1. Fisheries Research

1.1 Coastal (artisanal) fishery

Data from the artisanal fishery were collected on a monthly basis at 25 selected fish landing stations to estimate the catch and effort by fish species and gear type. During the year, 3 766 landings were thus recorded. .

1.1.1 Catch, effort and catch per fisherman day

The production of fresh fish was estimated at 682 tonnes and comprised 367 tonnes from the lagoon and 315 tonnes from off-lagoon areas. Compared to 2007, the estimated catch from both the lagoon and off lagoon increased by 42 tonnes mainly on account of good weather conditions prevailing during the month of December. The average catch per fisherman-day (CPFD) for the lagoon and off-lagoon areas was 5.6kg and was higher than that in 2007. Table 1.1 and figure 1.1 and 1.2 show the catch, number of fisherman-days and CPFD.

Table 1.1: Catch, fisherman-days and CPFD

Year	Catch (t)			Fisherman-days			CPFD (kg)		
	L	OL	Total	L	OL	Total	L	OL	M
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
2006	579	371	950	145 089	68 961	214 050	4.0	5.4	4.4
2007	354	286	640	93 261	51 622	144 883	3.8	5.5	4.4
2008	367	315	682	77 719	44 248	121 967	4.7	7.1	5.6

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

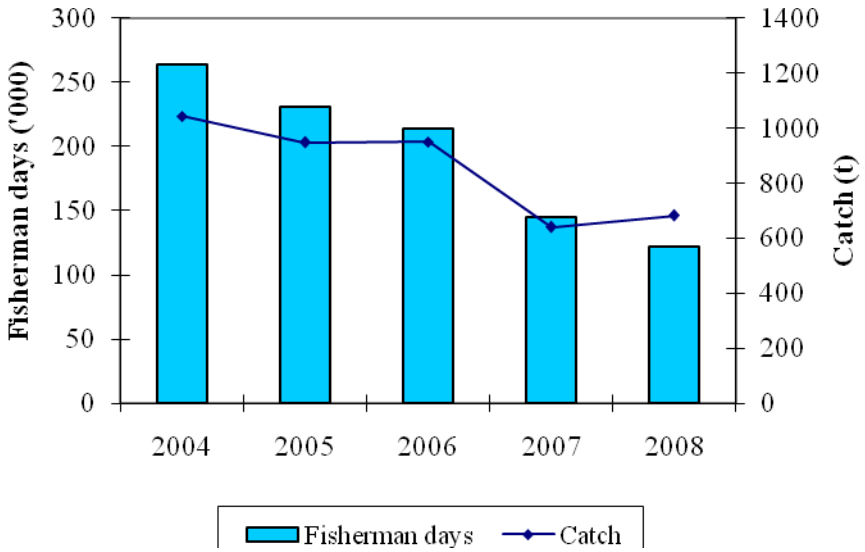


Figure 1.1: Fisherman-days and total catch

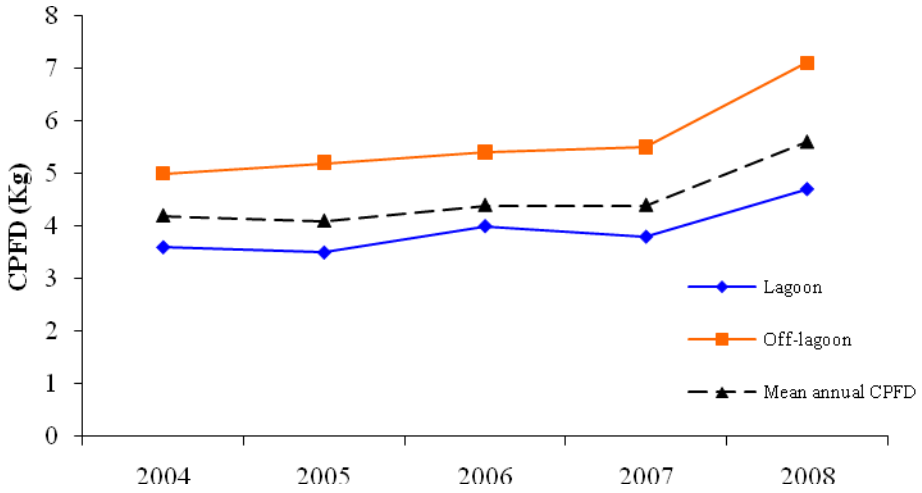


Figure 1.2: Catch per fisherman-day

1.1.2 Monthly landings

The monthly production of fresh fish from the lagoon and off-lagoon, value of catch, effort and CPFD are presented in table 1.2. Peak landings were recorded in the months of March, May, August and December.

