschia marmorata* was attempted. Fingerlings of berri rouge and juveniles of *Macrobrachium rosenbergii* were distributed to fish farmers. Sea bream fingerlings were released in the lagoon with a view to enhancing the stock.

3.1 Plankton culture

3.1.1 Phytoplankton

Live feed was produced in an adequate quantity to meet the requirements for the larval rearing of the silver sea bream, the giant tiger prawn, the sea cucumber and the freshwater prawn. Pure cultures of four phytoplankton species namely *Nannochloropsis* sp., *Tetraselmis* sp., *Chaetoceros calcitrans* and *Isochrysis galbana* were maintained in the phytoplankton room. The *Isochrysis galbana* was cultured for feeding sea cucumber larvae. Mass production of *Nannochloropsis* sp. was undertaken throughout the year to provide food for the culture of rotifers and as a water conditioner for the larval rearing of the sea bream, while *Chaetoceros calcitrans* was produced for feeding the penaeid shrimp larvae. During the peak production of *Nannochloropsis* sp., a maximum of 140m³ of phytoplankton rich water was attained with an average cell density of 1.8 x 10⁶ micro algae/ml.

3.1.2 Zooplankton

The rotifer, *Brachionus rotundiformis*, was produced to feed sea bream larvae using the batch culture technique. In winter, an optimum temperature range of 28 to 30°C was maintained in the rotifer culture tanks by making use of heaters. Baker's yeast was added to the rotifer tanks at the rate of 0.3 to 0.5g/million rotifers, as a supplement whenever it was not possible to provide high cell densities of micro algae.

3.2 Sea bream culture

3.2.1 Broodstock

Sixteen sea bream breeders were collected from the estuary at Albion and the barachois at Montagu in the beginning of June. They were stocked in two fibre glass tanks of 3m³ capacity each and having a continuous flow of water. The fish was disinfected in 25ppm sodium nifurstyrenate (NFS-Na), followed by a freshwater dip for a few minutes to prevent infection by ecto-parasites. The fish of body weight ranging from 0.5 to 1.2kg were fed daily on fresh mussels and freshly prepared moist pellets at 10% biomass. The average water temperature during the seed production cycle was 22.5°C.

3.2.2 Seed production

The breeders started to spawn at the beginning of June and continued till the end of August. The total number of eggs obtained was 2.7 million, out of which 1.8 million showed good buoyancy and were incubated. A total of 792 000 larvae of sea bream hatched out and was stocked in nine tanks of capacity ranging between 2.5 and 10 tonnes. During the seed production cycle, the average water temperature was 22°C and the average pH was 7.5. The fish larvae were fed on live rotifers and brine shrimp nauplii. The diet of the larvae was supplemented with weaning feed. As a preventive measure against infection by *Oodinium* sp., copper sulphate at a dosage of 0.5ppm was applied daily as from the tenth day of rearing. After a culture period of 60 to 70 days, 280 000 sea bream fingerlings were obtained; the body length ranged from 2 to 3cm and the body weight from 0.15 to 0.3g, representing a survival rate of 35.3%. The annual fingerling production for the past five years is presented in table 3.1.

Table 3.1: Production of sea bream fingerlings

Year	No. of fingerlings
2001	181 610
2002	338 200
2003	292 000
2004	255 400
2005	280 000

3.3 Camaron culture

3.3.1 Broodstock

A broodstock of 339 camaron was used during the production cycle. A total of 202 breeders was obtained from La Ferme Fish Farm, 77 from Riche en Eau Sugar Estate and 60 from the Medine Sugar Estate. The females were conditioned and maintained in rectangular fibreglass tanks and circular polycarbonate tanks in the dark at an ambient water temperature of 27.5°C. The berried females were fed once daily on chopped frozen mussels and fish at 10% body weight.

3.3.2 Seed production

The camaron seed production cycle was undertaken from January to April and from October to December when the average water temperature was 28.5°C. Twenty-five rearing cycles were

carried out and a total of 1 896 000 larvae were obtained and stocked in fibreglass and polycarbonate tanks of 0.5 to 3m³ capacity in clear brackish water at 12 ppt. The camaron larvae were fed daily on brine shrimp nauplii, minced and sieved frozen bonito and octopus. The larval stage index was closely monitored and post-larvae of stage-12 were obtained after a culture period ranging between 30 and 49 days. The salinity of the culture medium was gradually brought down to zero. A total of 125 000 camaron juveniles was produced. A batch of 5 500 hatchery-produced camaron juveniles of a mean body weight 0.02g was stocked in one 1 000m² earthen pond at the La Ferme Fish Farm. The juveniles were fed on camaron crumbles once daily during the first month and subsequently on camaron pellets twice daily.

3.3.3 Sale of camaron

Camaron juveniles were sold as a priority to small farmers. A total of 114 100 camaron juveniles was sold to seven farmers; 165kg of marketable-size camaron were harvested. Camaron juveniles were sold at the rate of Rs 1.25/unit; adult camaron at Rs 325/kg. Proceeds of sales amounted to Rs 196 088.

3.3.4 Building-up of a broodstock at La Ferme Fish Farm

After culling exercises, 4 000 camarons of average body weight 25g were selected and reared in one 1 000m² earthen pond at La Ferme Fish Farm to constitute a broodstock for seed production. Adults were fed on camaron pellets twice daily at 1% biomass. The broodstock pond was flushed continuously to avoid oxygen depletion. *Hydrilla* sp., *Elodea* sp. and other filamentous algae were removed manually and water quality was monitored. Camaron of body weight ranging between 20g and 70g were harvested. The growth of the camaron from April 2004 to February 2005 is shown in figure 3.1.

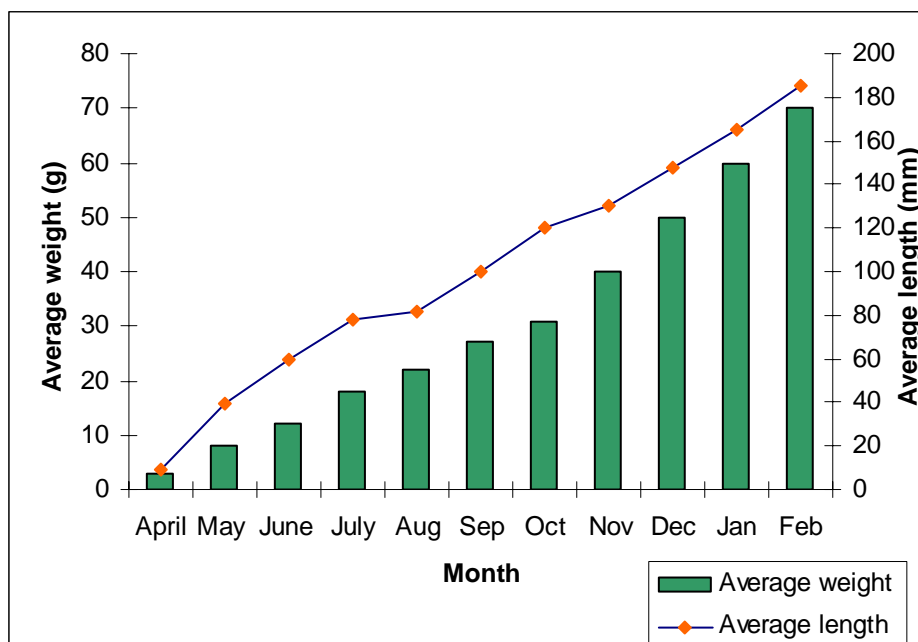


Figure 3.1: Growth of camaron

3.4 Resource propagation

3.4.1 Release of sea bream fry

A total of 280 000 sea bream fry was released in the lagoon at three sites, namely Albion, Ferney and Tamarin. The sites are located near large estuarine systems, suitable habitats for small size sea breams. The number of sea bream fry released during the last five years is presented in table 3.2.

Table 3.2: Number of sea bream fry released

Site	Year				
	2001	2002	2003	2004	2005
Ferney	-	153 900	100 000	-	90 000
Tamarin	-	24 300	85 000	-	70 000
Albion	1 175	105 000	107 000	122 000	120 000
Trou d'Eau Douce	-	-	-	133 400	-
Total	1 175	283 200	292 000	255 400	280 000

3.5 Berri rouge culture

3.5.1 Broodstock

The broodstock consisted of 1 000 selected breeders of the Saint Petersburg variety obtained in December 2002 and 500 breeders of the Malaysian strain introduced in August 2001. Signs of discoloration were observed in a large number of adults of both varieties and had to be culled, harvested and sold; the weight of the fish ranged between 0.6 and 1.0kg. The two varieties were maintained in separate ponds and fed twice daily on dry pellets at 1% body weight.

3.5.2 Seed production

All male fry were produced by the sex reversal method and visual selection. Reproduction of the berri rouge of both the Malaysian and the Saint Petersburg varieties occurred in the ponds from January to April and October to December. The sex reversal treatment consisted of providing micro-granulated feed (1 000g mixed with 0.07g male hormone ‘testosterone’ dissolved in 700ml absolute alcohol) over a continuous period of 28 days three times daily. A total of 6 154 sex reversed fry was produced. Fry exceeding 0.5cm body length were cultured to an average body weight of 30g and a total of 17 683 fingerlings was visually sexed. The number and type of berri rouge fingerlings produced for the past five years are presented in table 3.3.

Table 3.3: Number and types of berri rouge fingerlings produced

Year	Malaysian strain			St. Petersburg strain kept at LFFF	Total
	Sex reversed	Visually sexed	Acclimatised to seawater		
2001	13 000	5 795	nil	-	18 795
2002	16 735	14 750	nil	-	31 485
2003	43 154	27 318	6 414	8 586	85 472
2004	8 000	20 977	nil	9 780	38 757
2005	6 154	17 683	75	10 000	33 912

A total of 12 239 male fingerlings was sold to 206 farmers at a unit price of Rs 1.25, for a sum of Rs 15 300. As from December, fingerlings were provided free of charge to fish farmers having a pond area of less than 1 000m². Moreover, 971kg of berri rouge of both strains were harvested and sold for a sum of Rs 29 115.

3.6 Crayfish culture

The culture of the crayfish, *Cherax quadricarinatus*, was phased out as there was no demand from farmers.

3.7 Sea cucumber culture

3.7.1 Broodstock

From June to December, a broodstock of 66 sea cucumbers belonging to six different species namely *Holothuria atra*, *H. scabra*, *H. nobilis*, *Bohadschia marmorata*, *Thelenota ananas* and *Actinopyga echinites* was collected from the lagoon at Albion, Le Morne and Petite Riviere Noire as presented in table 3.4.

Table 3.4: Details of sea cucumbers collected

Species	No.	Length range (cm)	Weight range (g)	Site
<i>B. marmorata</i>	30	8.0 – 11.0	30 – 120	Albion & Le Morne
<i>H. atra</i>	12	13.5 – 17.7	30 – 200	Le Morne
<i>T. ananas</i>	4	19.5 – 22.0	840 – 950	Le Morne
<i>H. scabra</i>	1	13.0	160	Le Morne
<i>A. echinites</i>	7	12.0 – 15.0	150 – 250	Petite Riviere Noire
<i>H. nobilis</i>	12	13.0 – 18.0	120 – 440	Petite Riviere Noire

Each species was maintained separately in 0.5m³ polycarbonate tanks at a water temperature ranging from 21.5 to 29°C and at a salinity of 36ppt. The tanks were provided with a layer of 15cm of sand. Water was exchanged at a rate of 70% on alternate days. The sea cucumbers were fed once daily at the rate of 10% biomass on seaweed paste comprising mainly *Ulva* sp. and *Chaetomorpha* sp.

3.7.2 Seed production

3.7.2.1 Sexual reproduction

Induced spawning of both *B. marmorata* and *H. atra* was carried out using the two methodologies: thermal stimulation and drying followed by spraying a powerful jet of seawater. Eight specimens of *B. marmorata* were induced to spawn by thermal stimulation with a temperature difference of $\pm 5^{\circ}\text{C}$, whereas *H. atra* was induced to spawn with a temperature difference of $\pm 3^{\circ}\text{C}$. The males released the milt, which induced the females to spawn.

B. marmorata started to spawn in February and a total of 624 000 eggs hatched into 450 000 auricularia larvae after two days. After 12 days of rearing 78 500 doliolaria larvae were obtained which metamorphosed into 59 400 pentactula larvae. The survival of the 20-day old pentactula larvae was 13.2%. Mass mortality of pentactula larvae occurred after thirty days of rearing. The different larval stages of *B. marmorata* are presented in figure 3.2.



Figure 3.2: Larval stages of *B. marmorata*

The spawners of *H. atra* released 800 000 eggs which hatched into 750 000 auricularia larvae after 2 days. After 15 days of rearing, the auricularia larvae metamorphosed into 62 000 doliolaria larvae. Pentactula larvae were obtained after 20 days. Mass mortality of pentactula larvae occurred after 30 days of rearing. The survival from auricularia to the pentactula stage was 6.4%, details of which are presented in table 3.5.

Table 3.5: Details of spawning and larval rearing of sea cucumbers

Species	No. used	No. of eggs	No. of auricularia larvae	No. of doliolaria larvae	No. of pentactula larvae
<i>B. marmorata</i>	8	624 000	450 000	78 500	59 400
<i>H. atra</i>	12	800 000	750 000	62 000	48 000

The larval rearing was carried out in 1m³ and 0.5m³ fibre glass tanks at a water temperature ranging between 26 and 28°C. The salinity was 36ppt and the pH ranged between 8.2 and 8.4. The larvae were fed on *Chaetoceros calcitrans* at a density 20 000 to 25 000 cells/ml.

Attempts to induce spawning in *H. nobilis* and *A. echinites* by thermal stimulation with a temperature difference of $\pm 3^{\circ}\text{C}$ at 27°C , and $\pm 5^{\circ}\text{C}$ at 25°C were not successful.

3.7.2.2 Asexual reproduction

Asexual reproduction of *B. marmorata* and *H. atra* was carried out on 82 specimens by induced transverse fission. The specimens were cut into two pieces slightly anterior to the middle part of the body. The asexually produced sea cucumbers were maintained in 0.5m^3 polycarbonate tanks provided with a sandy substratum of 15cm thickness. Out of the 164 cut-specimens, 155 fully regenerated. They were fed on seaweed paste and water exchange was at a rate of 70% on alternate days. The cut pieces regenerated at 95.5% for *H. atra* and at 94% for *B. marmorata* as shown in table 3.6.

Table 3.6: Growth and survival of *H. atra*. and *B. marmorata* after asexual reproduction

Species	No. used	Initial mean weight (g)	Final mean weight* (g)	Growth/day (g)	Survival (%)
<i>H. atra</i>	28	126.5	277.8	0.52	95.5
<i>B. marmorata</i>	54	86.8	210.8	0.44	94.0

* after 305 days

3.8 Marine shrimp, *Penaeus monodon*

3.8.1 Broodstock

Twelve *Penaeus. monodon* females with body weight ranging from 90 to 230g and 20 males from 67.4 to 87.3g were collected at Bambous Virieux barachois. The broodstock was kept in 2m^3 conical fibreglass tanks at a water temperature ranging between 25 and 29°C and a salinity of 36ppt. The broodstock was fed daily on chopped frozen mussels, squid, beef liver and oligochaete worms at 12 to 15% biomass. Water exchange in the maturation tanks was 70% daily.

3.8.2 Seed production

Following eyestalk ablation, the twelve females spawned after 10 days. A total of 290 000 nauplii was obtained. Larval rearing was carried out in thirteen tanks of 2.0 to 2.7m³ capacity using the low cost technology which consisted mainly of feeding the larvae on diatoms, *Chaetoceros calcitrans*. From PL-1 to PL-20, the larvae were fed on brine shrimp at 0.25 individual/ml together with artificial feed. No antibiotic was used during the rearing period. Treflan was applied at a dosage of 0.025ppm as a prophylactic treatment during the seed production cycle. A total of 72 000 PL-20 was obtained representing a survival of 24%. The 20 day-old post larvae were gradually acclimatised to freshwater for a period of 5 days. The survival rate of the post larvae during the acclimatisation process was 95 %.

3.8.3 Culture of *P. monodon* juveniles in freshwater

The acclimatised shrimp juveniles were stocked at the Albion Fisheries Research Centre in three ponds of 250m³ capacity supplied with borehole water and one control pond having seawater. The stocking density was 14/m². After 81 days of culture, heavy blooms of microalgae with a high density of dinoflagellates contributed to oxygen depletion leading to mass mortality of the shrimps in one freshwater pond. The trial culture experiment in the other two freshwater ponds was pursued for 105 days. The growth of the shrimps was significantly better in freshwater than in seawater. Details of the rearing of acclimatised *P. monodon* are presented in table 3.7

Table 3.7: Culture of marine shrimp, *P. monodon* in freshwater and seawater

No. of days cultured	Average weight (g)		
	Freshwater (Pond 1)	Freshwater (Pond 2)	Seawater (Pond 3)
0	0.24	0.24	0.24
30	1.17	1.93	0.75
45	2.32	2.80	1.32
60	3.78	3.93	2.17
80	4.93	5.58	3.54
105	9.40	9.50	4.50

The physico-chemical parameters in the freshwater and seawater culture ponds were monitored regularly as presented in table 3.8

Table 3.8: Physico-chemical parameters of water

	Nitrate (mg/l)	Phosphate (mg/l)	pH	Temperature (°C)
Freshwater (pond 1)	0.1 – 1.2	0.12 – 0.23	8.6 – 9.3	21 - 27
Freshwater (pond 2)	0.2 – 1.5	0.10 – 1.15	8.1 – 9.3	21 - 27
Seawater (pond 3)	0.1 – 0.5	0.03 – 0.17	8.3 – 8.4	20 - 28

An experimental trial culture of marine shrimp in freshwater was carried out at the La Ferme Fish Farm. One pond was stocked with 2 003 acclimatised shrimp juveniles of 0.4g body weight. After 30 days of culture, no shrimps were found in the pond. Further experimentation would be undertaken to investigate the causes of the mortality.

3.9 Barachois

A survey of all the barachois was carried out jointly with officers of the Ministry of Housing and Lands. The objective was to assess the status of government-owned barachois. A consolidated list of government-owned barachois was drawn up with details of potential uses. There were eleven government-owned barachois leased and eleven not leased.

3.10 Aquaculture extension service

The extension service provided technical advice to 389 persons. Site visits were effected to assess culture sites and to assist the potential fish farmers on pond construction and aquaculture practices.

3.11 Aquaculture production

Aquaculture production of red drum, silver sea bream and rabbit fish for the local market amounted to 360 tonnes. A total of 7.5 tonnes of chilled red drum was exported to Dubai, South Africa, Switzerland and the USA. Three tonnes of marine fish and 1.6 tonnes of mud crab together with 83 600 units of oysters were harvested from different barachois. The production of freshwater fish was 23.3 tonnes. Total aquaculture production was 395.4 tonnes, details of which are shown in table 3.9.

Table 3.9: Aquaculture production (tonnes)

Species	Production
Berri rouge	15.0
Freshwater prawn	8.0
Crayfish	0.3
Marine fish (barachois)	3.0
Mangrove crab (barachois)	1.6
Red drum (floating cages) Sea bream (floating cages) Rabbit fish (floating cages)	367.5
Total	395.4

4. MARINE PARKS AND RESERVES SERVICE

4.1 Blue Bay Marine Park

4.1.1 Management of the park

Officers of the Fisheries Protection Service posted at the Blue Bay Marine Park Patrol and Visitors' Centre were assisted by the officers of the National Coast Guard, "Police de l'Environnement" and "Police du Tourisme" to carry out surveillance and to control permissible

activities such as glass-bottom boating, snorkelling, diving, water-skiing, swimming and fishing in the park.