Table 1.2: Monthly catch with value, effort and CPFD

Month	Catch (t)			Value(MR)	Fisherman days	CPFD (kg)		
	L	OL	Total			L	OL	Mean
January	16	26	42	7.3	9 367	3.9	5.1	4.6
February	19	11	30	4.5	7 400	3.7	4.7	4.0
March	38	39	77	11.6	12 790	5.3	6.9	6.0
April	39	21	60	9.3	10 268	5.4	7.2	5.9
May	60	26	86	12.8	12 784	6.7	6.7	6.7
June	30	10	40	6.6	8 714	4.3	5.9	4.6
July	25	8	33	4.2	9 144	3.2	5.2	3.5
August	35	35	70	10.0	11 968	4.7	7.9	5.9
September	32	17	49	7.5	9 717	4.7	5.9	5.0
October	18	12	30	4.5	7 258	3.7	5.3	4.2
November	18	42	60	9.6	9 269	4.1	8.4	6.4
December	37	68	105	14.6	13 288	5.4	10.4	7.9
Total	**367**	**315**	**682**	**102.5**	**121 967**			

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

1.1.3 Catch by gear

Sixteen large nets and four gill nets were in operation during the year. Other gears used were basket traps, hooks and lines, harpoons and a combination of basket traps and hooks and lines. A decrease in catch was observed for basket trap with line (BTL) and gill net fishing, while fishing by lines, basket traps and large nets showed increased catches. 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
2004	285 832	425 327	54 874	168 069	11 300	97 402	**1 042 804**
2005	288 818	433 832	16 786	121 521	8 196	78 165	**947 318**
2006	303 675	343 794	19 608	201 122	11 298	70 501	**949 998**
2007	169 963	251 233	16 227	132 656	7 565	62 426	**640 070**
2008	178 656	270 923	13 920	143 644	6 669	68 171	**681 983**

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

1.1.4 Fishermen

A total of 2 028 fishermen were involved in fishing activities. The number of fishermen by gear type for the past five years is presented in table 1.4. A 2% decrease in the number of active fishermen was noted in 2008 as compared to 2007.

Table 1.4: Number of fishermen by gear type

Year	BT	L/H/OF	BT/L	LN	GN	Total
2004	445	896	736	159	20	**2 256**
2005	493	789	689	189	14	**2 174**
2006	275	764	1 111	149	13	**2 312**
2007	283	770	876	137	12	**2 078**
2008	275	795	807	138	13	**2 028**

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

1.1.5 Price of fish

Table 1.5 shows the yearly average price of fresh fish. An overall increase was noted in the price of fresh fish.

Table 1.5: Yearly average retail price of fresh fish (Rs/kg)

Fish	2004	2005	2006	2007	2008
Homard	495	515	550	600	680
Crabe & crevette	275	290	275	320	320
Vieille rouge	190	215	230	255	275
Vacoas, sacréchien	160	160	175	175	210
Capitaine	155	170	170	180	200
Dame berri	140	150	170	170	190
Octopus	105	125	130	135	150
Carangue	115	115	120	130	150
Cordonnier	100	105	115	120	140
Rouget, tuna	90	95	110	115	135
Mullet voilé	85	95	100	105	130
Bordemar	100	95	90	110	135
Licorne	100	115	115	125	150
Cateau	75	70	85	90	105
Shark	45	45	50	50	50
Other fish	55	65	65	75	80

1.1.6 Study on net fishery

The study on net fishery which started in 2007 was continued. Data collected by the FPS regarding large nets and gill nets were also compiled. Data on fish landed were collected from Case Noyale, Grand Gaube, and Trou d'Eau Douce where 260 specimens of fish were sampled. Details are given in table 1.6.

Table 1.6: Fish sampled with size range

Species		Size range (min & max)	
Common name	**Scientific name**	**Length (mm)**	**Weight (g)**
Mullet sec	*Valamugil seheli*	500 - 525	1 100 – 1 670
Breton	*Gerres oyena*	240 – 333	240 - 500
Batardet	*Lethrinus harak*	260 – 370	310 - 810
Mullet voile	*Mugil cephalus*	420 – 505	790 – 1 380
Carangue	*Caranx sp.*	260 – 425	220 – 810
Capitaine	*Lethrinus nebulosus*	280 – 450	320 - 960
Cordonnier	*Siganus sutor*	225 – 380	170 – 1 100
Dame berri	*Lethrinus mahsena*	260 – 320	335 - 590
Rouget	*Parupeneus sp.*	265 – 340	200 – 470
Guele pavee	*Rhabdosargus sarba*	292 – 418	350 – 1 250
Sisar	*Decapterus macarellus*	240 – 330	150 - 460

1.2 Banks fishery

Seven vessels were engaged in fishing activities in the shallow waters of the Albatross, Nazareth and Saya de Malha banks. Fourteen fishing trips were carried out in 2008 and particulars of the fishing vessels are given in table 1.7.

Table 1.7: Particulars of the fishing fleet

Vessel	LOA (m)	GRT (t)	Hold (t)	Crew	Fishermen	Joined in
Silver Star 2 (ex-Noorstar 2)	51	300	200	18	54	1992
Shandrani	55	398	300	35	60	1994
Hoi Siong 5	45	315	180	20	72	1996
Shandrani 2	42	449	130	30	45	2002
Talbot IV*	44	317	176	28	57	1989
Bethu*	55	391	196	17	54	2005
Diego Star* (ex-Hoi Siong 2)	54	388	190	16	50	2005

LOA: Length overall; GRT: Gross registered tonnage * under foreign flag

1.2.1 Production of frozen fish

A total of 1 694 tonnes of frozen fish was landed which comprised lethrinids (90.9 %), snappers and groupers (7.9 %) and tuna and others (1.2 %). Table 1.8 shows the annual catch from the different fishing areas and figure 1.3 illustrates the trend in catch. Table 1.9 shows the fishing effort and catch from the different banks. It is to be noted that no fishing was carried out in the Chagos Archipelago area.

Table 1.8: Annual catch (t) of frozen fish by fishing area/bank

Year	No. of vessels	Catch (t)				Total catch
		Albatross	Nazareth	Saya de Malha	Chagos Archipelago	
1999	13	226	1 121	2 107	127	3 581
2000	12	141	1 080	2 099	312	3 632
2001	11	202	1 366	1 283	228	3 079
2002	10	55	918	2 090	223	3 286
2003	9	37	468	2 354	235	3 094
2004	8	21	855	1 686	117	2 679
2005	7	36	578	1 028	0	1 642
2006	10	54	777	1 645	136	2 612
2007	7	10	506	1 481	130	2 127
2008	7	6	722	966	0	1 694

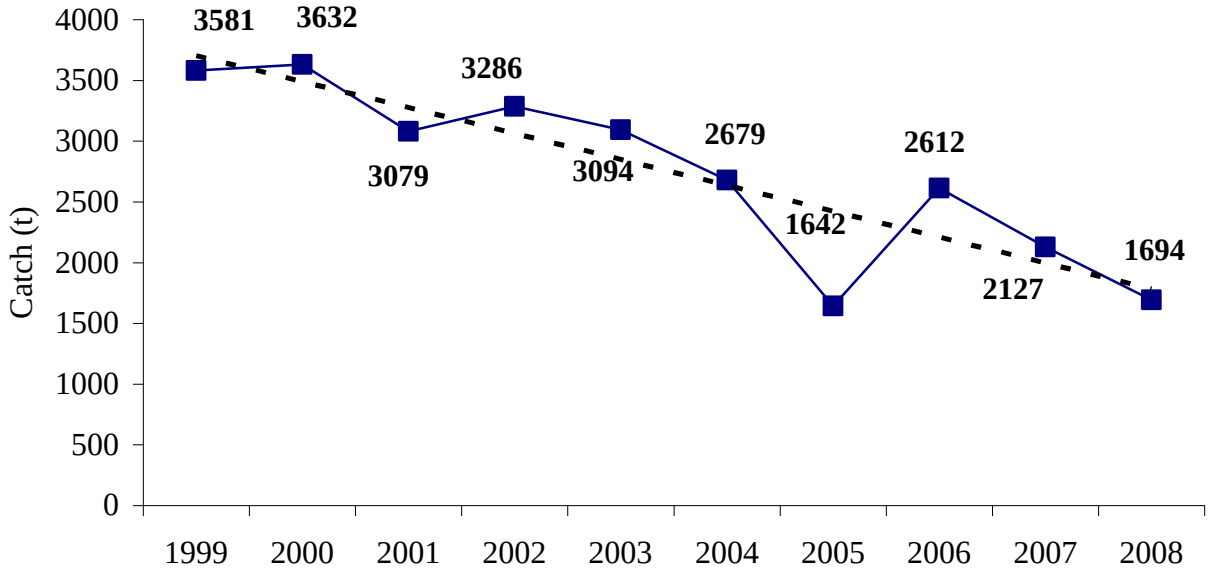


Figure 1.3: Trend in catch for the banks fishery 1999-2008

Table 1.9: Fishing effort, catch (t) and catch per fisherman day (kg) by fishing areas

Fishing areas	Fishing days	Bad weather days	Fisherman days	Catch (t)	CPFD (kg)	Total catch (%)
Saya de Malha	262	101	12 759	966	75.7	57.0
Nazareth	169	79	8 405	722	85.9	42.6
Albatross	3	0	160	6	37.5	0.4
Chagos Archipelago	0	0	0	0	0.0	0.0
Total	**434**	**180**	**21 324**	**1 694**	**79.4(ave)**	**100.0**

1.2.2 Comparative analysis of data from Nazareth and Saya de Malha banks

The effort, catch and CPFD for the Nazareth and Saya de Malha banks are given in table 1.10.

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

Year	Nazareth bank			Saya de Malha bank		
	Effort	Catch	CPFD	Effort	Catch	CPFD
2004	10 154	855	84.2	23 729	1 686	71.0
2005	7 675	578	75.2	12 663	1 028	81.2
2006	9 627	777	80.7	23 233	1 645	70.8
2007	5 262	506	96.2	19 473	1 481	76.1
2008	8 405	722	85.9	12 759	966	75.7

The CPFD was 85.9 kg on the Nazareth bank compared to 75.7 kg on the Saya de Malha bank. The trend in CPFD from the two banks is shown in figure 1.4.