Twenty-nine cases of illegal fishing were recorded in the park, which included seven cases of fishing with nets, five cases of possession of non-permitted fishing gear and one case of use of spear gun, eight basket traps picked up, 92 metres of nets and 21 fish seized and three persons prosecuted for illegal fishing.

During the year, 127 permits were issued to the different users of the park and 210 renewed for a sum of Rs. 560 600, details of which are shown in table 4.1.

Table 4.1: Number of permits issued and fees collected

Type of permit	First issue	Renewal	Permit fees (Rs)
Boat/vessel	44	58	100 000
Basket trap	2	15	200
Line fishing	71	43	18 400
Commercial activities	2	9	55 000
Recreational	2	85	87 000
Interference	6	Nil	300 000
Total	127	210	560 600

Maintenance works were regularly carried out to ensure that the mooring structures for demarcating and delimiting the different zones were in good condition. One submerged boat, which was causing obstruction to navigation was removed from the mooring zone and disposed of. An underwater survey was carried out for the demarcation of a swimming zone in the lagoon near the Shandrani Hotel.

Sensitization campaigns on the need to conserve and protect the marine ecosystems and the resources within the park were pursued among the members of the public and students visiting the park. Lectures on Marine Protected Areas were also given to fishers following training at the Fishermen Training and Extension Centre at Pointe aux Sables. Visitors including children from pre-primary schools, students from schools, colleges, the University of Mauritius, visiting scientists, foreign consultants, officers from other Ministries and eminent personalities had the opportunity to visit and discover the exceptional beauty of the coral garden of the park in glass

bottom boats. During the year about 150 000 persons comprising both local and foreign tourists visited the park.

4.1.2 Long-term ecosystem monitoring in the park

Monitoring was carried out at the five established stations using the Line Intercept Transect (LIT) method and the visual fish survey method.

Data on the sea-bottom substrate in terms of corals, macro-algae and marine invertebrates at stations 2 and 3 located in the patch reef within the strict conservation zone were collected. Results on the percentage substrate cover at those stations are given in table 4.2.

Table 4.2: Percentage substrate cover at stations 2 and 3

Substrate	Station 2	Station 3
Acropora branching	0.6	27.3
Acropora digitate	3.6	12.3
Acropora tabular	62.5	41.1
Coral foliose	7.2	2.3
Coral submassive	16.3	0.8
Mushroom coral	0.0	1.7
Total live coral cover	90.2	85.5
Sand	2.6	0.0
Rock	0.0	0.4
Dead coral	6.5	13.1
Macroalgae	0.7	0.8
Zoanthids	0.0	0.2

Live coral cover was high at both the stations and was in a healthy state. Table corals were the dominant species.

The occurrence of fish at the five stations comprised mainly families pomacentridae, acanthuridae, scaridae, labridae, chaetodontidae, mugilidae, mullidae and zancidae. The fish count per 100m² is presented in table 4.3.

Table 4.3: Number of fish per 100m² at established stations

Family	Stations
--------	----------

	1	2	3	4	5
Acanthuridae	5	7	18	0	0
Balistidae	1	1	0	0	0
Blennidae	0	0	0	1	0
Chaetodontidae	0	4	3	0	0
Gobidae	0	0	0	1	1
Labridae	8	7	4	1	0
Monacanthidae	0	1	0	1	0
Mugilidae	0	0	0	2	1
Mullidae	1	2	1	0	0
Scaridae	2	3	3	0	0
Serranidae	2	1	1	0	0
Zanclidae	0	1	1	0	0
Plotosidae	0	0	0	224	0
Pomacentridae	19	32	41	0	0

4.2 Balaclava Marine Park

4.2.1 Management of the park

Officers of the Fisheries Protection Service carried out regular patrols for the enforcement of fisheries regulations and to sensitise the park users on the MPA Regulations and on the need to protect and conserve the marine flora and fauna.

The number of boats encountered and the activities they are engaged in were recorded monthly. During the year, 101 boats of all categories operated in the park. There were 6 boat houses, 107 snorkeling sets, 27 pedalo, 39 kayaks, 24 lasers, 5 hobby cats, 39 windsurfs, 3 oxoons, 3 parasails and 6 glass bottom boats, engaged in recreational activities.

The tender document for the installation of buoys and floats to demarcate the park boundaries, the multiple use zone, the conservation zone, the traffic lane, the ski lanes, the swimming and the mooring zones was reviewed.

A total amount of Rs 100 000 was charged as interference permit fee in the park.

4.2.2 Long-term ecosystem monitoring in the park

Underwater surveys were conducted at seven established stations within the park to collect data on coral, fish and other benthic communities. Stations 3, 5 and 7 are located on the fore reef whilst the remaining four are found in the lagoon.

The occurrence of the different substrates at the seven stations and their respective percentage substrate cover are presented in table 4.4. The most abundant live coral was branching *Acropora*. The largest diversity of coral was found at station 4.

Table 4.4: Percentage substrate cover at Balaclava

Substrate	Stations						
	1	2	3	4	5	6	7
Acropora branching	23.8	23.2	0.0	54.2	0.0	20.0	0.0
Acropora tabular	4.5	4.9	0.0	1.8	0.0	0.0	0.0
Coral encrusting	0.0	0.0	7.8	0.0	1.3	0.0	11.8

Coral foliose	0.0	7.0	0.0	0.2	0.0	2.0	0.0
Coral massive	3.0	13.7	24.3	2.4	14.1	2.0	17.8
Coral submassive	1.0	16.9	27.8	8.0	0.2	0.0	3.7
Mushroom coral	0.0	0.0	0.0	1.3	0.0	2.0	0.0
Soft coral	0.0	0.0	0.0	0.0	0.9	0.0	0.0
Total live coral cover	32.3	65.7	59.9	67.9	16.5	26.0	33.3
Rubble	0.0	0.0	0.0	0.0	0.0	15.0	0.0
Rock	0.0	0.0	1.0	0.0	68.3	0.0	66.7
Sand	0.0	3.6	10.7	0.0	15.2	6.0	0.0
Turf algae	0.0	0.0	0.0	4.0	0.0	5.0	0.0
Macroalgae	0.0	0.0	0.0	0.5	0.0	0.0	0.0
Coralline algae	0.0	0.0	0.0	0.0	0.0	1.0	0.0
Dead coral	67.7	30.7	28.4	27.6	0.0	47.0	0.0

The fish count per 100m² at the seven stations is presented in table 4.5. Among the 14 families encountered, the dominant ones were the acanthuridae, labridae, scaridae and pomacentridae.

Table 4.5: Number of fish per 100m² at Balaclava

Family	Stations						
	1	2	3	4	5	6	7
Acanthuridae	23	11	17	7	29	8	5
Aulostomidae	1	2	0	0	0	0	0
Balistidae	0	1	2	0	5	1	0

Chaetodontidae	2	9	3	4	6	1	0
Cirrhitidae	0	1	0	0	2	0	0
Labridae	18	6	14	11	18	6	3
Lethrinidae	0	2	2	21	1	0	8
Monacanthidae	21	3	1	0	2	0	0
Mullidae	0	2	1	3	3	2	2
Scaridae	15	7	18	13	31	3	3
Serranidae	2	2	4	2	3	1	0
Siganidae	1	0	0	0	1	0	0
Holocentridae	8	2	11	0	0	0	4
Pomacentridae	122	72	47	522	14	318	7

4.3 Fireworks

Following requests made for firework displays in the lagoon for New Year celebrations, underwater surveys were carried out to identify appropriate sites in front of four hotels for the shooting of fireworks in the marine parks.

5. COASTAL ZONE MANAGEMENT

The Coastal Zone Management Division (CZMD) was created in May to provide services for the sustainable management of the coastal zone. In so doing, the Division has to deal with other relevant Ministries, the fishing community, coastal zone users, promoters of coastal development

projects, the private sector, the public at large and with local, regional and international non-governmental organisations.

The activities carried out by the CZMD are:

- Assessment of Environmental Impact Assessment (EIA) applications and Preliminary and Environmental Reports (PER)
- Post EIA monitoring
- Ecological surveys for the delimitation of swimming zones, for widening of sea passes and dredging of channels
- Assessment of coastal development projects and tourism related activities
- Mapping of the bathymetry of the lagoons of Mauritius and Rodrigues
- Monitoring of mangrove propagated areas
- Public awareness campaigns on coastal zone development.

The CZMD represents the Ministry in the following Committees and Sub-committees:

- Environmental Impact Assessment Committee
- National Ramsar Committee
- National Ramsar Sub-committee
- Nature Reserves Board
- Environment Liaison Officers Committee
- National Biodiversity Strategic Action Plan (NBSAP)
- Integrated Coastal Zones Management Sub-committee
- Islet Management Committee

5.1 Environmental Impact Assessment

During the year, 46 EIA applications for coastal projects were assessed (*Appendix 8*). Following 36 site surveys (*Appendix 9*) and consultations with different stakeholders, recommendations

were forwarded to the Ministry of Environment and NDU. The following EIA reports concerned the construction and extension of hotels and the rehabilitation of coastal areas:

- EIA Application for the proposed Hotel Development at Flic-en-Flac for Osprey Co. Ltd
- EIA Application for the proposed Hotel Development at Flic-en-Flac for Osprey Co. Ltd
- Proposed Mirabel Beach Resort at Riambel by Kwavungu Co. Ltd.
- Proposed hotel development at Les Salines, Black River by Four H Co. Ltd.
- Proposed relocation of beach works and reprofiling of beach at Le Palmar beach Resort by Sojefal Ltd

5.2 Fisheries development projects

Environment Impact Assessment for the following projects were prepared:

- Dredging of a proposed boat passage at Ilot Bernache
- Dredging of a proposed boat passage at Case Noyale

5.3 Mapping of the bathymetry of the lagoons of Mauritius and Rodrigues

The project for the mapping of the bathymetry of the lagoons of Mauritius and Rodrigues which was undertaken by the Canadian firm, the Borstad Associates Ltd was completed.

The deliverables included the near true colour, thematic and bathymetry maps in digital format on CDs on the MapInfo software. Hard copies of the maps have been printed for sale at the centre.

6. FISHERIES TRAINING, DEVELOPMENT AND EXTENSION

6.1 Fisheries Training and Extension Centre

The Fisheries Training and Extension Centre (FiTEC) became operational in October 2004 and courses were held for officers of the Ministry, to trainee and registered fishers.

6.1.1 General course for fishers

Three sixteen-week training courses in “General Course for Fishers”- *Course Code FO1*, were dispensed to 23, 24 and 24 trainee fishers from the regions of Grand River South East, Port-Louis and La Preneuse/Case Noyale/Baie du Cap respectively. Upon successful completion of the course, the trainee fishers were awarded certificates which made them eligible for an off-lagoon fishermen registration card.

6.1.2 Training course for officers of the Fisheries Protection Service

Seven two-week training courses in “Mid Management”- *Course Code FPS01*, were carried out for officers of the Fisheries Protection Service. In all seventy five officers in the grade of Principal and Senior Protection Officers were trained in management of fisheries posts and the FAD fishery.

6.1.3 Training course in FAD associated fishery

53 registered fishers in 3 different batches comprising 18 from Baie du Cap, 24 from Souillac/Riambel and 11 from Riambel/Baie du Cap were given training in the specialised course in FAD Fishery – *Course Code FO3*.

6.2 Fish Aggregating Devices

Implementation of activities in relation to the project for the development of the Fish Aggregating Device fishery under the International Fund for Agricultural Development/United Nations Office for Project Services (IFAD/UNOPS) Rural Diversification Programme (RDP) was continued.

6.2.1 FAD development

Thirty-one trips were undertaken for the deployment/setting, verification and maintenance of FADs around the island. Two new FADs, namely FAD Poudre d'Or I and FAD Poudre d'Or II, were set following requests from fishers of the region. Six lost FADs were replaced. At the end of December, eighteen FADs were active around the island as shown in table 6.1 and figure 6.1.

Table 6.1: List and details of FADs (end of December)

Name	Mooring depth (m)	Distance from coast (nm)	Latitude-S	Longitude-E
Tombeau Bay	1050	2.7	20° 04' 40	57° 27' 88
Tamarin	450	2.2	20° 19' 99	57° 19' 58
Riviere Noire II	490	2.8	20° 21' 69	57° 19' 78
Flic en Flac	1200	2.5	20° 15' 99	57° 19' 39
Medine	2500	5.5	20° 12' 27	57° 17' 56
Passe Danoise II	450	5.3	20° 22' 08	57° 50' 75
La Preneuse	2300	5.2	20° 17' 71	57° 16' 08
Pte aux Caves	2600	4.7	20° 10' 08	57° 19' 61
Trou aux Biches I	1900	4.8	19° 59' 73	57° 27' 93
Flat Island	740	9.5	19° 49' 14	57° 34' 44
Riviere Noire I	1000	4.6	20° 23' 77	57° 16' 85
Port Louis II	3500	10	20° 05' 14	57° 16' 09
Souillac	1092	2.3	20° 33' 80	57° 31' 24
Poudre d'Or I	920	2.2	20° 05' 42	57° 46' 93
Trou aux Biches II	2450	6.9	20° 01' 64	57° 24' 05
Poudre d'Or II	243	4.2	20° 02' 34	57° 46' 05
Port Louis I	3500	11.5	20° 02' 12	57° 16' 13
Grand Carreau	260	8.2	20° 21' 60	57° 55' 33

Ile Plate ●



Figure 6.1: FADs around the island

6.2.2 FAD fishery monitoring

6.2.2.1 Data collection – fish landings from the FAD fishery

Seven enumerators from the Fisheries Protection Service recorded data of fish landings from FADs at nine selected fish landing stations, namely Trou aux Biches, Pointe aux Piments, Baie du Tombeau, Roche Bois, Bains des Dames, Pointe aux Sables, Tamarin, La Preneuse and Black River. Data recorded included catch, species composition, gear and effort. Fish landings from FADs by species are given in table 6.2.

Table 6.2: Fish landings from FADs

Common name	Scientific name	Catch (kg)
Germon	<i>Thunnus alalunga</i>	174 925
Thon jaune	<i>Thunnus albacares</i>	28 701
Dorade	<i>Coryphaena hippurus</i>	4 780
Becune	<i>Acanthocybium solandri</i>	1 385
Sharks	<i>Carcharhinus</i> sp.	628
Others	-	3 723
Total		214 142

6.2.2.2 Monitoring of fishing activities

A team of eight Fisheries Protection Service officers undertook ninety trips on board of the patrol boats FPS 1 and FPS 2 for the monitoring of FAD fishing activities in the northern and western regions. The officers were previously trained at the Sea Training School as “Coxswain” and “Marine Engine Driver”. The boats were operated from Pointe aux Sables.

During the monitoring exercise, the physical conditions of the FADs were assessed; fishers encountered at sea were sensitized to carry along safety equipment and given advice on the safe use of FADs.

6.2.3 Monitoring, Evaluation and Impact Assessment of the FAD Fishery (M & E)

A one-year study for “Monitoring, Evaluation and Impact Assessment of the FAD fishery” under IFAD/UNOPS was initiated in June. A team from the FAD fishery technical staff and FAD monitoring unit were involved in the study. The study included the collection of information on the activities of FAD fishers to evaluate the socio-economic impact of the FAD fishery for the duration of the IFAD Rural Diversification Programme, and to assess whether the target set had been achieved in the alleviation of poverty among fishers operating around FADs. Prior to the start of the study, a ten-day training programme was conducted by the Programme Coordinating

Unit of IFAD/UNOPS on M&E and an action plan with specific guidelines was formulated to carry out the study.

6.3 Interactive information campaign for artisanal fishers

Sensitisation campaigns were organised on facilities and assistance provided to artisanal fishers by the Ministry. The Development Bank of Mauritius, the Fisherman Welfare Fund (FWF), the FiTEC and the FPS participated in the information campaigns. Subjects discussed included the importance of the FAD fishery, safety and security at sea, financial assistance granted by the FWF and loan facilities, and services provided by Fisheries Posts.

Since July, six sensitisation campaigns for nine different regions were conducted at Vieux Grand Port, Trou d'Eau Douce, Grand Sable/Petit Sable, Grand Baie/Pointe aux Cannoniers, Tamarin and Melville/Grand Gaube targeting a total of 634 fishers as shown in table 6.3.

Table 6.3: Programme of information campaigns for artisanal fishers

Fisheries Post	Region	Fishers targeted	Date	Venue
Mahebourg	V. Grand Port	51	29 July	Grand Port Village Hall
T. d'Eau Douce	T. d'Eau Douce	135	26 Aug	T. d'Eau Douce Village Hall
Mahebourg	Grand Sable	60	30 Sep	Grand Sable Village Hall
	Petit Sable	11		
T. aux Biches	Grand Baie	123	14 Oct	Grand Baie Social Welfare Centre
	Pte aux Cannoniers	14		
La Preneuse	Tamarin	75	28 Oct	Tamarin Village Hall
Grand Gaube	Melville	30	11 Nov	G. Gaube Community Centre
	Grand Gaube	135		

6.4 Demonstration fishing

Demonstration fishing to acquaint prospective operators and trainee-fishers with the techniques for fishing the deepwater shrimp was effected on two occasions on research boats Sphyrna II and Maustral.

A batch of 23 trainee-fishers from Grand River South East was given demonstration in deepwater shrimp fishing in February. The trip was effected in the northern regions of the island and the fishers were acquainted with the use of traps for that fishery.

7. FISHERIES MANAGEMENT

7.1 Licensing of fishing vessels

7.1.1 Licensing of foreign fishing vessels

Licences are issued to foreign fishing vessels operating in the Exclusive Economic Zone (EEZ) of Mauritius against payment of the appropriate fee for longline, purse seine or hand line fishing.

The Fishing Agreement between Mauritius and the European Union provides for the issue of licences to 41 purse seiners, 49 longliners and to handline fishing vessels (25 GRT/month on an annual average). During the year, 34 longline and 37 purse seine licences were issued.

Under the Fishing Agreement with the Japan Tuna Fisheries Co-operative Associations (JTFCAs) which provided for the issue of 20 longline licences, 18 were issued to vessels of the JTFCAs.

The Fishing Agreement with the Republic of Seychelles provides for the issue of 15 licences to tuna purse seiners and 30 licences to longliners. Two purse seine licences were issued.

In addition, 123 longline licences were also issued to fishing vessels of other nationalities. Licence fees from EU vessels amounted to Euros 118 600 and for the other nationalities amounted to US\$ 1 128 000.

Details of licences issued are shown in table 7.1 and the number of foreign fishing licences issued for the last five years is summarized in table 7.2.

Table 7.1: Number of licences issued by nationality

Category	Nationality	Number issued
Mauritius longliners	Mauritius	2
EU longliners	France	17
	Spain	14
	Portugal	3
EU Purse seiners	Spain	20
	France	16
	Italy	1
Other nationalities	Cambodia	1
	China	1
	Indonesia	3
	Japan	6
	Seychelles	1
	Philippines	1
	Taiwan	108
Longliners licenced under Fishing Agreement with JTFCA	Japan	18
Purse seiners licenced under Fishing Agreement with Seychelles	Seychelles	2

Table 7.2: Licences issued by category (2001 – 2005)

Year	Longliner	Purse seiner	Handline	Trawler	Total
2001	138	32	0	2	172
2002	182	34	1	0	217
2003	156	39	1	0	196
2004	181	34	1	0	216
2005	175	39	0	0	214

7.1.2 Licensing of Mauritian vessels

During the year, there were 29 Mauritian vessels licensed to practice different types of fishing activities in the EEZ. The vessels were engaged in the production of chilled fish and frozen demersal fish from the banks as detailed in table 7.3.