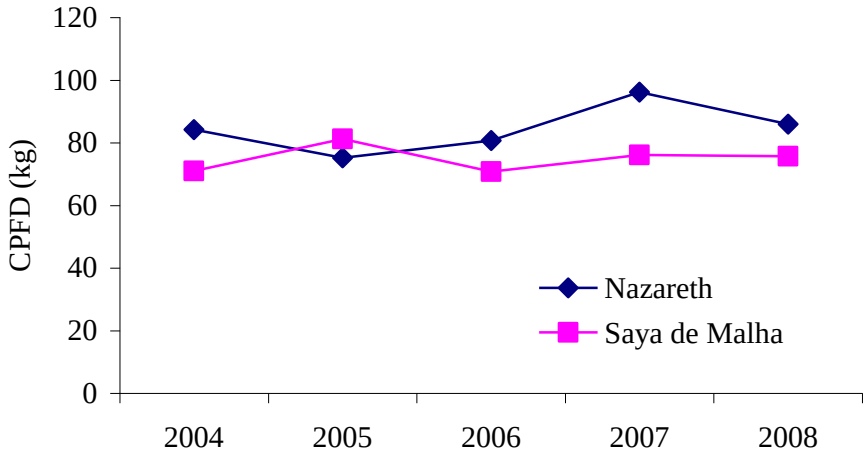


Figure 1.4: Trends in CPFD for the Nazareth and the Saya de Malha banks 2004-2008

1.2.3 Length frequency distribution of *Lethrinus mahsena*

Length frequency data on samples of *Lethrinus mahsena* were collected during unloading of fishing vessels. The number of fishes sampled from the Nazareth and Saya de Malha banks were 939 and 2 106 and the lengths ranged from 260 to 520 mm and 230 to 580 mm, respectively. The length frequency distributions are shown in figures 1.5 and 1.6.

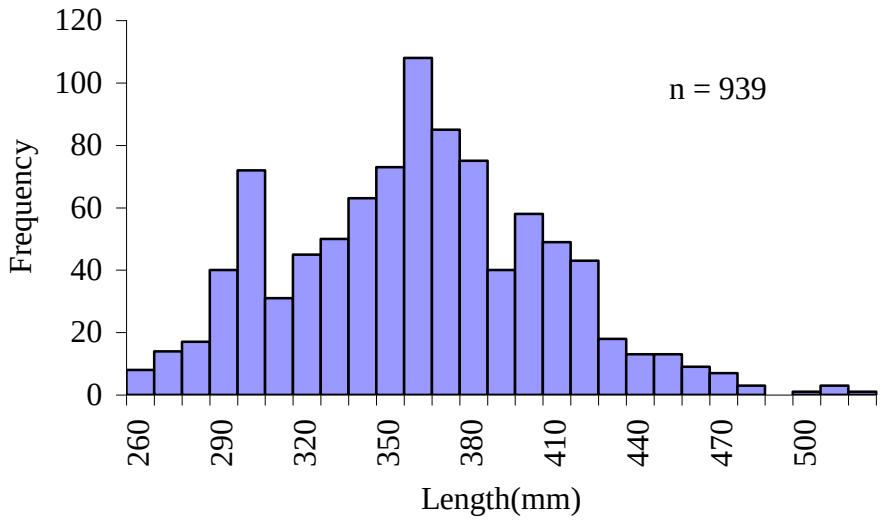


Figure 1.5: Length frequency of *Lethrinus mahsena* from the Nazareth bank

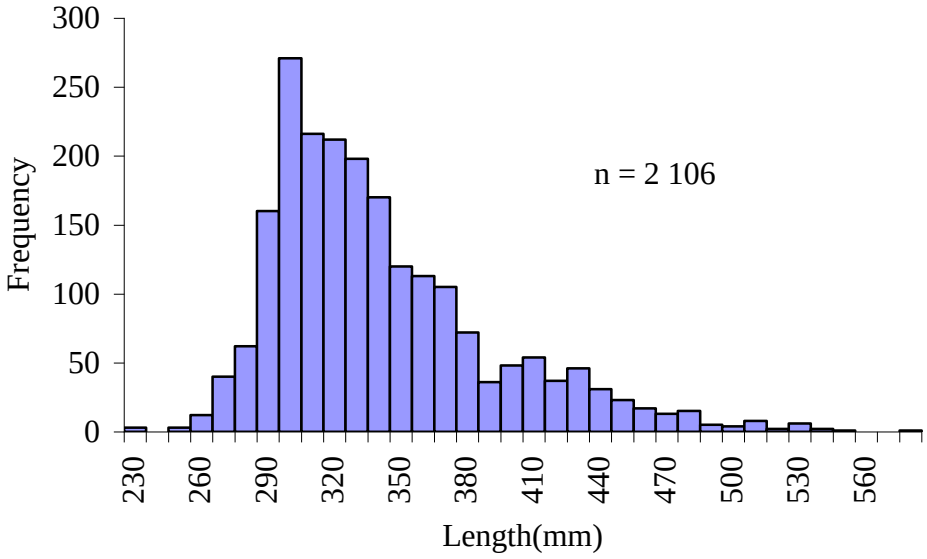


Figure 1.6: Length frequency of *Lethrinus mahsena* from the Saya de Malha bank

1.2.4 Fishing in the waters of the Chagos Archipelago

No fishing took place in the waters of Chagos Archipelago. Details on the catch and effort during the past five years are given in table 1.11.

Table 1.11: Particulars on fishing activities in the waters of the Chagos Archipelago

Year	No. of trips	No. of vessels	Fishing days	Bad weather days	Catch (t)	Fishermandays	CPFD (kg)
2004	2	2	34	26	117	1 761	66.4
2005	nil	nil	nil	nil	nil	nil	nil
2006	1	1	34	10	136	1 802	75.5
2007	1	1	44	6	130	2 376	54.5
2008	nil	nil	nil	nil	nil	nil	nil

1.3 St. Brandon inshore fishery

The catch from the St. Brandon fishery comprised frozen, chilled and salted fish, octopus and lobsters. Six fishing vessels, namely Sainte Rita, Etretat, Marie Charlotte, Vimaya, La Derive and l'Espoir were active in that fishery. The total amount of fish and fish products produced was 454 tonnes. The different products landed from the St. Brandon fishery from 2004 to 2008 are presented in table 1.12.

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

Year	Trips	Frozen fish	Chilled fish	Salted fish	Octopus	Lobster	Total
2004	43	115.6	102.8	34.1	0.0	2.3	**254.8**
2005	49	171.0	132.6	35.4	4.6	0.0	**343.6**
2006	29	116.8	59.2	45.2	2.1	1.1	**224.5**
2007	14	98.4	21.9	16.4	3.6	0.0	**140.2**
2008	33	313.0	90.9	41.2	6.1	2.8	**454.1**

The FV Sainte Rita fished on the drop-offs of St. Brandon and the frozen catch consisted of sacre chien (4 354 kg), guele pave doree (4 931 kg) and vieille laboue (2 573 kg). The frozen catch of FV L'Espoir consisted mostly of white fish and the rest comprised vieilles species, cordonniers, cateaux and licornes.

1.3.1 Sampling of fish from St. Brandon

Sampling of the main fish species, *Lethrinus mahsena,* was carried out at the fishing port during unloading of fishing vessels from St. Brandon. Length-weight data of 896 specimens were collected. The lengths varied from 300 to 560mm while the weight ranged from 400 to 2 900g.

Figures 1.7 and 1.8 show the length/weight relationship and the length frequency distribution of fish from the St. Brandon inshore fishery.

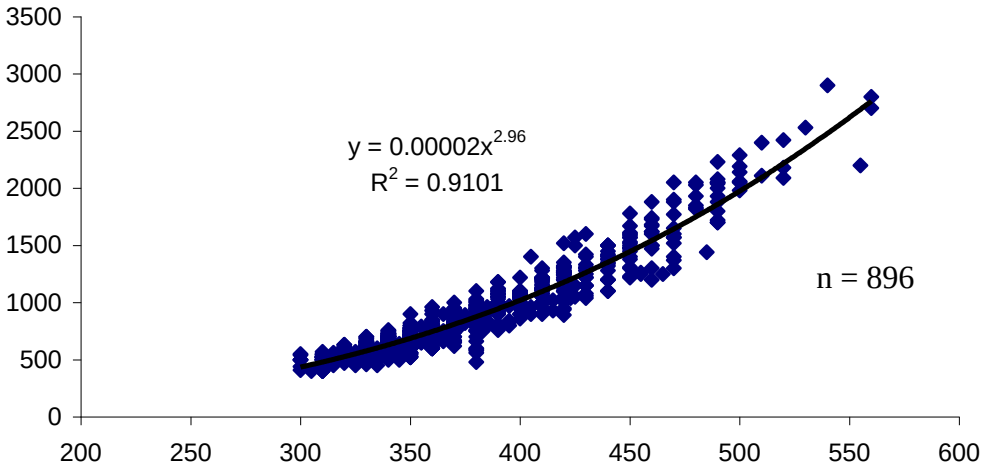


Figure 1.7: Length/weight relationship of *Lethrinus mahsena* from St. Brandon

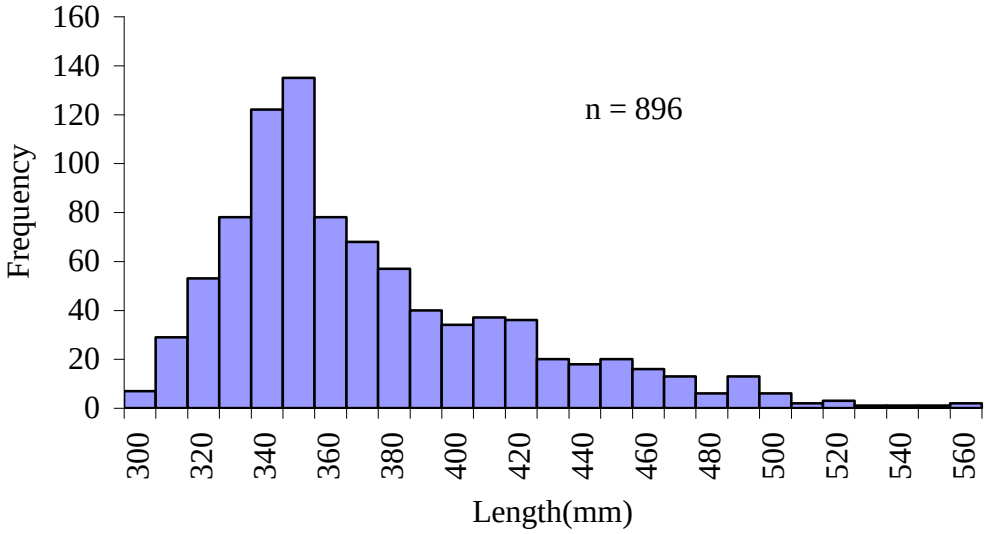


Figure 1.8: Length frequency distribution of *Lethrinus mahsena* from St. Brandon

1.4 The semi-industrial fishery

Twenty-one semi-industrial vessels operated on the Soudan, Albatross, Nazareth and Saya de Malha banks undertaking 132 trips with an average duration of 12 days each. A total of 173.3 tonnes of chilled fish and 7.1 tonnes of frozen fish were landed. Table 1.13 shows the particulars of the vessels while the species composition of the catch by banks is given in table 1.14.