Table 7.3: Number of licensed vessels by category

Category	Number of vessels
Banks fishery	5
Demersal chilled fish fishery	14
Surface longlining (swordfish fishery)	6
Fish carriers from St. Brandon	2
Banks drop-off fishery	2

7.2 Monitoring of vessels

7.2.1 Monitoring of local fishing vessels

The movement of local fishing vessels is closely monitored for fishery management purposes. All local vessels require a clearance from the Ministry prior to leaving for a fishing trip. Before a clearance is issued, it is ensured that the vessel is seaworthy, it has the appropriate insurance covers and has the required licence.

During the year, 149 clearances were issued to vessels involved in the demersal chilled fish fishery, 98 to vessels involved in the pelagic chilled fish fishery, 48 to carrier vessels from St Brandon and 17 to bank fishing vessels.

Clearances for unloading the catch are issued to the fishing vessels after inspection of the fish quality and checking of logbooks.

7.2.2 Monitoring of foreign fishing vessels

Foreign fishing vessels call at the port for different purposes such as loading/unloading/export of fish and fish products, transshipment, bunkering, change of crew, provisions and repairs. During the year, 707 foreign fishing vessels called at Port Louis. Table 7.4 gives details of the different categories of vessels having called at the port.

Table 7.4: Details of calls of foreign vessels

Type of vessel	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Reefers	2	1	3	2	1	2	3	2	2	6	3	5	32
Squid vessels	4	1	-	-	5	-	-	-	-	-	-	3	13
Bottom gill netters	-	-	-	-	-	1	-	1	-	--	-	1	3
Tuna longliners	52	64	52	30	36	62	47	36	78	63	43	52	615
Trawlers	1	-	-	1	1	2	2	2	-	2	1	1	13
Patagonian toothfish	2	2	-	1	-	1	2	3	3	1	-	4	19
Purse seiners	-	-	-	1	2	-	-	-	-	2	3	-	8
Others (lobster, trap)	-	1	-	1	-	-	-	-	-	1	1	-	4
Total	61	69	55	36	45	68	54	44	83	75	51	66	707

The nationalities and the number of calls of fishing vessels at Port Louis are given in tables 7.5 and 7.6, respectively.

Table 7.5: Details of vessels calling at Port Louis

Type of vessel	Flag country	Number of calls
Reefer	Mauritius	9
	Panama	16
	Taiwan	11
	Grenade	2
	Belize	1
Squid	Taiwan	11
	Vanuatu	1
Bottom gill nets	St Kitts & Nevis	2
	Equatorial Guinea	1
Tuna longliners	Mauritius	10
	Taiwan	399
	Spain	29
	Indonesia	29
	Japan	80
	Togo	4
	Portugal	1
	Sri Lanka	2
	Great Britain	1
	Seychelles	17
	Belize	15
	Equatorial Guinea	3
	Thailand	3
	China	3
	France	6
	Korea	4
	Madagascar	6
	Panama	3
	Philippines	3
	Bolivia	1
Cambodia	3	
Vietnam	1	
Trawlers	Mauritius (foreign owned)	5
	Cooks Islands	7
	Australia	3
	Namibia	2
Patagonian toothfish	France	17
	Australia	2
Purse seiner	France	5
	Spain	1
	Italy	1
Other (lobster trap)	France	2
Banks fishing vessels (Mauritian vessels)	Madagascar	3

with foreign flag)		
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Table 7.6: Calls of vessels at Port Louis

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
2001	41	47	55	57	81	54	50	51	89	69	41	61	696
2002	51	38	32	30	72	27	46	34	104	38	37	46	555
2003	39	53	40	20	29	58	34	42	64	51	37	44	511
2004	45	35	33	18	42	63	33	31	73	59	40	40	512
2005	61	69	55	36	45	68	54	44	83	75	50	66	706

7.2.3 Monitoring of patagonian toothfish fishing vessels

Mauritius acceded to the Convention for Conservation of Antarctic Marine Living Resources (CCAMLR) on 02 October 2004. States party to the Convention are required to implement the CCAMLR conservation measures, which include the Catch Documentation Scheme (CDS) for toothfish, established under Conservation Measure 10-05 (2003).

Training on the CDS was provided by the Australian Fisheries Management Authority (AFMA) and the CCAMLR Secretariat to Mauritian officials from 18 to 22 July 2005 with regards to the implementation of the CDS. Mauritius is now validating the Dissostichus Catch Document (DCD) for any toothfish vessel calling into port.

During the year, there were 19 calls of toothfish fishing vessels out of which only two called for transshipment. The others did not have any toothfish on board. The amount of toothfish transhipped was 990 tonnes. The quantities of toothfish transhipped during the past five years are presented in table 7.7.

Table 7.7: Transshipment of patagonian toothfish

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total (t)
2001	912	499	490	1 693	248	192	1 325	1 176	547	1 134	726	1079	10 021
2002	0	122	980	289	739	1 153	1 232	0	1 184	221	0	0	5 920
2003	753	235	0	99	71	246	1 174	195	0	0	106	0	2 879
2004	0	68	206	0	493	540	214	0	0	0	0	0	1 521
2005	0	0	0	0	0	0	410	0	0	580	0	0	990

7.2.4 Calls and transshipment of deep-sea trawlers

During the year, 17 calls were made by 5 trawlers of different nationalities. A total of 4 395 tonnes of deep-sea demersal fishes was transhipped. The main species were alfonsino, cardinal, orange roughy, blue nose, spiky dory, smooth dory, butter fish, boar fish, and black dory. Details of calls and quantity of fish transhipped are given at table 7.8.

Table 7.8: Transshipment by trawlers

Year	Qty transhipped (t)	Qty for local market (t)
2001	8 758	0
2002	3 746	428
2003	2 581	175
2004	3 463	0
2005	4 395	0

7.3 Tuna fisheries

Tuna fisheries are monitored through the collection, processing and analysis of fishing and biological data obtained from local and foreign licensed vessels.

7.3.1 Sampling of catch from licensed purse seiners

Length frequency data were obtained from the catches of licensed purse seiners. A total of 4 727 tuna comprising 3 562 skipjack, 806 yellowfin and 359 bigeye were sampled.

7.3.1.1 Length frequency distribution of skipjack tuna (*Katsuwonus pelamis*)

The length frequency distribution of skipjack tuna is shown in figure 7.1. The length of the fish ranged from 38 to 71 cm with the mode at around 50 cm.

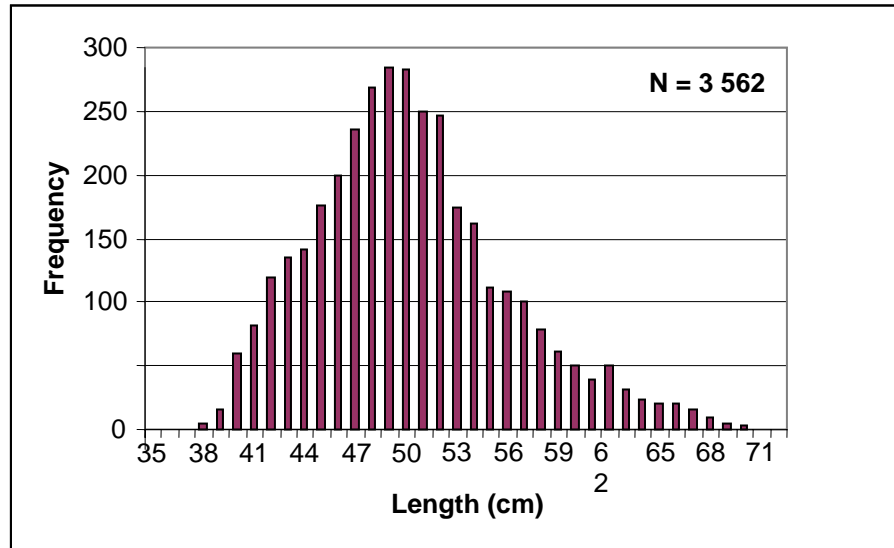


Figure 7.1: Length frequency distribution of skipjack tuna

7.3.1.2 Length frequency distribution of yellowfin tuna (*Thunnus albacares*)

The length frequency distribution of yellowfin tuna is presented in figure 7.2. The fish had a length range between 48 and 149 cm. Most of the fish sampled was below 85 cm in length representing fish which had not reached sexual maturity. Yellowfin tuna caught by purse seiners comprised mostly juvenile fish which is typical of catch made on schools associated with logs.

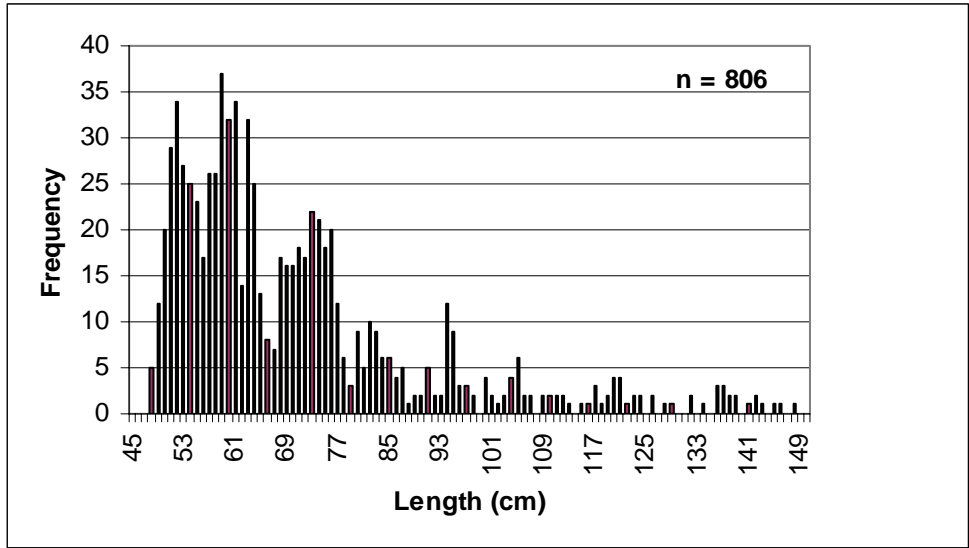


Figure 7.2: Length frequency distribution of yellowfin tuna

The length of the bigeye tuna ranged between 44 and 126 cm and the length frequency distribution is presented in figure 7.3. The bigeye tuna caught by the purse seiners was mostly juvenile fish measuring less than a metre, typical of catch made on log schools.

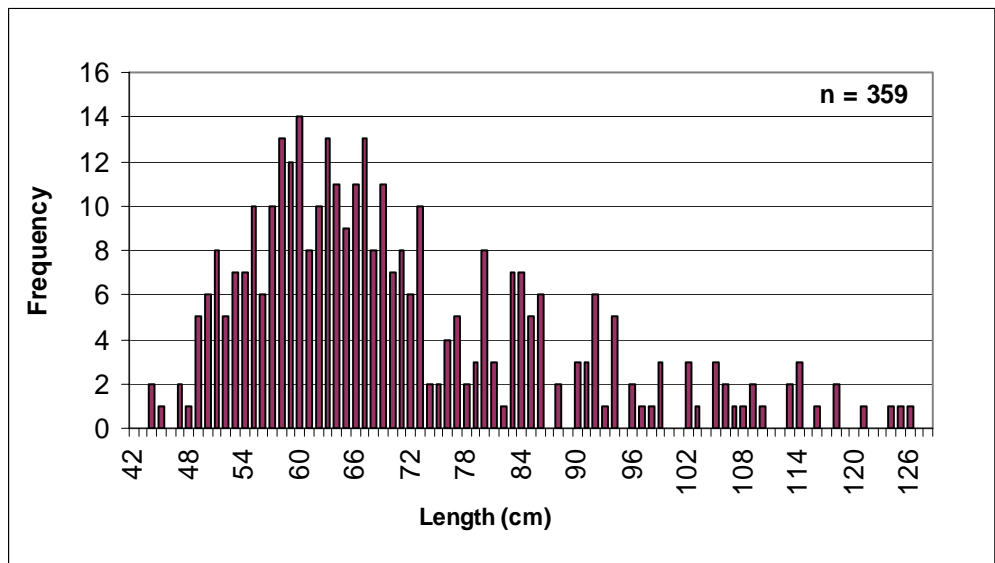


Figure 7.3: Length frequency distribution of bigeye tuna

7.3.2 Species composition

The catch was composed of 55% skipjack, 38% yellowfin, 5% bigeye and 2% miscellaneous fish. The species composition of the purse seine catch unloaded in Mauritius for the past five years is presented in table 7.9.

Table 7.9: Species composition of purse seiners catch (%)

Year	Species			
	Skipjack	Yellowfin	Bigeye	Miscellaneous
2001	70	20	10	-
2002	60	32	7	1
2003	68	25	6	1
2004	60	31	8	1
2005	55	38	5	2

7.3.3 Reproductive biology of skipjack tuna

Samples for the studies on reproductive biology of skipjack tuna were obtained at the local cannery. Gonad and liver from 409 skipjack tuna were removed for determining maturity stage, spawning period, reproductive index, sex ratio, seasonal sexual variation and length at first maturity.

7.3.3.1 Gonado-somatic Index (GSI)

The GSI for both males and females was maximum during February, April, September and October and minimum during January, June, and August. The monthly variations of the GSI are presented in figure 7.4, showing four peaks of intense sexual activity and spawning. The reproductive cycles of the males and females were synchronous as observed in previous years.

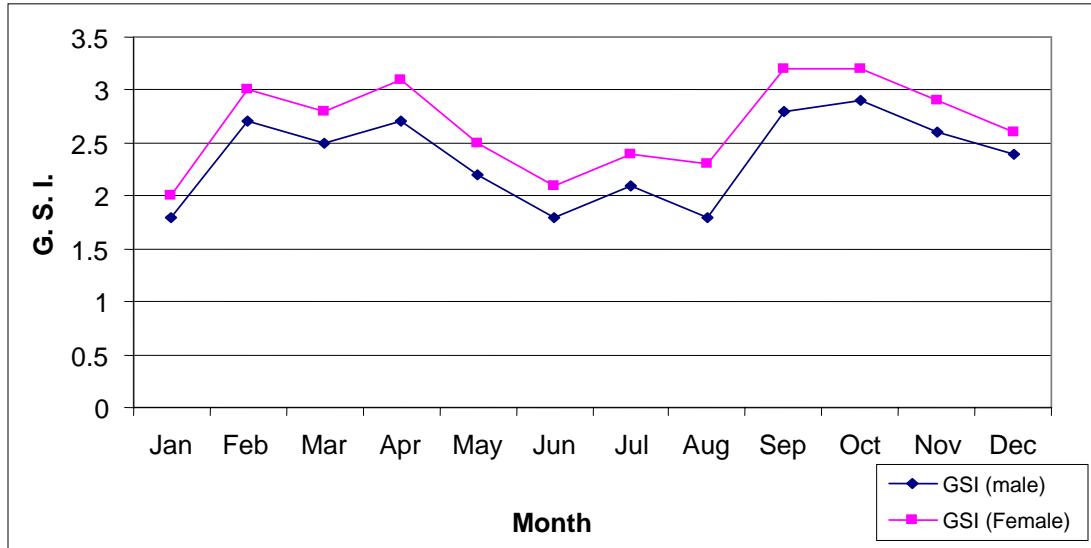


Figure 7.4: Gonado-somatic Index (GSI) of skipjack tuna

7.3.3.2 Spawning period

The skipjack tuna spawned throughout the year with certain periods of intense sexual activity. More than 75 % of females had ovaries in the terminal stage of maturation at any time of the year.

7.3.3.3 Sex ratio

The sex ratio calculated on an annual basis was 1.1:1, showing that males and females were present in almost equal proportions.

7.3.3.4 Length at first maturity (Lm_{50})

Length at first maturity is defined as the length at which 50 % of the fish population has attained sexual maturity and was calculated for each size class starting from 41 cm as shown in figure 7.5. Lm_{50} for males and females was found to be at 43 cm and 42 cm respectively.

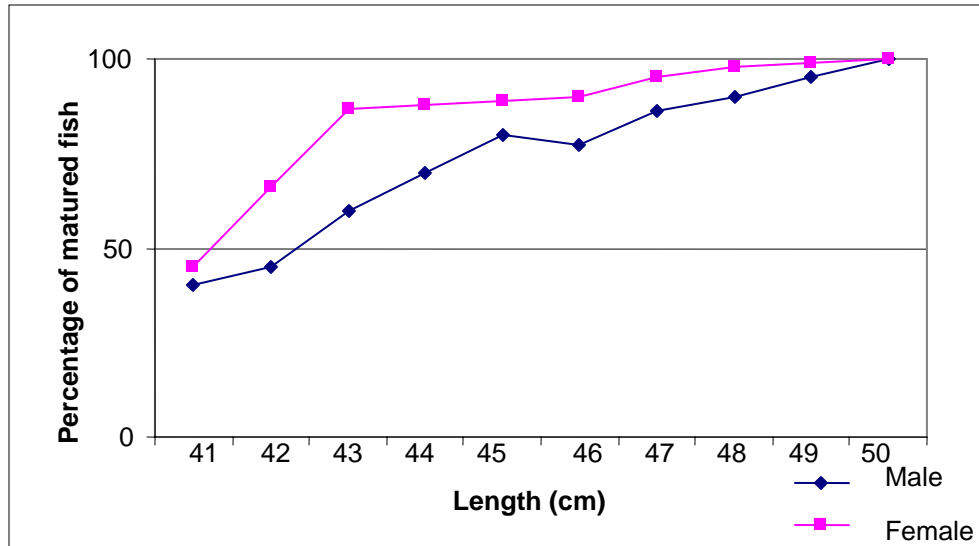


Figure 7.5: Length at first maturity of skipjack tuna

7.3.4 Monitoring of the catch of licensed longliners

Log returns were collected for licensed vessels. These vessels transhipped 12 604 tonnes of tuna and tuna-like species including 3 676 tonnes caught by licensed European longliners and 663 tonnes caught by three mauritian flagged vessels. A total of 209 logbooks was received, of which 180 were considered for processing; the remaining contained inconsistencies. The catches made in the mauritian EEZ based on the correct returns amounted to 4 963 tonnes.

7.3.4.1 Species composition of the catch of licensed longliners

The species composition of the catch of the licensed foreign longliners is shown in table 7.10.

Table 7.10: Species composition of the catch of licensed foreign longliners

Species	Scientific name	Catch (t)	%
Bluefin	<i>Thunnus maccoyii</i>	19	0.2
Yellowfin	<i>Thunnus albacares</i>	3 073	24.4
Bigeye	<i>Thunnus obesus</i>	1 590	12.6
Albacore	<i>Thunnus alalunga</i>	1 941	15.4
Skipjack	<i>Katsuwonus pelamis</i>	3 721	29.9
Other tunas	<i>Xiphus yezoensis</i>	17	0.1
Other billfishes	<i>Istiophorus albicans</i>	17	0.1

Sharks	1 287	10.2
Others	760	6.0
Total	12 604	100.0

The major part of the catch was composed of swordfish and yellowfin. Swordfish was the target species of the local and EU surface longliners. The high volume of yellowfin was due to the fact that there had been an increase in the number of calls of Japanese longliners which targeted this species.