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

Fishing Vessel	LOA (m)	GRT (t)	Fish hold (t)	Crew	No of F/men	Joined in
Albacore**	16.3	49.5	30.0	4	8	2007
Amina	16.4	29.7	10.0	2	6	2008
Coryphaena	12.0	8.5	2.5	2	4	1999
Dai Fah1	17.0	14.0	14.0	2	4	2002
Diamax	20.0	81.6	18.0	2	4	2008
Etelis	33.6	394.0	100.0	8	5	2007
Etretat*	22.0	99.4	80.0	1	6	2008
Fv Ouma	14.0	17.5	9.0	2	6	2008
Espoir*	50.1	299.4	155.6	33	54	2005
La Derive*	17.0	58.4	9.0	12	-	1995
Mahi-Mahi (ex Kingfish4)	15.0	24.0	6.0	2	4	2002
Makaira (ex Kingfish 1)	17.0	14.5	5.5	2	10	1996
Marie Charlotte*	22.8	66.5	15.0	2	4	2008
Quo Vadis 1	12.0	26.9	4.0	2	4	2003
Sainte Rita	34.0	222.0	100.0	7	9	2006
Sea Quest	20.0	59.0	20.0	8	7	2004
Sea Tiger**	23.9	77.8	25.0	5	18	2008
Sea Treasure**	19.9	75.0	35.0	4	14	2007
Snapper**	16.3	14.0	10.0	3	10	2008
Vimaya*	22.0	49.0	15.0	2	10	2000
Vivano (ex Kingfish 6)	13.1	11.0	3.5	2	3	2005

***Carrier boats; **Boats involved in production of frozen and chilled fish**

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

Fishing area	Catch chilled			Total chilled
	Lethrinids	Snapper/grouper	Tuna and others	
Albatross bank	114 325	8 473	684	123 482
Nazareth bank	7 302	27 080	677	35 059
Saya de Malha bank	-	11 960	-	11 960
Soudan bank	2 006	360	389	2 755
Total	**123 633**	**47 873**	**1 750**	**173 256**

During the year, FV "Sea Quest", FV "Sea Tiger" and FV "Etelis" brought 7.1 t of frozen white fish from the banks. The catch consisted mainly of lethrinids, serranids and some red fish.

The catch, fishing days, fishermen-days and catch per fisherman-day (CPFD) in the different fishing areas are presented in table 1.15.

Table 1.15: Catch, effort and CPFD in the fishery

Fishing area	Catch (kg)	Fishing days	Fisherman-days	CPFD (kg)
Albatross bank	123 482	395	2 171	56.9
Nazareth bank	35 059	242	1 614	21.7
Saya de Malha bank	11 960	61	403	29.7
Soudan bank	2 755	15	96	28.6
Total	**173 256**	**713**	**4 284**	**-**

Sampling of *Lethrinus mahsena* was carried out upon arrival of the fishing boats and vessels. 1 830 specimens ranging from 260 to 640mm in length and from 310 to 3 560g in weight were sampled. Figures 1.9 and 1.10 illustrate the length-frequency distribution and the length-weight relationship of the fish landed.

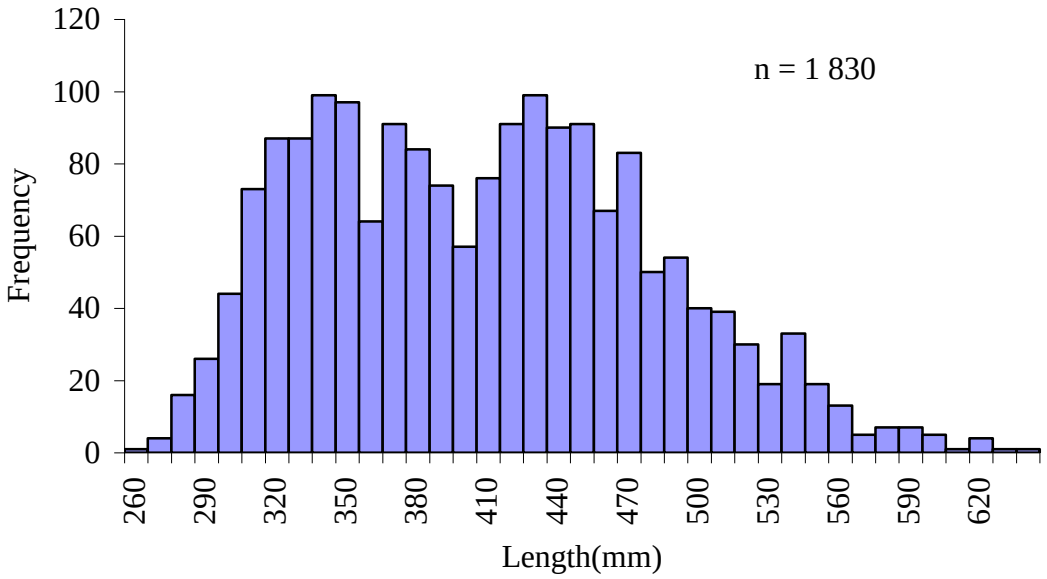


Figure 1.9: Length frequency of *Lethrinus mahsena* from Albatross bank

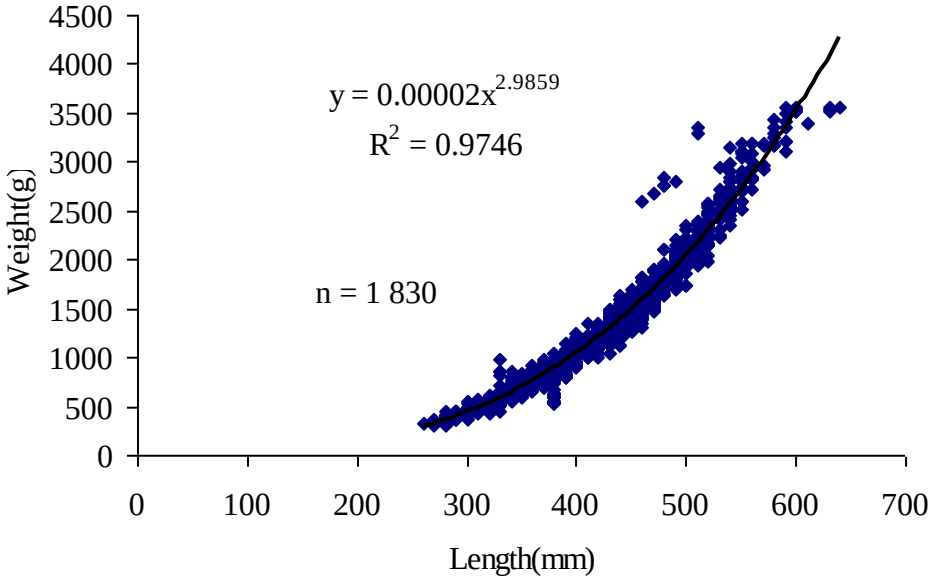


Figure 1.10: Length-weight relationship of *Lethrinus mahsena* from Albatross bank

1.5 The fishery on the drop-off of banks

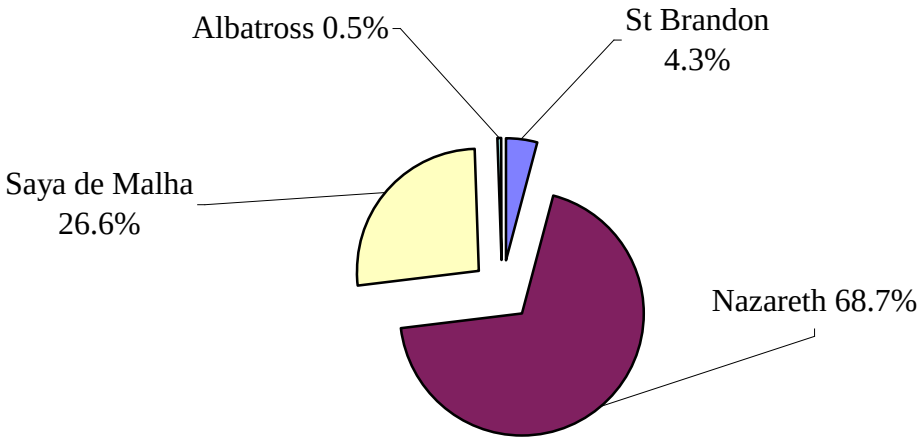
Ten fishing vessels from the semi industrial fishery were active in the fishery on the drop-off of the St. Brandon, Albatross, Nazareth and the Saya de Malha banks targeting snappers and groupers. A total of 237.7 tonnes of frozen fish and 38.5 tonnes of chilled fish were landed. The details of the catch are given in table 1.16.

Table 1.16: Catch by species from drop-off of banks

Fishing area	Catch (kg)			Total
	Sacréchien	Gueule pavée doré	Vieille laboue	
Nazareth bank	100 114	61 568	28 094	189 776
Saya de Malha bank	49 712	15 984	7 674	73 370
St. Brandon bank	4 354	4 931	2 573	11 858
Albatross bank	954	300	-	1 254
Total	**155 133**	**82 783**	**38 341**	**276 257**

Most of the catch was from the Nazareth bank (69 %), followed by the Saya de Malha bank (27%). The breakdown of the catch of the snappers and groupers consisting of sacréchien (56 %), gueule pavée doré (30 %) and vieille laboue (14 %) is given in figures 1.11(A) and 1.11(B), respectively.