7.3.4.2 Spatial distribution of the catch of licensed longliners

The fishing area of the licensed longliners was spread widely in the Western Indian Ocean between 9° N and 35° S and 41° E and 90° E as depicted in figure 7.6.

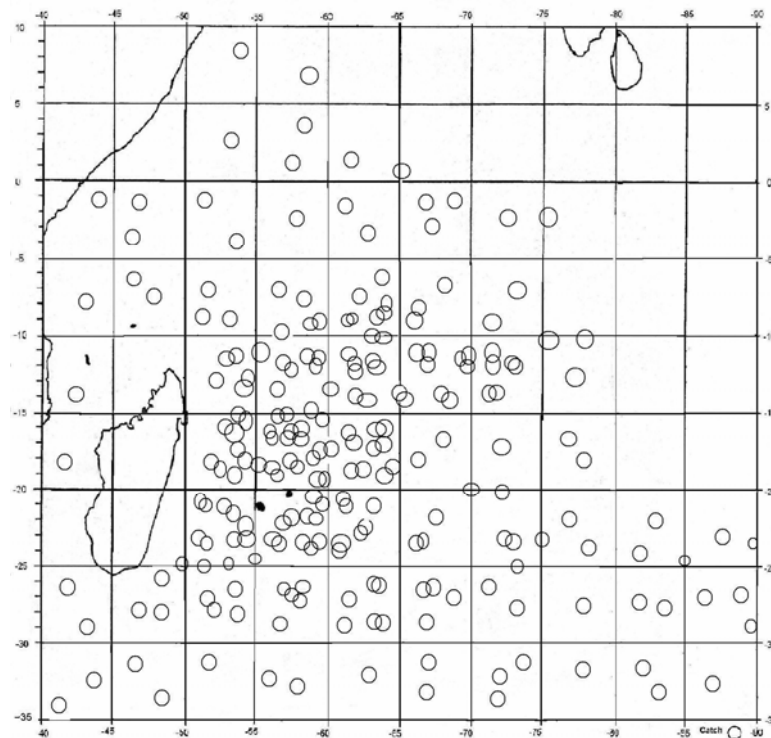


Figure 7.6: Catch distribution of licensed longliners

7.3.4.3 Sampling of catch of licensed longliners

Length frequency data of the albacore tuna were obtained during regular sampling carried out on the catch of licensed longliners. A total of 4 182 albacore tuna was sampled. The length

frequency distribution is shown in figure 7.7. The length varied from 67 to 130 cm. The major part of the catch comprised fish in the range of 82 to 105 cm.

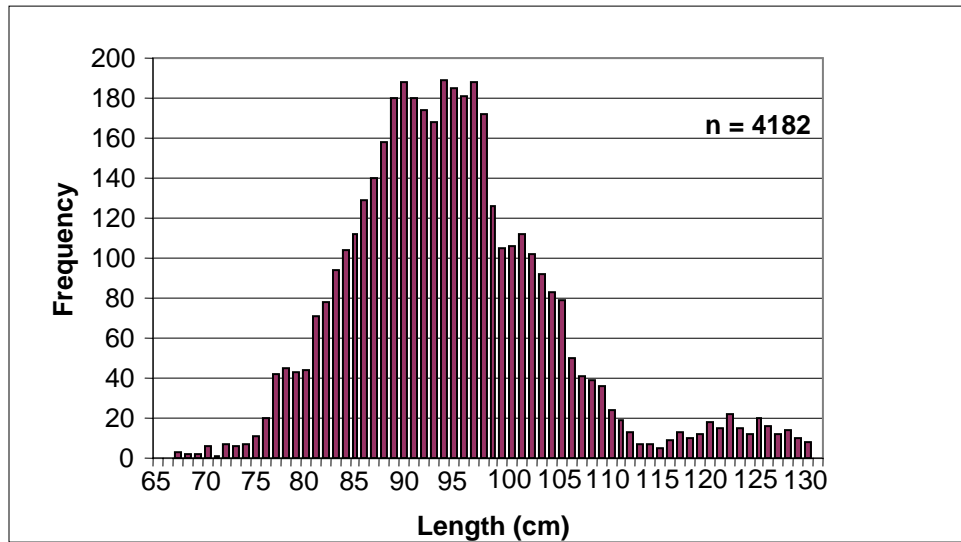


Figure 7.7: Length frequency distribution of albacore tuna

7.3.5 The local longline fishery

Three vessels operating under the Mauritian flag were actively engaged in the fishery. They undertook 9 fishing trips, unloading a total of 663 tonnes of fish. The species composition of the landings is shown in figure 7.8. Most of the catch composed of swordfish (56%), which was the target species of the vessels. The catch per unit effort was 1.2 kg per hook. The fishing area was spread between latitudes 04° S and 35° S and longitudes 41° E and 71° E.

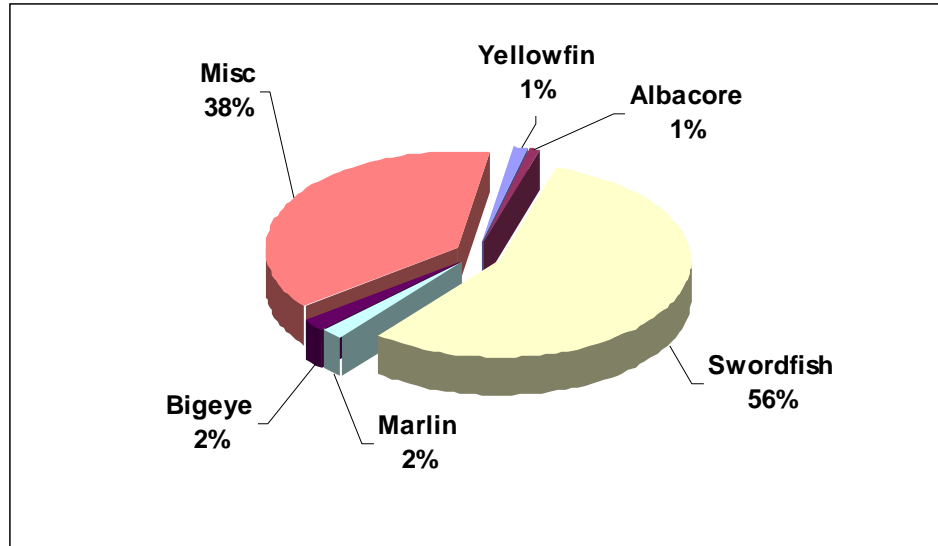


Figure 7.8: Catch composition of Mauritian longliners

7.3.6 Transshipment by tuna longliners

A total of 17 667 tonnes of tuna and tuna-like species was transhipped at Port Louis by licensed and non-licensed longliners which effected 615 calls. The species composition of the fish transhipped is shown in table 7.11. Albacore tuna constituted 4 946.8 tonnes of the total quantity transhipped. The decrease in the quantity of albacore tuna and the rise in the amount of yellowfin and swordfish transhipped, were due to the fact that there had been an increase in the number of EU and Japanese longliners calling at Port Louis, from 44 in 2002 to 118 in 2005. These fleets targeted mostly yellowfin and swordfish compared to Taiwanese vessels which aimed at albacore tuna.

The percentage of the three main species which were transhipped is shown in figure 7.9.

Table 7.11: Species composition of fish transhipped (t)

Year	Albacore	Yellowfin	Bigeye	Skipjack	Swordfish	Bluefin	Marlin	Sailfish	Shark	Misc.	Total
2001	13 595	898	880	-	274	-	319	25	-	336	16 327
2002	13 584	2 505	528	-	228	-	267	20	-	315	17 447
2003	6 225	1 280	415	25	2 126	3	187	59	1 657	456	12 433
2004	4 633	4 110	1 361	3	1 595	1	172	6	2 022	352	14 255

2005	4 947	3 887	1 413	-	3 357	-	318	35	2 473	1 237	17 667
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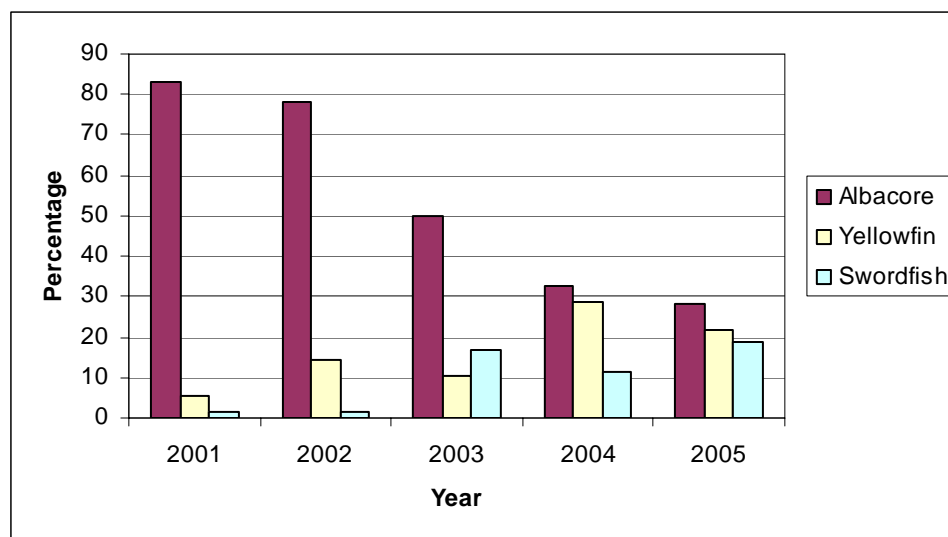


Figure 7.9: Percentage of the three main species transhipped by longliners

7.3.7 Production of the local tuna canning factories

The local canneries received 64 235 tonnes of round tuna fished by European purse seiners operating in the Western Indian Ocean. A total of 35 137 tonnes of canned tuna, 2 527 tonnes of pet food and 6 584 tonnes of fishmeal were produced. The total export value was approximately Rs. 3 billion. A total of 1 142 tonnes of canned tuna, 195 tonnes of pet food and 6 584 tonnes of fish meal for a total value of Rs. 88.7 million were sold on the local market.

7.4 Swordfish fishery

Five fishing vessels effected 87 trips and landed 177.6 tonnes of chilled fish. Swordfish constituted 48.5% of the catch. The fishing areas were spread around Mauritius, between latitudes 11°S and 24°S and longitudes 54°E and 61°E. The catch and species composition are shown in table 7.12 and figure 7.10.

Table 7.12: Catch composition of the local swordfish fishing vessels (kg)

Year	Swordfish	Yellowfin	Bigeye	Albacore	Marlin	Shark	Sailfish	Misc.	Total
2001	33 919	24 061	5 098	17 754	2 483	-	-	4 042	87 357

2002	26 248	5 288	2 152	7 242	1 162	220	-	4 108	46 492
2003	35 123	21 395	2 190	14 003	2 413	228	-	3 986	79 338
2004	51 844	12 597	4 412	19 864	2 236	538	-	5 876	97 187
2005	86 069	35 219	11 059	29 774	4 298	578	1 549	9 033	177 581

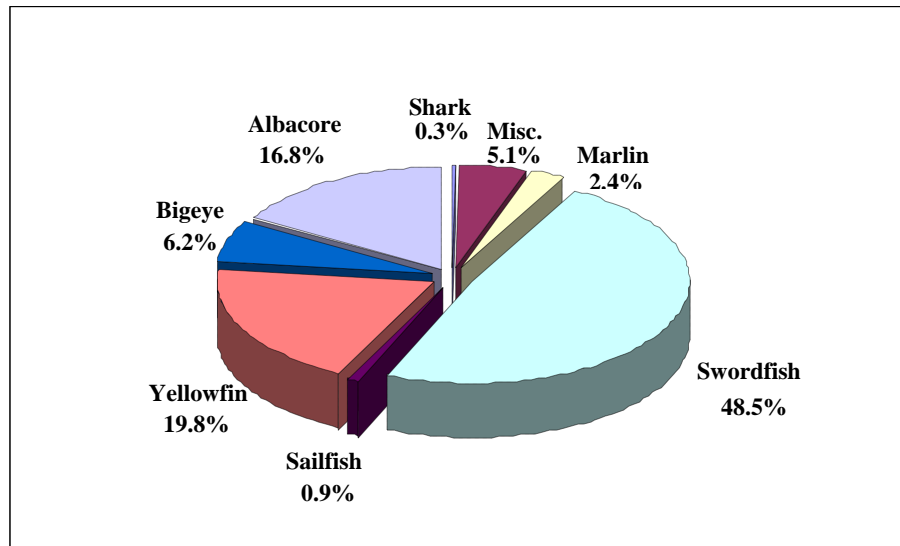


Figure 7.10: Species composition of the catch

7.4.1 Length frequency distribution of swordfish

The lengths of the swordfish were measured during the landings of the local vessels. The length frequency distribution is shown in figure 7.11. The length of the swordfish measured from the operculum to keel ranged between 48 to 182 cm with the majority between 56 and 102 cm.

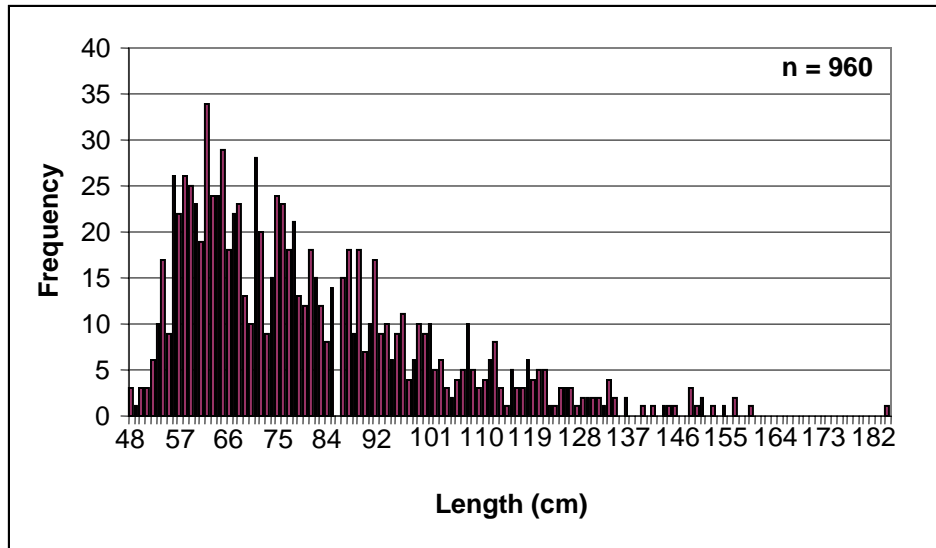


Figure 7.11: Length frequency distribution of swordfish

7.5 Vessel Monitoring System

A Vessel Monitoring System (VMS) was set up in February 2005. The VMS monitors the location, speed and direction of licensed fishing vessels by means of the Inmarsat and Argos satellite-based tracking systems. The satellites send data at regular intervals to the Land Earth Station (LES), which after processing are transmitted to a database at the Fisheries Monitoring Centre (FMC) at the Albion Fisheries Research Centre. The VMS network includes five workstations, three located at the FMC, one at the National Coast Guard (NCG) Headquarters, Port Louis and one at the NCG Maritime Air Squadron (Plaisance). Twenty local fishing vessels were fitted with mini-C transponders.

All fishing vessels that are licensed to fish in Mauritius waters are required to transmit data to the FMC while operating in the waters of Mauritius. Regulations in this regard were promulgated on 1 June 2005. Sixty-six vessels thus reported to the FMC during the year starting from March.

7.6 Import and export of fish and fish products and fish processing

7.6.1 Import of fish and fish products

During the year, 1 814 permits were issued for the import of fish and fish products, including 15 permits for the import of fish samples and fish bait. The fee payable for an import permit is Rs. 2 000 per consignment and Rs. 500 for fish samples or fish bait. Proceeds from such permits amounted to Rs. 3 635 500.

Random samples were collected from imported fish and fish products at the ports of entry and forwarded to the Veterinary Services Laboratory for bacteriological analysis. A total of 78 samples was analysed and the results were found to be within established norms.

Imported fish and fish products for direct consumption amounted to 10 621 tonnes representing 12.5 % of the total fish imports. A total of 64 235 tonnes of raw material were imported for the tuna processing plants from French and Spanish vessels transhipping in the Seychelles, while 1 126 tonnes of frozen barracouta were imported from Namibia and New Zealand for the production of salted snoek. Details of imports are shown in figure 7.12.

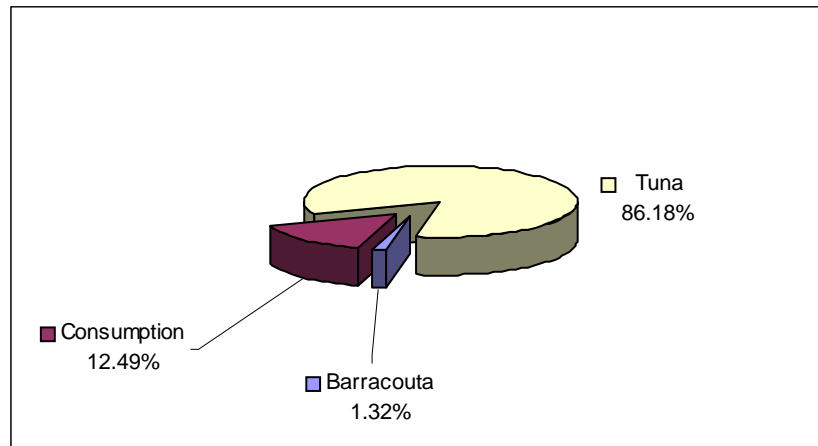


Figure 7.12: Details of import

Imports of frozen and canned fish and fish products amounted to 9 900 tonnes, representing 93.2% of imports for direct consumption. Details of fish and fish products imported for direct consumption are presented in figure 7.13.

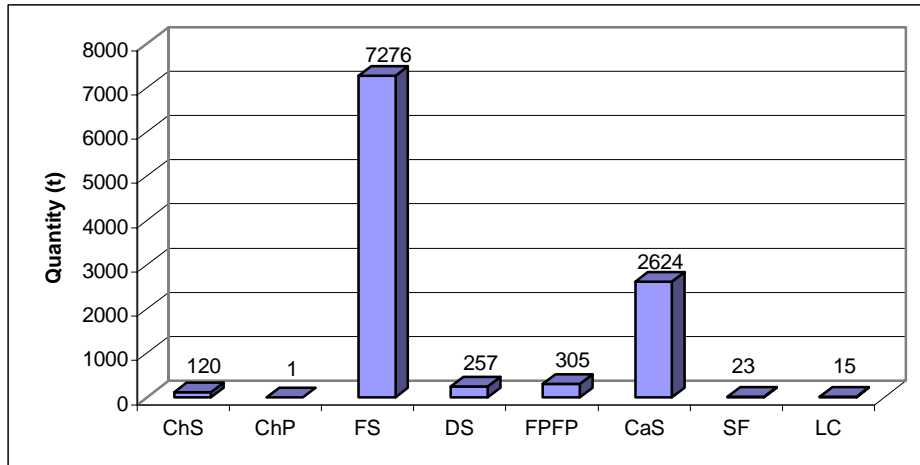


Figure 7.13: Import of fish and fish products (t)

(ChS: chilled, ChP: chilled processed, FS: frozen seafood, DS: dried, FPPF: frozen processed fish products, CaS: canned, SF: smoked fish, LC: live crustacean.)

The fish and fish products were imported from various countries as detailed in figure 7.14.

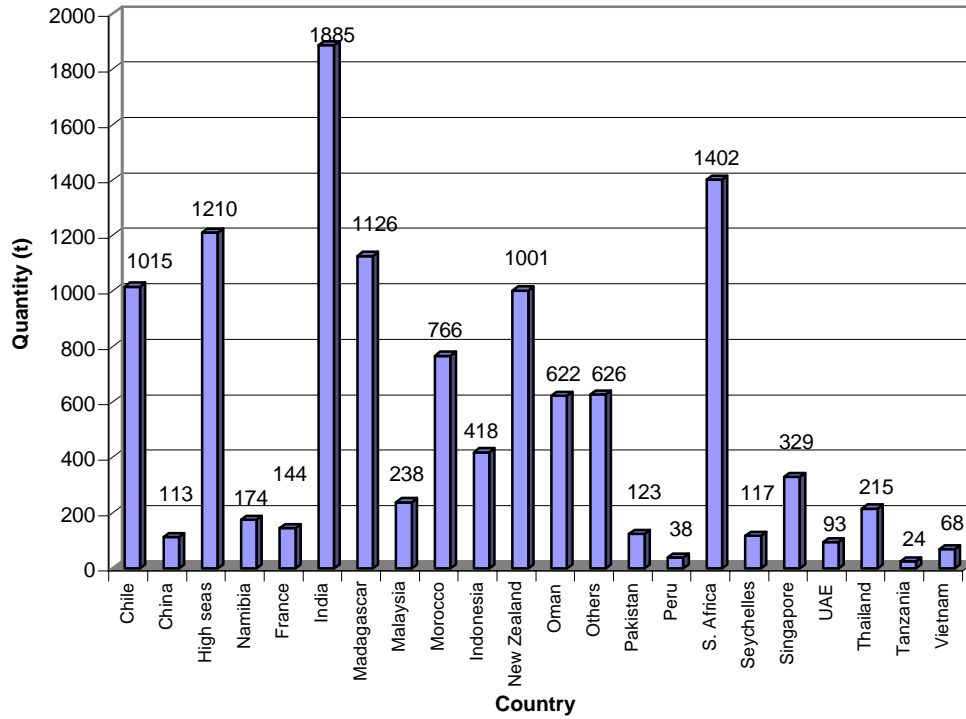


Figure 7.14: Import of fish and fish products by country

7.6.1.1 Chilled fish and fish products

A total of 120 tonnes of chilled fish and fish products was imported mainly from India, Dubai, France and Seychelles and comprised salmon, trout, anchovy, herring, sole fish, “capitaine”, “vacoas”, “sacrechien”, giant freshwater prawn (*rosenbergii*), shrimps, lobsters, crab, squid, oyster, mussel, clams and scallop. Details of the import are shown in table 7.13.

Table 7.13: Import of chilled fish and fish products (t)

Year	Fish	Crustacean	Shellfish	Squid	Total
2001	16	28	3	1	48
2002	21	27	5	3	56
2003	21	14	8	1	44
2004	48	27	0	0	75
2005	95	10	15	0	120

7.6.1.2 Chilled processed fish and fish products

Chilled processed fish and fish products are those that have undergone a certain amount of preparation and processing. These products included “roll mop”, “rape de mer”, “terrines de poisson”, “jambon de mer”, “batonnet de crabe”, “oeuf de lompe”, morue, surimi, mussels, fish sticks, fish cakes and “crevette rose” which were imported from France, UK and Seychelles. Imports for the year amounted to 120 tonnes.

7.6.1.3 Frozen fish and fish products

Imported frozen fish and fish products for direct consumption amounted to 7 276 tonnes. These products were imported mainly from India, Oman, Madagascar, South Africa, New Zealand, Vietnam, Tanzania, Belgium, USA, Indonesia, Thailand, Australia, France, Mauritius Free Port and fishing vessels calling at Port-Louis. Details of import for the past five years are presented in table 7.14.

Table 7.14: Import of frozen fish and fish products (t)

Year	Fish	Crustacean	Cephalopod	Shellfish	Total
2001	2 879	1 075	1 013	24	4 991
2002	2 141	819	1 005	19	3 984
2003	2 690	991	776	23	4 480
2004	3 497	1 216	822	21	5 556
2005	4 721	1 326	1 174	55	7 276

The species composition of frozen fish imported is shown in figure 7.15. Fin fish commonly imported were “capitaine”, blue nose, ruby fish, boarfish, “cateau”, marlin, oil fish, sail fish, seabream and tuna. By-catch from tuna longline fishing vessels purchased by the Agricultural Marketing Board comprised tuna, oil fish, sailfish, moonfish, marlin, “becune”, “empereur”, shark and “dorade”.

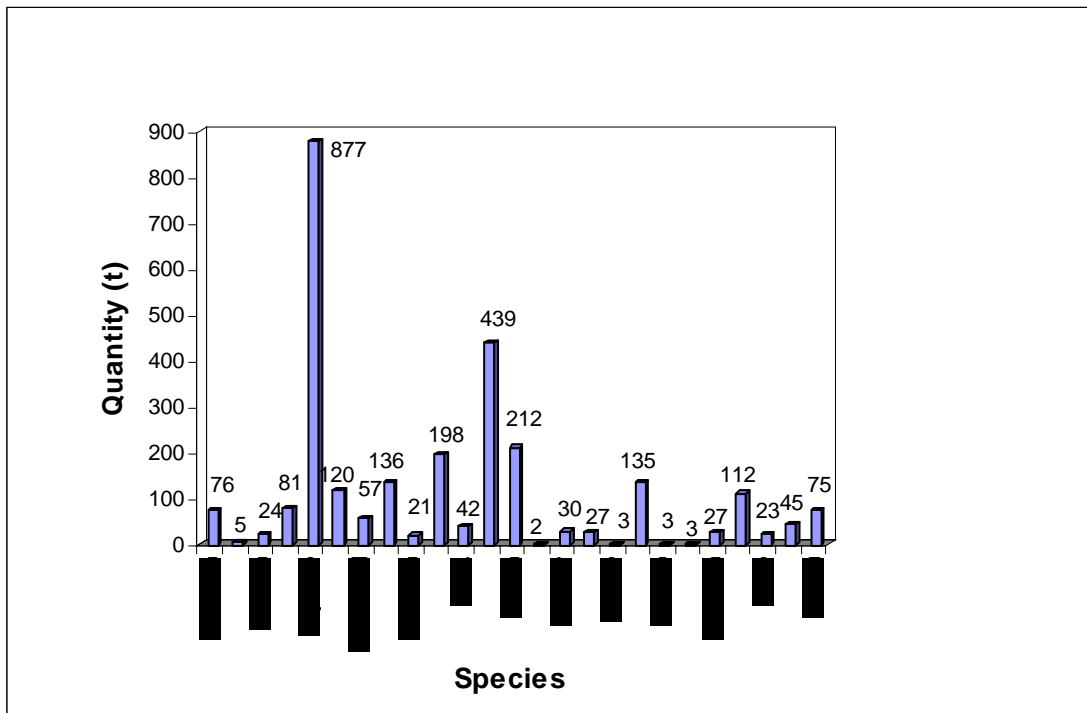


Figure 7.15: Import of frozen fish

7.6.1.4 Frozen processed fish and fish products

Frozen processed fish and fish products were imported from South Africa, China, Malaysia, Indonesia, Singapore, Thailand and France. They included fish fingers, fish cakes, fish fillets, fish balls, fish sticks and other breaded products. The total import amounted to 305 tonnes compared to 847 tonnes in 2004.

7.6.1.5 Dried fish and fish products

Dried fish and fishery products were imported from India, China, Malaysia, Indonesia and Singapore. The total import for the year amounted to 257 tonnes. Details are presented in table 7.15.

Table 7.15: Import of dried fish and fish products (t)

Year	Fish	Bombay duck	Squid/cuttlefish	Octopus	Prawn	Others	Total
2001	5	178	1	27	91	2	304
2002	2	154	1	38	105	0	300
2003	4	157	1	0	132	1	295
2004	2	189	2	0	127	2	322
2005	23	136	1	0	97	0	257

7.6.1.6 Smoked fish and fish products

Smoked fish and fish products were imported from France, Denmark, South Africa and Australia for the supermarkets, hotels and restaurants. Smoked fish comprised “hareng”, trout, salmon, haddock, surimi, “morue” and mackerel and amounted to 23 tonnes.

7.6.1.7 Canned fish and fish products

Canned fish and fish products such as sardines, pilchards, mackerels, “anchois”, “foie de morue”, salmon and tunas were imported from Morocco, Chile, Peru, South Africa, Thailand, Indonesia, Malaysia, China, France and United Kingdom. With the exception of tuna, these products are not

produced locally. Morocco was the main country for the supply of canned sardines while Chile and South Africa were the main suppliers of canned pilchards. A total of 2 624 tonnes of canned fish and fish products was imported during the year. Details on canned fish and fish products imported for the past five years are presented in table 7.16.

Table 7.16: Import of canned fish (t)

Year	Sardines	Pilchards	Mackerel	Tuna	Others	Total
2001	1 126	1 302	606	16	30	3 080
2002	1 115	1 490	679	31	11	3 326
2003	1 073	1 360	742	243	84	3 502
2004	1 022	1 102	994	107	193	3 418
2005	804	624	1 015	118	63	2 624

(others : “anchois”, dace, “hareng” and salmon)

7.6.1.8 Live crustaceans

Fifteen tonnes of live crab and lobster were imported from Madagascar and South Africa, respectively.

7.6.1.9 Live ornamental fish

A total of 571 822 units of live freshwater ornamental fish were imported from Singapore and Malaysia. Common ornamental fish included gold fish, tetra, guppies, mollies, cichlids and terrapins.

7.6.1.10 Live fish for culture

The Ferme Marine de Mahebourg Ltd imported 350 750 units of live fish fry/fingerlings (cobia and red drum) for culture purposes.

7.6.1.11 Fish meal

A total of 336 tonnes of dried fish meal and 84 tonnes of soluble fish protein concentrate were imported from France and South Africa, respectively. These products were used in the manufacture of animal feed. A total of 2.1 tonnes of fish feed was imported for live ornamental fish.

7.6.1.12 Sea shells

A total of 48 309 units and 3 036 kg of sea shells were imported from Madagascar and Philippines.

7.6.2 Export of fish and fish products

7.6.2.1 Export of chilled fish

A quota of 35 tonnes was set for export of red chilled fish to Reunion. Three companies have approved status. The total export amounted to 28.6 tonnes and consisted of “vieille rouge” (*Epinephelus fasciatus*), “croissant queue blanc” (*Variola albimarginata*), “vieille laboue” (*Epinephelus morrhua*), and “sacréchien” (*Pristipomoides filamentous* and *Etelis carbunculus*).

7.6.2.2 Export of ornamental fish

Two companies exported live ornamental marine fish to Japan, Reunion Island, USA, Hong Kong, UK, Germany, and France. Out of the set quota of 6 500 units, 4 653 units of marine fish were exported.

7.6.3 Fish processing

7.6.3.1 Canned tuna

The local cannery imported 64 235 tonnes of raw material. The amount of canned tuna and by-products produced is shown in table 7.17.

Table 7.17: Production of canned tuna and its by-products (t)

Products	2001	2002	2003	2004	2005
Canned tuna	26 012	28 873	30 523	34 248	35 137
Pet food	2 570	3 204	3 441	3 331	2 527
Total	28 582	32 077	33 964	37 579	37 664

Most of the canned tuna was exported to the European countries. About 1 142 tonnes were put for sale on the local market. Export and local sale of the produce for the past five years is presented in table 7.18.

Table 7.18: Export and local sale of canned tuna and pet food (t)

Product	2001		2002		2003		2004		2005	
	Local	Export	Local	Export	Local	Export	Local	Export	Local	Export
Canned tuna	976	25 797	1 083	27 411	643	30 787	1 005	30 555	1 142	31 674
Pet food	167	2 482	179	2 951	183	3 301	231	3 070	195	2 394
Total	1 143	28 279	1 262	30 362	826	34 088	1 236	33 625	1 337	34 068

7.6.3.2 Tuna loin production

A new fish processing plant started operation in the port area for the production of tuna loins for export. Raw material of Spanish origin was transhipped from the Seychelles. 16 037 tonnes of frozen raw tuna were imported by the company for the processing of tuna loins. A total of 3 759 tonnes of tuna loins was produced and exported to Europe and the USA.

7.6.3.3 Salted fish

Two companies were engaged in the production of salted snoek from frozen barracouta (*Thyrsites atun*). The amount produced was 772 tonnes out of which 152 tonnes were exported to UK, Reunion Island and France. Details of the import of raw materials, production and sale for the past five years are presented in table 7.19.

Table 7.19: Import, production and sale of salted fish (t)

Year	2001	2002	2003	2004	2005
Import of barracouta	1 223	1 115	1 105	1 183	1 126
Production of snoek	841	770	717	958	772
Local sale of snoek	761	710	632	672	570

7.6.3.4 Fish meal production

A total of 6 584 tonnes of fish meal was produced using rejects from the local tuna processing plants and trash fish imported from South Africa. The fish meal produced was used in the manufacture of livestock feeds. Production for the last five years is given in table 7.20.

Table 7.20: Production of fish meal (t)

Year	2001	2002	2003	2004	2005
Production	4 143	5 114	5 189	5 263	6 584

7.7 Fish production, consumption & trade balance

7.7.1 Total fish production

A decrease of the total fish production from the artisanal fishery, shallow water banks and semi-industrial chilled fish fishery was noted in 2005. The total annual production by different fisheries is given in table 7.21.

Table 7.21: Fish production in tonnes (fresh-weight equivalent)

Sector	Type	2001	2002	2003	2004	2005
Artisanal fishery						
Mauritius	Fresh	1 075	1 302	1 166	1 043	947
Rodrigues	Fresh	1 937	1 404	1 664	1 500	1 500
Agalega	Fresh	30	30	30	30	30
Sports fishery	Fresh	650	650	650	650	650
Amateur fishery	Fresh	300	300	300	300	300
Barachois	Fresh	6	7	6	4	5
Ponds (prawn & fish)	Fresh	52	39	27	32	23
Marine aquaculture (cage)	Fresh	--	--	--	325	367
Sub-total		4 050	3 732	3 843	3 884	3 822
Offshore demersal fishery						
Shallow water banks	Frozen	3 366	3 943	3 713	3 216	2 178
Banks deep water snappers	Frozen	329	5	--	7	--
St Brandon inshore	Frozen, chilled & salted	557	491	578	204	414
Semi-industrial chilled fish	Chilled	188	204	234	284	223
Tuna fishery	Frozen	0	219	1 118	1 640	1 402
Semi-industrial pelagic fish	Chilled	87	45	111	97	118
Demersal trawlers	Frozen	2 184	2 113	1 806	1 595	2 584
Sub-total		6 711	7 020	7 560	7 043	6 919
Grand Total		10 761	10 752	11 403	11 003	10 720

7.7.2 Per capita consumption of fish

Table 7.22: Per capita consumption of fish (kg)

Year	Quantity
2001	19.9
2002	20.3
2003	18.7
2004	19.8
2005	18.8

7.7.3 Trade balance in relation to total imports and exports

The import and export of fish and fish products and trade balance are given in the table 7.23. In 2005 a positive trade balance of Rs. 580.9 M was noted.

Table 7.23: Import and export of fish and fish products and trade balance

Year	Import		Export		Balance
	Qty (t)	Value (MR)	Qty (t)	Value (MR)	Value (MR)
2001	52 050	1 754.3	27 381	1 840.8	86.5
2002	63 032	3 984.7	49 560	4 081.0	*249.0
2003	62 323	2 560.1	48 719	3 178.4	*618.3
2004	80 943	3 170.1	54 242	3 358.1	188.0
2005	104 830	4 261.2	67 249	4 842.1	580.9

* Data for 2002 and 2003 include operations carried out in the Free Port

MR – Million rupees

8. FISHERIES PLANNING

8.1 Seafood hub

The strategy of the seafood hub is focused on the development of value added fisheries and related fishing activities. The One Stop Shop, set up in April 2004 at the Trade and Marketing Centre (TMC) in the free port area, continued to provide faster services to seafood operators.

In the context of the development of the seafood hub, the “Thon des Mascareignes” with a capacity of 50 000 tonnes annually started its operation in June. To improve infrastructure the Mauritius Freeport Development Company Ltd embarked in the construction of a 2 300m² fishing quay to facilitate landing and transshipment operations.

8.2 Fishing agreements

8.2.1 Fishing agreement with the Seychelles

A fishing agreement with the Seychelles was signed in March. It provides for fishing opportunities in both Mauritius and Seychelles waters for 10 purse seiners and 20 long liners to each country annually. Consequently, seven licences were issued to fishing vessels from the Seychelles.

8.2.2 Fishing agreement with the Federation of Japan Tuna Fisheries Cooperative Associations

The fishing agreement between Mauritius and the Federation of Japan Tuna Fisheries Cooperative Associations was renewed in May for a further period of 12 months. It included an additional provision to enable effective monitoring of the movement of licensed vessels operating in the maritime zones of Mauritius. Eighteen licences were issued under the agreement.

8.3 Regional and International Cooperation

8.3.1 Comprehensive Economic Cooperation and Partnership Agreement (CECPA)

The Ministry contributed in the negotiations towards a Preferential Trade Agreement with India. The CECPA would help both the countries to face the challenges of an increasingly globalise and competitive world together. Four meetings were held in Mauritius and in India with a view to finalise the Preferential Trade Agreement. In the same context, a Memorandum of Understanding was signed between the Mauritius Chamber of Commerce and the Seafood Exporters Association of India.

8.3.2 Comprehensive Economic and Trade Cooperation Agreement

Discussions for a Comprehensive Economic and Trade Cooperation Agreement between China and Mauritius were initiated. In that context, specific areas of collaboration between the two countries were explored.

8.3.3 Kuwait Fund

The Kuwait Fund approved the grant of 100 000 Kuwait Dinars for a feasibility study for the development of a long line fishery. Tender documents for the study were under preparation.

8.3.4 Regional Fisheries Framework Agreement

Mauritius participated in regional negotiations with the EU for the development of a Regional Fisheries Framework Agreement and with the World Trade Organisation (WTO) on the rules of origin, market access and subsidies for fisheries.

8.3.5 South West Indian Ocean Fisheries Project (SWIOFP)

Several sessions for the preparation of a project appraisal document for fisheries research and management in the South West Indian Ocean were held. The project estimated to cost around US\$ 35 millions would be mainly funded by the World Bank under GEF (Global Environment Facility).

8.3.6 Research on swordfish

Discussions were held with “l’Institut Français de Recherche pour l’Exploitation de la Mer” (IFREMER) for the implementation of a regional scientific project to study the genetic structure and characteristics of the swordfish stocks in the Indian Ocean. A workshop would be held in Reunion Island in September 2006 to define the scientific action plan and for the drafting of a proposal for funding support.

8.4 Fishermen Investment Trust

Discussions were initiated on the modalities for the setting up of the Fishermen Investment Trust (FIT). The Trust will have entitlements to exploit the resources around St Brandon and the banks, for the benefits of fishers. A task force was set up to work on the framework of the FIT.

8.5 Fisheries Sector Policy

An EU team carried out a Fisheries Sector Policy Study in the context of negotiations for a new bilateral fisheries agreement starting January 2008. An evaluation of past agreements was also carried out.

8.6 New fishing projects

Seven fishing projects submitted for the chilled fish and swordfish fisheries were analysed and approved.

8.7 Land Based Ocean Industry (LBOI)

The Fisheries Division actively collaborated in the preparation of a proposed Land Based Ocean Industry project document by the Mauritius Research Council.

8.8 Aquaculture Master Plan

The Fisheries Division assisted the Board of Investment in the preparation of the terms of reference for a study on marine aquaculture development. The focus will be on finfish farming in the lagoon and the outer lagoon of Mauritius while taking into account the effect of introduction of new species, the impact on the environment and user conflicts among others.

9. FISHERIES PROTECTION SERVICE

The Fisheries Protection Service, is responsible for the enforcement of the fisheries legislation, and operates mainly from 14 Fisheries Posts around the island.

Officers are also involved in the monitoring of the FAD fishery and enforcement duties at the marine parks and in delivering clearances at the One Stop Shop.

9.1 Registration of artisanal fishers

The total number of registered artisanal fishers was 2 326 in 2005 compared to 2 307 in 2004; 62 new fisherman cards were issued and 43 fishers were deregistered. Details of registered fishers by category and district are presented at table 9.1.

Table 9.1: Categories of artisanal fishers

District	Net	Basket Trap	Line	Basket Trap & Line	Harpoon	Total
Port Louis	0	3	60	49	0	112
Pamplemousses	5	14	144	183	4	350
Riv. du Rempart	31	32	68	255	4	390
Flacq	39	16	30	220	4	309
Grand Port	35	35	40	385	6	501
Savanne	9	11	22	134	10	186
Black River	48	21	143	251	15	478
Total	167	132	507	1 477	43	2 326

9.2 Registration of boats

The number of registered boats as at 31 December is shown in table 9.2. During the year 235 new boats were registered and revenue collected amounted to Rs 5 875. The registration fee per boat is Rs 25.

Table 9.2: Registration of boats

District	Artisanal fishing	Pleasure boat	Big game	Total
Port Louis	136	249	0	385
Pamplemousses	199	377	68	644
Riv. du Rempart	420	294	1	715
Flacq	390	281	3	674
Grand-Port	543	479	2	1 024
Savanne	94	60	1	155
Black-River	574	619	20	1 213
TOTAL	2 356	2 359	95	4 810

9.3 Licences

The number of the different types of licences in force during the year is presented in table 9.3.

Table 9.3: Number of licences

District	Large -Net	Gill-Net	Fishmonger	Bait-Gear
Port Louis	0	0	204	29
Pamplemousses	1	0	136	50
Riv du Rempart	4	0	106	12
Flacq	3	1	90	33
Grand Port	3	2	141	74
Savanne	1	1	49	19
Black-River	5	0	133	59
Total	17	4	859	276

The quarterly licence fee for a large net and gill net was Rs 50 and Rs 25 respectively. The annual fishmonger's licence fee was Rs 200 for individuals and Rs 1 000 for companies. No fee was charged for a bait gear licence.

9.4 Illegal fishing

Enforcement is effected through patrol at sea and on land and contraventions are followed by legal proceedings. Since December, 3 mobile units have been re-introduced to better combat illegal fishing and to assist officers based at Fisheries Posts for better surveillance of our fisheries resources. The number of convicted cases is presented in table 9.4.

Table 9.4: Convicted cases

Year	Underwater fishing	Net fishing	Others	Total length of net seized (m)	Fines paid (Rs)
2001	10	9	24	2 064	138 500
2002	59	87	80	2 396	105 000
2003	12	16	47	5 570	54 200
2004	8	14	13	697	87 800
2005	21	12	32	6 183	163 000

9.5 Allowances to artisanal fishers

Registered artisanal fishers were paid an allowance for bad weather days on a monthly basis. The number of bad weather days for fishing is determined from data submitted by the Meteorological Services. Details of payment are presented in table 9.5 (a).

Table 9.5 (a): Bad weather allowance

Year	No. of days	Rate (Rs)	Beneficiaries	Total (Rs)
2001	111	105-115	1 946 – 2 272	26 598 135
2002	142	115-125	2 118 – 2 319	38 569 430
2003	114	125-130	2 121 – 2 363	32 809 255
2004	118	130-135	2 012 – 2 111	34 357 665
2005	137	135-145	1 978 - 2 247	41 597 895

Large and gill nets are not allowed to operate during the closed season. During that period net fishers are paid an allowance, details of which are presented in table 9.5 (b).

Table 9.5 (b): Closed season allowance

Year	No. of days	Rate (Rs)	Beneficiaries	Total (Rs)
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2001	119	105-115	208-190	2 595 691
2002	122	115-125	189-184	2 730 100
2003	123	125-130	179-184	2 849 250
2004	121	130-135	179	2 815 670
2005	122	135-145	161	2 763 010

A registered fisher is entitled to a sick leave allowance if admitted to a hospital or clinic for at least 14 days. Such allowance paid is presented in table 9.5 (c).

Table 9.5 (c): Sick leave allowance

Year	Rate (Rs)	Beneficiaries	Total (Rs)
2001	105 - 115	Nil	Nil
2002	115 - 125	2	3 220
2003	125 - 130	4	7 210
2004	130 - 135	3	5 670
2005	135 - 145	6	11 480

9.6 Incentives to registered fishers

The Fishermen Welfare Fund disbursed an amount of Rs 1 317 656.00 as scholarship allowance to children of registered fishers, details of which are shown in table 9.6.

Table 9.6: Scholarship allowance

Education Level	Beneficiaries	Amount (Rs)
------------------------	----------------------	--------------------

C.P.E	172	774 000
S.C	59	267 750
H.S.C	27	226 500
Vocational	2	4 500
Other related expenses	-	44 906
TOTAL	260	1 317 656

Duty concessions for the purchase of outboard motors were granted to 87 fishers, 77 on main outboards and 10 on spare outboards. Since the creation of the Small Fishermen Loan Scheme, the Development Bank of Mauritius has disbursed Rs. 37m to registered fishers at an interest rate of 3% per annum. For the year 2005, Rs.11 292 801 was disbursed. Out of that sum Rs 6.4m was loaned to 9 fishers for industrial fishing.

9.7 Buy-back scheme for nets

Implementation of the buy-back scheme for the reduction of net fishing was pursued and the details of payment made are presented in table 9.7.

Table 9.7: Amount paid (Rs)

Year	Fishers	Nets surrendered	To fishers	To net owners	Total
2001	18	0	575 000	0	575 000
2002	20	1	800 000	230 000	1 030 000
2003	2	0	100 000	0	100 000
2004	9	2	250 000	325 000	575 000
2005	2	0	140 000	0	140 000

10. MISCELLANEOUS

10.1 Third National Ocean Science Forum

Seven papers, as listed below, were presented at the 3rd National Ocean Science Forum held on 29 August at the Grand Bay International Conference Centre.

- Attempt at spawning and larval rearing of the sea cucumbers, *Bohadschia marmorata* and *Holothuria atra* in captivity by A. Laxminarayana, S. Rathacharen, O. Venkatasami and B. Codabaccus;
- Experimental studies on acclimatization of marine shrimps, *Penaeus monodon* and *Metapenaeus monoceros* to freshwater by A. Laxminarayana, S. Rathacharen, O. Venkatasami and B. Codabaccus;
- Larval rearing techniques and stock enhancement of silver sea bream (*Rhabdosargus sarba*) in Mauritius by S. Rathacharen, S. Ramsaha, R. Hassea, S. Thacoor, I. Auliar, H. Baccus and B. Codabaccus;
- Some results of the study on rearing of the mangrove crab, *Scylla serrata*, juveniles in barachois of Mauritius by R. Hassea, S. Khadun, H. Iwamoto and T. Shimizu;
- Estimates of the growth parameters and mortality rates of dame berri (*Lethrinus mahsena*, a major commercial fish species from St. Brandon based on length frequency data by L. Mootoosamy, G. Dhunnoo and S. Soondron;
- Estimation of Maximum Sustainable Yield (MSY) for the demersal fish stocks on Saya de Malha and Nazareth banks by S. Soondron, A. Venkatasami and S. Ramkissoon; and
- Investigation into the relationship between branching coral, *Acropora* spp. and damselfish, *Stegastes* spp. in two coral reef ecosystems in Mauritius by V. Munbodhe.

10.2 Training on Vessel Monitoring System (VMS)

A five-day training course on the operation of the VMS was held at AFRC from 28 February to 04 March. Representatives from the Central Information System Division and the National Coast Guard also attended the course.

10.3 In-house training

In the context of in-house training and staff development, 25 presentations for a total duration of 43 hours were made by officers having attended meetings, workshops, seminars and training courses.

10.4 Capital Projects

The construction of a new Fisheries Post at Bambous Virieux was started in June and that of a slipway at Ville Noire in November.

10.5 Participation in exhibitions

- Display of live fresh water fish species and fun fishing at the expo-fair in the context of the World Food Day activities at Mahebourg on 16 October and Quatre Soeurs on 23 October.
- Display of fresh water species at the annual pet show organized by the MSPCA on 6 November.
- Fun fishing at the Civil Service Kermesse, Vacoas on 13 November.
- Display of activities at an exhibition organised by the Reef Conservation Mauritius at Caudan waterfront from 18 to 20 November.
- Fun fishing for “C’est la fête au village” organised by the Ministry of Tourism and Leisure at Grand Gaube on 3 and 4 December.

10.6 Attachments at AFRC

10.6.1 Student Work Experience Programme (SWEP)

Four students from the University of Mauritius were attached to the AFRC from 06 June to 22 July under the SWEP programme

10.6.2 Skills Development Programme

Four unemployed degree holders were attached to the AFRC from 8 October 2004 to 24 June 2005 to acquire skills in the work environment.

10.7 Visits to the Albion Fisheries Research Centre

The Documentation Unit/Marine Information Centre organised and coordinated visits for 8 748 persons at the Albion Fisheries Research Centre. Most of the visitors were students from the primary and secondary schools. Table 10.1 shows the number of visitors by type of institution.

Table 10.1: Visits to AFRC

Institutions	Number of visitors
Pre-primary Schools	736
Primary Schools	4 936
Secondary Schools	1 612
Social organisations/welfare centres	1 291
Pre-vocational Institutions	140
Others (tourists, private firms, university students)	33
Total	8 748

The Documentation Unit/Marine Information Centre continued in its effort to give to students, stakeholders and the general public information on fisheries, the marine environment and marine affairs.

10.8 New library holdings

A total of 299 new publications were received during 2005. These included magazines, reports, newsletter, textbooks and serials. New books and periodicals were obtained from collaborating institutions (local and foreign).

10.9 Sales of publications

Sales of publications produced by the Fisheries Division amounted to Rs. 44 620.

10.10 e-Government projects – The Government Intranet System (GINS)

In line with the Government ICT projects, most of the units of the Fisheries Division have been connected to the Government Online Centre (GOC) through the Government Intranet System. Thus, officers have access to the Internet and the Government Email Services (GES).

10.11 Information Technology (IT) Corner

IT corners were set up at AFRC and the Head Office to provide internet facilities to staff members not having direct access to such resources.

10.12 ODINAFRICA project - Phase III

The goal of the current phase of ODINAFRICA is to improve the management of coastal and marine resources and the marine environment in participating countries by enhancing data flows into the National Oceanographic Data and Information Centres (NODCs) and strengthening the capacity of these centres to analyse and interpret the data so as to develop products and increase the delivery of services to end users. The Documentation Unit/Marine Information Centre was fully involved in the project. The software Inmagic DbTextworks which is used for the cataloguing of publications was upgraded to the latest version. ODINAFRICA has developed the OdinPubAfrica repository and training was imparted in the development of electronic repositories during a workshop held in Belgium. The Documentation Unit/ Marine Information Centre also participated actively in the activities held by the National Oceanographic Data Centre (NODC) through meetings and workshops held during the year.

10.13 Management of the Fisheries Division Website

The website of the Fisheries Division was updated regularly. It was revisited following the merging of the Ministry of Fisheries with the Ministry of Agriculture, Food Technology and Natural Resources. The new website of the Ministry of Agro-Industry and Fisheries provide improved access to information and services.

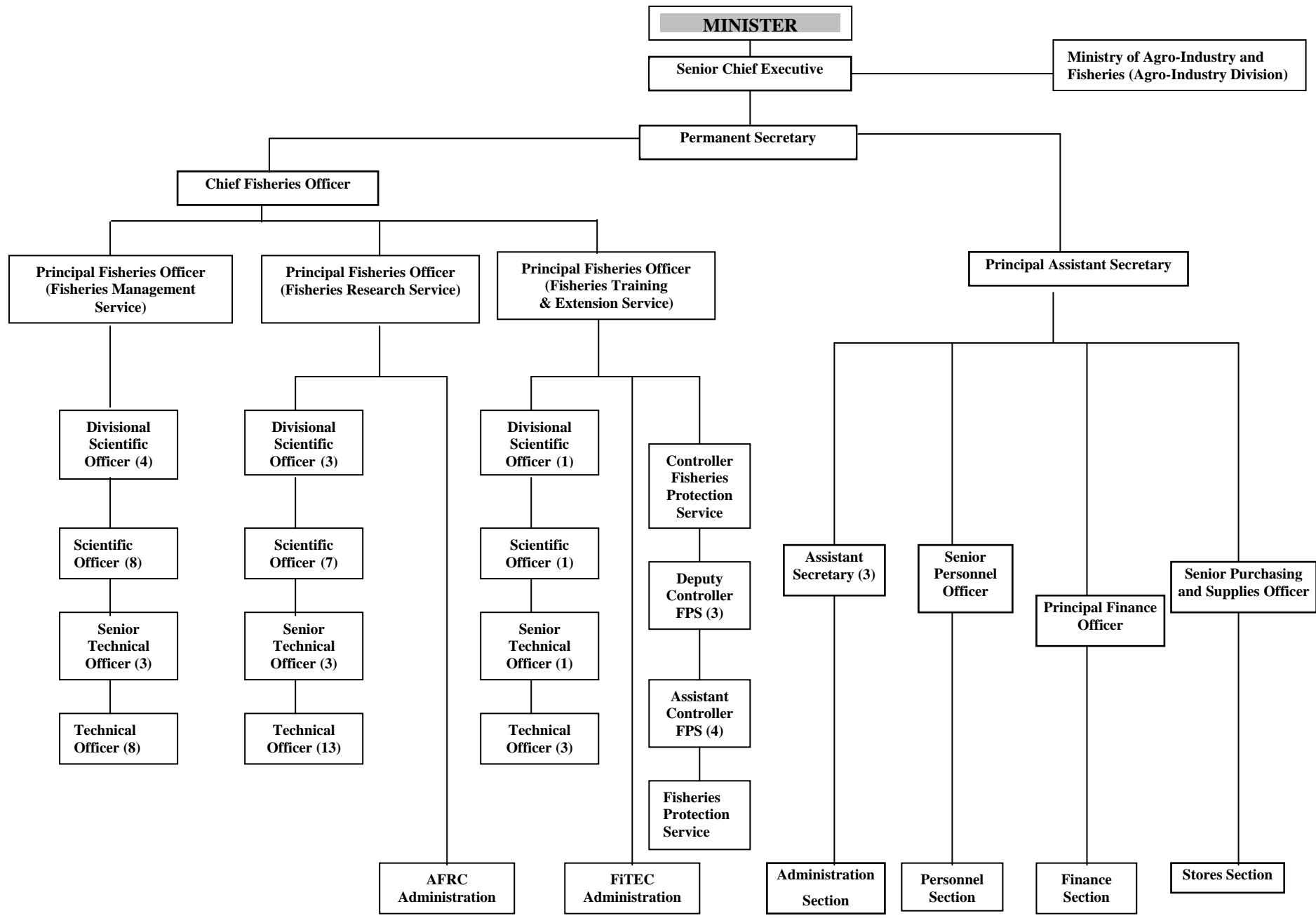
10.14 Retired

Mr. Vishwamitra Chineah, Principal Fisheries Officer, retired on 13 January. He joined the Ministry in February 1978 as Scientific Officer.

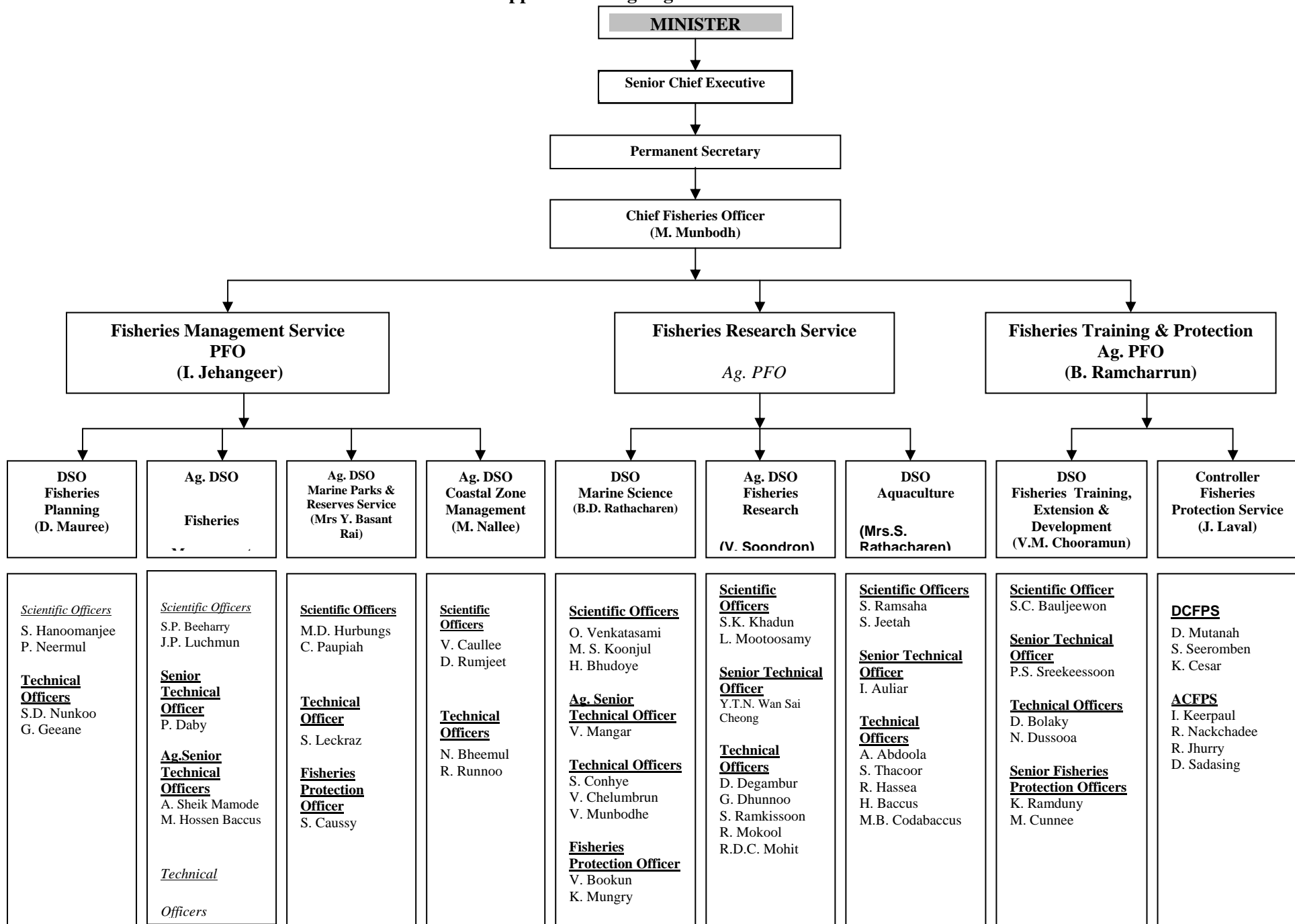
10.15 Obituary

Mr. Dhaneshwar Goorah, Principal Fisheries Officer, passed away on 08 April. He joined the Ministry as Technical Officer in December 1976, was appointed Scientific Officer in June 1977, Divisional Scientific Officer in July 1988 and Principal Fisheries Officer in April 2001. His contribution to the fisheries sector has been significant. He was posthumously awarded the President's Distinguished Service Medal (March 2006).

Appendix 1: Organigram of the Fisheries Division of the Ministry of Agro-Industry and Fisheries

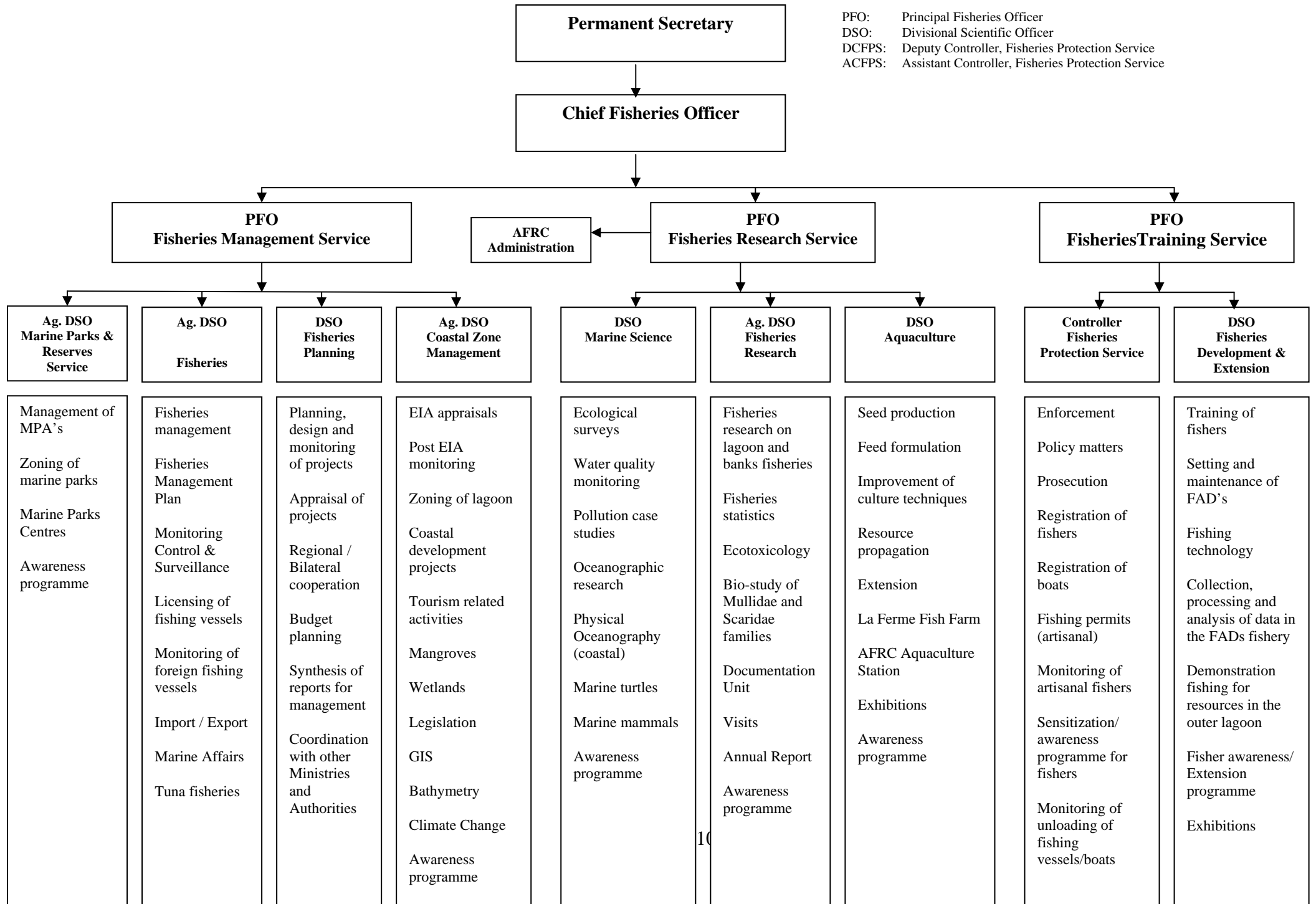


Appendix 2: Organigram of the technical services

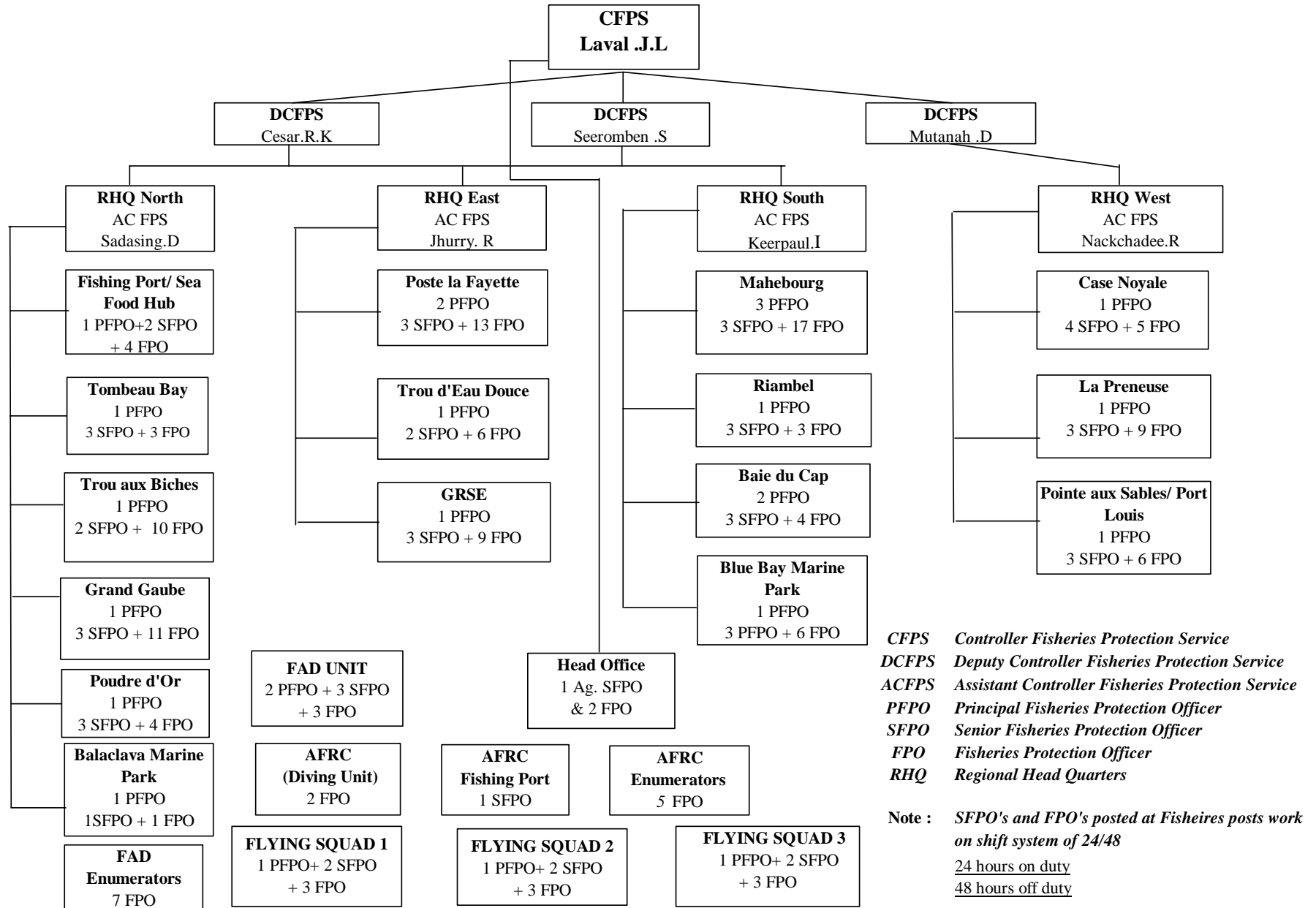


Appendix 3: Technical services staff activities

PFO: Principal Fisheries Officer
 DSO: Divisional Scientific Officer
 DCFPS: Deputy Controller, Fisheries Protection Service
 ACFPS: Assistant Controller, Fisheries Protection Service



Appendix 4: Organigram of the Fisheries Protection Service



Appendix 5: List of projects and services

Fisheries Research

Projects/services	Objective(s)	Main activities
Coastal fisheries	<ul style="list-style-type: none"> ◆ Maintain and update records of fishery statistics for estimation of fish landings and for coastal fishery management. 	<ul style="list-style-type: none"> ● Prepare sample survey programme. ● Collect and analyse data on coastal fish landings. ● Perform checks on landing stations. ● Collect and compile fishery statistics. ● Produce statistical bulletins.
Banks fisheries	<ul style="list-style-type: none"> ◆ Maintain and update records of data on offshore demersal fishery for estimation of yields and for provision of advice on their management. 	<ul style="list-style-type: none"> ● Collect, process and analyse log book data. ● Monitoring of fishing licences, quotas and fish landings. ● Advise on fishing quota. ● Advise fishing operators. ● Keep register of demersal fishing vessels.
St Brandon inshore fishery and semi-industrial chilled fish fishery	<ul style="list-style-type: none"> ◆ Determine growth parameter estimates for fish at St Brandon, Albatross, Soudan, Hawkins and small northern banks. ◆ Monitor catch and effort of the St Brandon inshore and semi-industrial chilled fish fishery, Albatross, Soudan, Hawkins and small northern banks. ◆ Analyse data for fishery management 	<ul style="list-style-type: none"> ● Effect sampling programmes for length/weight frequency data analysis. ● Collect, check, analyse and compile data from logbooks. ● Data entry of catch, effort, fishing positions, species, fishing days and estimate of catch per fisherman day.
Ecotoxicology	<ul style="list-style-type: none"> ◆ Screen toxic fish. ◆ Monitor toxic fish and harmful microalgae. 	<ul style="list-style-type: none"> ● Bioassay toxicity tests with mouse; ● Collection of microalgal samples; ● Microscopic examination of microalgae.
Fish Biology	<ul style="list-style-type: none"> ◆ Gather biological information on mullidae and scaridae families. 	<ul style="list-style-type: none"> ● Collect length-weight data. ● Check and analyse gut contents to determine feeding habits. ● Check and analyse gonads for maturity and fecundity.

Marine Science

Projects/services	Objective(s)	Main activities
Coastal Ecosystem Research	<ul style="list-style-type: none"> ◆ Long-term monitoring of the coastal ecosystem at selected sites. 	<ul style="list-style-type: none"> ● Collect data on substrate cover (coral, seagrass, algae, fish census and invertebrate counts). ● Eradication of crown of thorns. ● <i>Ad hoc</i> surveys (stranded mammals, fish mortality, M. Jacquot sewerage project). ● Observations on coral bleaching. ● Processing and analysis of data. ● Submit recommendations on new coastal development projects.
Coastal Environment Research	<ul style="list-style-type: none"> ◆ Monitor water quality in coastal waters. ◆ Monitor coliform bacteria at selected beaches. 	<ul style="list-style-type: none"> ● Collect water samples at sea. ● Record physical parameters. ● Perform chemical analysis of water. ● Investigate on cases of marine pollution and fish mortality. ● Perform tests for coliform bacteria. ● Advise on suitability of beach water for users. ● Advise on formulation of standards and guidelines for wastewater discharge.
Monitoring of pesticides and trace metals	<ul style="list-style-type: none"> ◆ Long term monitoring of pesticides and trace metals levels at eight estuaries. 	<ul style="list-style-type: none"> ● Collect water samples in estuaries. ● Record physical parameters. ● Analyse water samples.
Monitoring of ex-sand mining sites	<ul style="list-style-type: none"> ◆ Study the regeneration of ex-sand mining sites. 	<ul style="list-style-type: none"> ● Perform underwater surveys on bottom substrate. ● Estimate rate of colonisation of biota. ● Perform visual census of fish and invertebrate count.
Lagoon watch programme	<ul style="list-style-type: none"> ◆ Monitor sea surface temperature in the lagoon. 	<ul style="list-style-type: none"> ● Collect daily sea surface temperature at selected sites. ● Analysis of temperature data.

Aquaculture

Projects/services	Objective(s)	Main activities
<ul style="list-style-type: none"> • Shrimp maturation • Seed production of marine shrimps in sea water. • Acclimatisation of marine shrimps in fresh water at PL 20. • Rearing / grow out of marine shrimps in ponds. 	<ul style="list-style-type: none"> ◆ Production of acclimatised marine shrimps. 	<ul style="list-style-type: none"> • Carry out maturation and induced spawning. • Spawning of <i>P. monodon</i> in captivity and larval rearing • Production of live feeds (<i>Brachionus</i> sp., <i>Tetraselmis</i> sp., <i>Nannochloropsis</i> sp., <i>Isochrysis galbana</i> sp. and <i>Chaetoceros</i> sp.). • Maintain pure strains of the four phytoplankton. • Acclimatisation of juveniles of two species, namely <i>Penaeus monodon</i> and <i>Metapenaeus monoceros</i>.
Larval rearing, asexual reproduction and induced spawning in sea cucumbers.	<ul style="list-style-type: none"> ◆ Produce seed of sea cucumbers 	<ul style="list-style-type: none"> • Maintain and rear broodstock. • Induced spawning by two methodologies: thermal stimulation; drying and spraying by water jet. • Larval rearing of sea cucumbers.
Seabream seed production	<ul style="list-style-type: none"> ◆ Improve larval rearing techniques for the production of fingerlings for resource propagation. 	<ul style="list-style-type: none"> • Maintain and rear broodstock. • Hatchery operation and management. • Larval rearing of fish. • Release of hatchery reared juveniles in the lagoon.
Pond management and extension service	<ul style="list-style-type: none"> ◆ Grow-out of marine shrimp and sea bream for distribution and resource propagation. 	<ul style="list-style-type: none"> • Management of ponds. • Extension service to barachois farmers. • Release of fish and shrimp in the lagoon and follow-up activities.
Freshwater fish culture	<ul style="list-style-type: none"> ◆ Production and grow-out of berri rouge of two strains (Malaysian and St. Petersburg). ◆ Provide extension service for freshwater aquaculture development. ◆ Produce seed for berri rouge in sufficient quantity to service farmers. 	<p><u>Extension service</u></p> <ul style="list-style-type: none"> • Advise fish farmers in freshwater aquaculture. • Site visits and stocking of ponds. • Exhibitions.
Freshwater prawn culture Seed production of freshwater prawn	<ul style="list-style-type: none"> ◆ Maintain a broodstock ◆ Production of prawn juvenile to service farmers 	<ul style="list-style-type: none"> • Operate the prawn hatchery • Broodstock management

Marine Parks and Reserves Services

Projects/services	Objectives	Main activities
Establishment of Marine Parks	<ul style="list-style-type: none"> ◆ Construction and setting up of the Blue Bay and Balaclava Marine Park Centres. ◆ Zoning of marine parks. ◆ Management of marine parks. 	<ul style="list-style-type: none"> ● Co-ordination with project consultants for the construction of marine park centres. ● Management of marine parks. ● Delimit the different zones in the marine parks. ● Monitor and maintain buoys and floats. ● Enforcement of MPA regulations. ● Issue of MPA permits. ● Awareness on MPA.

Coastal Zone Management.

Projects/services	Objective(s)	Main activities
Coastal zone management	<ul style="list-style-type: none"> ◆ Provide services to ensure the development of coastal zone projects in a sustainable manner. 	<ul style="list-style-type: none"> ● Assessment of EIA applications and Preliminary & Environmental Reports (PER). ● Conduct post EIA monitoring. ● Carry out ecological surveys for the delimitation of swimming zones in the lagoons and public beaches. ● Effect site visits in connection with coastal development projects. ● Assess and recommend coastal development tourism related activities. ● Mangrove monitoring. ● Conduct public awareness campaigns on the sustainable development of coastal zones. ● Attend meetings.
Mangrove propagation	<ul style="list-style-type: none"> ◆ Reforestation of coastal areas. 	<ul style="list-style-type: none"> ● Identification of potential sites. ● Collection of ripe mangrove propagules. ● Plantation of propagules. ● Monitoring of growth & survival of mangrove seedlings.

Fisheries Training, Development and Extension

Project/services	Objective(s)	Main activities
FAD fishery development	<ul style="list-style-type: none"> ◆ Develop, support and maintain a FAD fishery. ◆ Encourage fishers to move to off lagoon to increase their income and hence to alleviate poverty. 	<ul style="list-style-type: none"> • FAD design and construction. • Set and maintain FADs. • Operate and manage research vessels. • Monitor FAD fishery.
Sensitisation	<ul style="list-style-type: none"> ◆ Enhance fishers` skills and knowledge in exploiting fishery resources around FADs and in the open sea. 	<ul style="list-style-type: none"> • Sensitisation meetings with fishers. • Interactive information campaigns for artisanal fishers.
Awareness campaigns Off-lagoon fishery development	<ul style="list-style-type: none"> ◆ Promote and support the development of the off-lagoon fishery. 	<ul style="list-style-type: none"> • Demonstrate fishing techniques, handling and preservation in the: <ul style="list-style-type: none"> ➢ Swordfish fishery ➢ Deepwater shrimp fishery ➢ Chilled fish fishery
Fisheries Training and Extension Centre	<ul style="list-style-type: none"> ◆ Provide training to enhance: safety and security at sea. ◆ Improve knowledge and skills of fishers to operate in the off lagoon. ◆ Relocate fishermen from the heavily exploited lagoon areas to the open sea, with a view to increasing their catch and concurrently reducing fishing pressure in the lagoon. ◆ Standardise and harmonise procedures at level of Fisheries Posts and improve management capabilities of subordinate staff. 	<ul style="list-style-type: none"> • Training of fishers. • Training of fishers in the FAD fishery. • Training of mid-management staff of the Fisheries Protection Service.

Fisheries Management

Projects/services	Objective(s)	Main activities
Monitoring of Fishing vessels	♦ Monitor movement and operation of fishing vessels.	<ul style="list-style-type: none"> • Collect fishing log book. • Record movement of vessels. • Enforce licence conditions. • Check licences and relevant documents (foreign vessels). • Give clearance for departures and arrivals. • Check safety equipment. • Monitor transshipment activities.
Licensing of fishing vessels	♦ Provide support for fishery management.	<ul style="list-style-type: none"> • Issue licences to Mauritian and foreign fishing vessels. • Allocation and monitoring of catch quota.
Fish imports and exports	♦ Provide services for import and export of fish and fish products.	<ul style="list-style-type: none"> • Process and issue import permits. • Inspect imported products. • Follow up on fish trade issues. • Advise importers/exporters/fish sellers on quality norms. • Monitor fish supply on the local market.
Support services to the seafood hub	♦ Provide a one stop shop service.	<ul style="list-style-type: none"> • Monitor all fishing vessels calling at Port Louis. • Issue of landing permits for imported fish and fish products. • Give authorisations for exports. • Survey and give clearance to bank fishing vessels prior to departure.
Vessel Monitoring System	♦ Monitor the position and movement of all licensed fishing vessels.	<ul style="list-style-type: none"> • Monitor of every licensed vessel's position at regular time intervals. • Receive and securely store all position reports received from fishing vessels. • Provide, via electronic communications, selected information from the VMS to other interested parties such as the Coast Guard. • Generate reports summarising the movement of fishing vessels.
Pelagic fisheries	♦ Collect basic data on tuna and billfish fisheries.	<ul style="list-style-type: none"> • Collect, process and analyse tuna and swordfish data in relation to the study of stock structure, spatial distribution, migration, catch rates and biology. • Maintain and update records of licensed tuna vessels. • Exchange data with IOTC.

Fisheries Planning

Projects/services	Objective(s)	Main activities
Project proposals	<ul style="list-style-type: none"> ◆ Formulate new projects. 	<ul style="list-style-type: none"> ● Identify needs for fisheries sector. ● Prepare project write-up. ● Financial analysis of projects and reporting. ● <u>Oversee project implementation.</u>
National / regional / bilateral / multilateral cooperation	<ul style="list-style-type: none"> ◆ Coordinate matters related to regional/bilateral issues. ◆ Cooperate with other countries. ◆ Cooperate with other local institutions. 	<ul style="list-style-type: none"> ● Follow-up on projects. ● Assist in evolving of fisheries policies with respect to EU, WTO, SADC, COMESA, NEPAD, IOR-ARC, SWIOFC, and FAO. ● Liaison and collaboration with other organisations.

Appendix 6: Meetings, workshops, seminars and courses attended by officers

Subject	Venue	Date	Officer
1 st Consultative Workshop on the Strategic partnership for a Sustainable Fisheries Investment Fund in Sub Saharan Africa	Dakar, Senegal	18 – 21 Jan	Mr. M. Munbodh
IOTC – OFCF Regional Workshop for the Improvement of the Database Management Systems	Victoria, Seychelles	21 – 26 Feb	Mr. N. Wan Sai Cheong
Workshop on Aquatic Ecotoxicology	University of Mauritius	23 Feb - 08 Mar	Mrs. R. Mokool
Workshop on the Southern African vision for water, life and environment in the 21 st century	Domaine Les Pailles, Mauritius	02 Mar	Mrs. S. Thacoor
26 th Session of the FAO Committee on Fisheries	Rome, Italy	07 – 11 Mar	Mr. P. Jhugroo Mr. I. Jehangeer
Field Survey at St Brandon under the TCP (FAO)	St Brandon	11 - 20 Mar	Mr. L. Mootosamy Mr. G. Dhunoo
1 st African Conference on quality management in the nuclear industry and research laboratory in the AFRA region	Gold Crest Hotel, Mauritius	17 - 18 Mar	Mrs. V. Chelumbrun
Joint International Atomic Energy Agency (IAEA) – United Nations Educational, Scientific and Cultural Organisation (UNESCO) Expedition	Flic en Flac, Mauritius	21 - 24 Mar	Mr. S. Conhye
3 rd Meeting of the Signatory States of the MoU on the Conservation and Management of Marine Turtles and Their Habitats of the Indian Ocean and South East Asia	Bangkok, Thailand	29 - 31 Mar	Mrs. M. S. Koonjul
Seminar to promote regional cooperation for the sound management of the EEZ of the United Republic of Tanzania	Bagamoyo, Tanzania	12 - 13 Apr	Mr. S.P. Beeharry
5 th Intergovernmental Consultation Meeting on the setting up of the South Indian Ocean Fisheries Agreement (SIOFA) and SWIO Commission	Mombassa, Kenya	16 – 22 Apr	Mr. B. Ramcharrun
FAO/WTO/INFOSA Workshop on the WTO and Fisheries	Windhoek, Namibia	18 – 22 Apr	Mr. S. Hanoomanjee
Working Visit to Spain	Spain	01 – 08 May	Mr. P. Jhugroo Mr. D. Mauree
First Meeting of the Fisheries Focal Points of the Indian Ocean Rim Association for Regional Cooperation	Oman	02 – 04 May	Mr. P. Neermul
South West Indian Ocean Fisheries Project (SWIOFP) – Combined working group meeting	Maputo, Mozambique	09 – 12 May	Mr. A. Venkatasami Mr. S. Soondron Mr. D. Norungee
Regional Exclusive Economic Zone	Mombassa, Kenya	10 - 20 May	Mr. R.Hossen Baccus

Course			
Meeting of the Regional Policy Trade Forum	Nairobi, Kenya	11 May	Mr. D. Mauree
Training Course on Monitoring and Evaluation of the FAD Fishery	St. Pierre, Mauritius	16 – 28 May	Mr. S.C. Bauljeewon
9 th Session of the Indian Ocean Tuna Commission (IOTC)	Victoria, Seychelles	30 May – 3 Jun	Mr. I. Jehangeer
Regional Workshop on Fisheries Partnership Agreements for the Western Indian Ocean States	Dar-es-Salaam, Tanzania	20 – 21 Jun	Mr. M. Munbodh
2 nd Consultative Workshop on the Strategic Partnership of a Sustainable Fisheries Investment Fund in Large marine Ecosystems of Sub Saharan Africa	Dar-es-Salaam, Tanzania	22 – 24 Jun	Mr. M. Munbodh
Senior Officials Meeting on WTO Fisheries Subsidies Disciplines and Fisheries Issues in the EPA Negotiations	Maputo, Mozambique	23 - 24 Jun	Mr. D. Mauree
Workshop on Socio-economic Monitoring	Mombassa, Kenya	27 – 28 Jun	Mr. N. Bheemul
Workshop on Marine Biodiversity Data Management	Veranda Hotel, Mauritius	22 - 27 Aug	Mrs. R. Mokool
4 th Western Indian Ocean Marine Science Association (WIOMSA) Symposium	Grand Bay Conference Centre, Mauritius	30 Aug -01 Sep	Mr. L. Mootosamy
United Nations University – Fisheries Training Programme (UNU-FTP) Marine and Inland Waters Resources Assessment and Monitoring	Reykjavik, Iceland	01 Sep 2005 – 24 Feb 2006	Mr. D. Degambur
United Nations University – Fisheries Training Programme (UNU-FTP) Aquatic Environmental Assessment and Monitoring	Reykjavik, Iceland	01 Sep 2005 – 24 Feb 2006	Mr. R.D.C. Mohit
Training course on warm water fish production	Cairo, Egypt	03 Sep – 11 Dec	Mrs. I. Auliar
5 th Plenary Meeting of the South West Indian Ocean Fisheries Project (SWIOFP)	Maputo, Mozambique	13 – 16 Sep	Mr. A. Venkatasami Mr. S. Soondron
1 st Steering Committee for the Pilot Project for the Monitoring, Control and Surveillance (MCS) of Large Pelagics in the Indian Ocean	Mauritius	10 - 13 Oct	Mr. I. Jehangeer Mr. D. Norungee Mr. S.P. Beeharry
Workshop on Patent Searching and Drafting of Patent Claims	University of Technology, Mauritius	20 – 21 Oct	Mrs. Y. Basant Rai
24 th Meeting of the Commission for the Conservation of Antarctic Marine Living Resources (CCAMLR)	Hobart, Australia	25 Oct - 05 Nov	Mr. D. Norungee Mr. J. P. Luchmun.
NODC – Workshop on Data and Information Needs for Integrated	Flic en Flac, Mauritius	27 – 28 Oct	Mrs. M. S. Koonjul Mrs. O. Venkatasami

Coastal Area Management (ICAM)			Mrs. S. Ramkissoon Mr. N. Bheemul
South West Indian Ocean Fisheries Commission – Workshop on Shrimp By-catch and Ecosystem Approach to Fisheries Management	Maputo, Mozambique	15 - 25 Nov	Mr. G. Dhunnoo Mr. S. P. Beeharry
Laboratory Accreditation	Mauritius Standard Bureau	17 - 21 Nov	Mr. H. Bhudoye Mrs. V. Chelumbrun
Workshop on Applied Plankton Ecology	University of Mauritius	05 - 16 Dec	Mrs. R. Mokool
OdinPubAfrica Training Course	Oostende, Belgium	05 - 09 Dec	Mrs. C. Lim Shung
3 rd National Ocean Science Forum	Grand Bay Conference Centre, Mauritius	29 Dec	Mr. S. Khadun Mrs. S. Ramkissoon Mr. L. Mootosamy

Appendix 7: Missions and visits

Name of visitor	Institution	Purpose	Date
Mr. J. Andersson	FAO	Training in MS Access	17 Feb
Mr. K. Jones	Bluefinger Ltd, UK	Setting up of the Vessel Monitoring System?	28 Feb – 4 Mar
Mr. Don Steel			
Mr. R. Shotton	FAO	Assess progress of work on St. Brandon Fish Stock Assessment Project	11 - 17 Apr
Mr. P. Beesudee	CEFAS Laboratory, UK	Visit in the capacity of EU delegate for information gathering purposes	02 Jun
Mr. H. Kawasaki	JICA	Cooperation with Japan	12 Aug
Mr. S. Sakurai			
Mr. N. Sarti	Department of Fisheries, Western Australia	Progress visit with regards to MoU	10 – 16 Sept
Mr. P. Millington			
Mr. K. Ida	IC Net Ltd, Japan	Cooperation with Japan	13 Oct
Mr. H. Rasoanarivo	JICA, Madagascar	Cooperation with Japan	13 Oct
Mr. R. Shotton	FAO	Assess progress of work on St. Brandon Fish Stock Assessment Project	18 – 31 Oct
Mr. T. Samsudeen	Indian Ocean Rim Association for Regional Cooperation	Courtesy visit	19 Oct
Mr. F. Karimian			
Mr. T. Nakanishi	System Scie and Consultant Inc., Japan	Inspection of the Fisheries Training and Extension Centre (FiTEC) after one-year warranty period	20 – 26 Oct
Mr. H. Sakurai	Nippon Koei Co. Ltd., Japan	Inspection of the Fisheries Training and Extension Centre (FiTEC) after one-year warranty period	20 – 26 Oct
Mr. D. Nicholls	Department of Fisheries, Western Australia	Assess fish handling, processing and marketing	5 – 25 Nov
Mr. T. Asgeirsson	United Nations University – Fisheries Training Programme, Iceland	Conduct interviews with officers for training in Iceland	23 – 24 Nov
Mr. I. Scott	Poseidon Aquatic Resources Management Ltd, UK	Fisheries Sector Policy Study	28 Nov – 16 Dec
Mr. T. Huntington			

Appendix 8: Environmental Impact Assessment (EIA) for coastal projects

- Flic en Flac - Installation of buoys and floats for the demarcation of swimming zone
- Black River Gorge - Problems related to hawkers
- Pamplemousses - Residential morcellement at Pont Praslin
- Le Souffleur - Proposed agricultural subdivision of land
- Belle Mare – Beau Rivage - Proposed construction of a Helipad
- Pointe aux Cannonier – Le Cannonier Hotel - Upgrading of beach facilities
- Mon Choisy – Public Beach - Proposed Nautical Centre
- Bain Boeuf - Proposed project for the construction of 83 Residential Units comprising penhouse duplexes and studios
- Bel Ombre – Salt lake Resorts Ltd - Proposed coastal improvement works
- La Tour Koenig - Relocation of gardening plant
- Grand Baie - Proposed construction of a heliport
- Pamplemousses - Construction of a residential morcellement at Ville Bague
- Pamplemousses - Proposed residential morcellement at Butte aux Papayes Hill
- Harel Freres - Residential Morcellement at Balaclava
- La Flora - Proposed Agricultural Morcellement at La Flora
- SSR Airport - Proposed construction of Cooperate/General Aviation Facilities at SSR International Airport
- Beau Bassin - Proposed construction of apartments
- Trou aux Biches - Housing and apartment
- Tamarin - Agricultural Morcellement Yemen
- Morcellement St. André - Proposed residential Morcellement St André
- Case Noyale - Proposed housing project
- Goodlands - Proposed VRS residential morcellement project
- Cluny - Proposed agricultural morcellement
- Trianon - Proposed residential morcellement
- Butte aux Papaye - Proposed residential morcellement
- Arsenal - Proposed residential morcellement
- Mahebourg - Proposed housing projects of 78 apartments
- Tamarin - Proposed agricultural subdivision of lands
- Souillac - Proposed parcelling our and provision of infrastructure works to NHDC site
- Roche Bois - Proposed relocation of existing fertiliser, production unit from Freeport zone 6 to Roche Bois
- Bel Ombre - Proposed monkey breeding farm at Frederica
- Trianon - Proposed residential morcellement
- Pailles Industrial Zone - Proposed factory for storage and sale of chemical substances at Pailles
- Plaine Wilhems - Proposed residential morcellement at Cinq Arpents, Plaine Wilhems for State Land Development Co. Ltd
- Souillac - Proposed residential morcellement at Terracine, Souillac for Union Sugar Estates Co. Ltd
- Petit Raffray - Proposed residential morcellement
- Richelieu - Proposed incinerator plant at Richelieu Station
- Montagne Blanche - Proposed refining of used oil at Montagne Blanche for Virgin Oil Company Ltd
- Fort Victoria - Proposed redevelopment of Fort Victoria Station
- Black River - Hotel Development at Les Salines
- La Marie - Proposed residential and commercial morcellement at la Marie
- Pamplemousses - Proposed residential morcellement at Madame Cayeux
- Grand Gaube - Proposed Housing project at Grand Gaube

Appendix 9: Site surveys

- South East Highway project for an application for the removal of mangrove trees along River Champagne.
- Pointe-aux-Roches, Riambel in connection with the construction of Ananda Spa Hotel.
- Illegal backfilling and felling of mangroves at Le Barachois Restaurant, Bambous Virieux.
- Deforestation of land adjacent to “Le Shandrani Hotel” at Le Chaland.
- Dolphins Watching at Riviere Noires.
- Construction of a 15 m groyne at the Frangipane Beach of the Tousserok.
- Ile des Deux Cocos following the passage of cyclone “Hennie “
- Cite La Chaux, Mahebourg, i.c.w the lease of a plot of State land to one Mr. Gervais Lamarque.
- Landscaping works to be carried out at the Pointe Jerome ex. sand mining site.
- Trou d’Eau Douce village i.c.w the presence of a pile of loose rocks in the lagoon.
- Demarcation of one swimming zone in front the wild beach of La Cambuse, Blue Bay Marine Park.
- Handing over the site of works, in respect of the construction of a slipway at Ville Noire, Mahebourg.
- Removal of mangrove trees for the construction of a new bridge at River Champagne, Ferney for the South Eastern Highway Project.
- Project site office, Pointe-aux-Roches, St. Felix in connection with the construction of Ananda Spa, which is a 5-star hotel.
- Extension of the Public Beach at Flic-en-Flac (near Villa Caroline).
- Converting an existing building into a restaurant and tourist shop at Pointe d’Esny.
- Removal of mangrove trees for the construction of a new bridge at River Champagne, Ferney for the South Eastern Highway Project.
- Belle Mare plage hotel - Firework display in the lagoon
- Balaclava region - Relocation of alternative sites for the construction of Balaclava Marine Park Service
- Site visit to Balaclava Marine Park site - Cleaning the site form shrubs and bushes
- Mon Choisy - Construction of a Nautical Centre
- Pointe aux Cannoniers - EIA site visit in connection with beach work at Le Cannonier Hotel
- Pereybere - Housing development projects
- Pereybere - Coastal erosion problem
- Cap Malheureux and Pereybere - Residential development
- Palmar - Demarcation of swimming zone at Le Plamar Beach Resort Hotel
- Mon Choisy lagoon - Submarine operation
- Pereybere and Cap Malheureux - Development projects
- Grand Bay and Pereybere - Development projects
- St Francois - Complaints from fishermen of the region relating to illegal occupancy at St. Francis Fish Landing Station
- Rivulet Terre Rouge - EIA for the construction of a fertilizer wharf in the Freeport zone.
- Trou aux Biches and Pointe aux Piment - Visits to Aquarium for monitoring purpose
- Pereybere lagoon - *In-situ* observations of mooring buoys at dive sites
- Belle Mare - Extension of existing golf course at Belle Mare

Appendix 10: Recurrent revenue for the financial year 2004/2005 (Rs. '000)

Item No./Sub-item	Description	Amount	Remarks
44-062.001	Sale of produce	218	Receipts from sale of fish, e.g. berri rouge fingerlings, camaron, berri rouge juveniles and harvest size, red-claw, etc. from AFRC and LFFF
44-062.002	Fishing vessel licence fees	37 787	Payment of new licences and renewal of licence fees where applicable (Non-EU, EU, Japanese and Seychelles vessels)
44-062.003	Fees for import permits	3 492	Fees in connection with import of frozen and chilled fish, fish products and shells, etc.

Appendix 11: Recurrent expenditure for the financial year 2004/2005 (Rs. '000)

Item	Details	Amount
	TOTAL EXPENDITURE	115 439
	<i>TOTAL PERSONAL EMOLUMENTS</i>	<i>75 986</i>
	<i>TOTAL OTHER STAFF COSTS</i>	<i>10 837</i>
	<i>TOTAL OTHER GOODS AND SERVICES</i>	<i>24 646</i>
	<i>CONTRIBUTIONS AND TRANSFERS</i>	<i>3 970</i>
	<i>TOTAL OTHER CHARGES</i>	<i>39 453</i>
001	TOTAL PERSONAL EMOLUMENTS	75 986
002	Wages	663
003	Travelling and transport	8 530
010	Staff Welfare	25
011	Fees to Chairman and Members of Boards and Committees	
012	Overtime	1 619
	TOTAL OTHERS STAFF COSTS	10 837
050	Office expenses and incidentals	326
051	Telephone bills	1 424
052	Rent	3 968
053	Maintenance and running of vehicles	2 244
054	Office equipment and furniture	221
055	Maintenance of building, grounds, plant and equipment	3 118
056	Training of Staff	23
057	IT Facilities	24
059	Electricity Charges	1 994
060	Water Rates	425
061	Publications	142
101	Uniforms	1 067
113	Security Services	1 494
119	Seminars	
136	Compensation to Net Fisherman	534
167	Postage Stamps	60
174	Fisheries Training & Extension Centre	2 406
176	Printing and Stationery	447
192	Fisheries Research	3 076
199	Other Operating Expenses	450
201	One Stop Shop (Sea Food Hub)	1 203
	TOTAL OTHER GOODS AND SERVICES	24 646
418	Fishermen Welfare Fund	3 253
500	Contribution to International Organisation(s)	717
	CONTRIBUTIONS AND TRANSFERS	3 970

Appendix 12: Statement of capital expenditure for financial year 2004/2005 (Rs ‘000)

Item	Project Title	Amount
001	Fisheries Development	6 589
002	Marine Parks and Conservation Project	264
003	Marine Environment Monitoring Programme in the Chagos Archipelagos	-
004	Demarcation of Swimming Zones in Lagoon	325
005	Construction/Upgrading of Fisheries Post	1 784
006	Construction/Extension of Building at Albion Fisheries Research Centre	-
007	Construction of a Fisheries Training and Extension Centre	88 606
008	Construction of a “Debarcadere” at Grand Baie	-
	Total	97 568

Appendix 13: Sale of publications

Title	Unit price (Rs.)
Poissons Commerciaux du Sud-Ouest de l’Ocean Indien (Guide)	110
Field Guide to Coastal Fishes of Mauritius	200
Basic Biostatistics for Marine Biologists (Textbook)	100
Field Guide to Corals of Mauritius	250
Common Corals of Mauritius (Poster)	80
Common Coral Reef Fishes of Mauritius (Poster)	80
Bathymetric Charts: A. Ile Maurice B. Ile Maurice Nord I C. Ile Maurice Nord II D. Banc Soudan E. Banc Hawkins F. Rodrigues Ouest G. Ile Rodrigues	50
Thematic Maps for coastal areas: – Format A4 – Format A3 – Format 36’’x 44’’	55 110 440