(A)



(B)

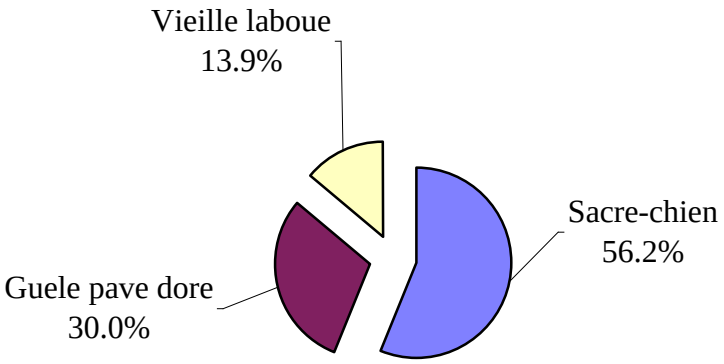


Figure 1.11: Percentage representation of catch (A) by banks and species (B) of the deep-water snapper and grouper fishery

A total of 1 475 specimens of *Polysteganus baissaci*, gueule pavée doré, were sampled for length composition. Results are shown in figure 1.12.

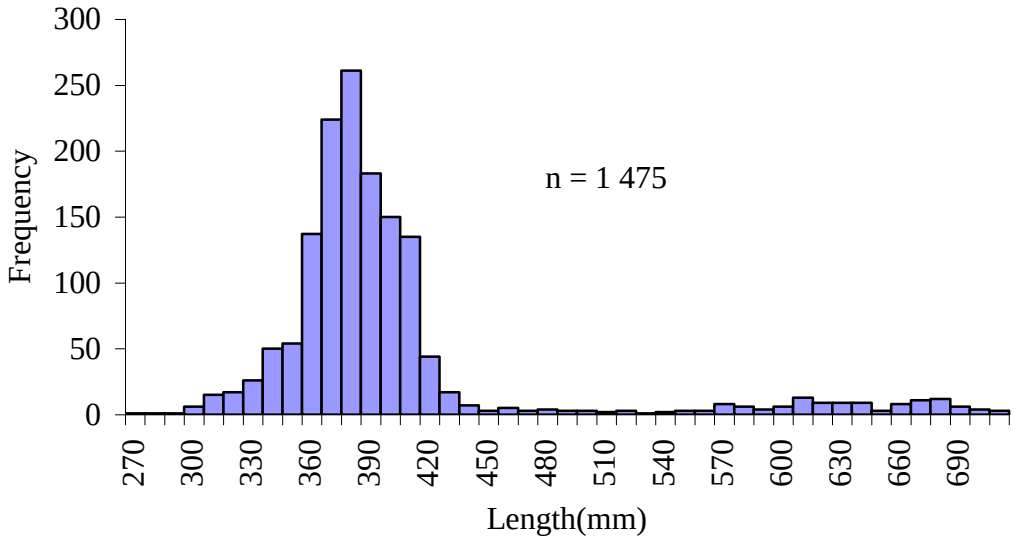


Figure 1.12: Length frequency of gueule pavée doré from the Nazareth bank

1.6 Ecotoxicology

1.6.1 Fish toxicity

One fish sample of vieille babonne, *Plectropomus maculatus*, was tested upon request from the Ministry of Health and Quality of Life for the presence of ciguatoxin through the mongoose bioassay method. The fish sample was found to be slightly toxic. Three fish samples were tested upon request from the Ministry of Health and Quality of Life for the presence of ciguatoxin using the mouse bioassay. Results are shown in table 1.17.

Table 1.17: Results of tests by mouse bioassay

Genus/Species	Mouse bioassay	
	Test 1	Test 2
Plectropomus spp	Moderately toxic	Moderately toxic
Variola louti	Slightly toxic	Slightly toxic
Unidentified fish (cooked state)	Non-toxic	Non-toxic

1.6.2 Harmful marine microalgae

The study of potentially harmful marine microalgae was continued at the four established sites namely, Albion, Blue Bay, Le Morne and Trou aux Biches. The sites were sampled quarterly for the presence and density of harmful marine microalgae. The main species of dinoflagellates recorded in high numbers were *Prorocentrum* spp. and *Ostreopsis*. Species of *Amphidinium* and *Synophysis* were not observed at Blue Bay. However, diatoms were present at all the sites in larger numbers than previously observed. The total number of dinoflagellates, per six litres of seawater and macroalgae, recorded at the four sampling sites is shown in table 1.18.

Table 1.18: Total number of dinoflagellates recorded (cell count)

Species	Blue Bay	Trou aux Biches	Albion	Le Morne
***Gambierdiscus* sp.**	nil	nil	nil	nil
***Ostreopsis* sp.**	34	11	67	16
Prorocentrum lima	51	7	15	17
Prorocentrum concavum	5	6	10	8
***Prorocentrum* sp.**	14	9	7	9
***Amphidinium* sp.**	nil	1	1	2
***Synophysis* sp.**	nil	l	1	1
***Coolia* sp.**	nil	3	nil	2

1.7 Identification of fish specimens

Fifty-one different fish species were brought to AFRC by officers of the Fisheries Protection Service, National Coast Guard, Police and Ministry of Health and Quality of Life for identification.

1.8 Sea cucumber fishery

1.8.1 Survey on sea cucumbers

Sea cucumber surveys were undertaken in April 2008 at 8 sites, i.e., Grand Gaube, Roche Noires, Grand River South East, Mahebourg, Le Morne, La Preneuse, Flic en Flac and Pointe aux Piments to assess the sea cucumber stocks. Seven species of sea cucumber, namely *Holothuria atra, Holothuria leucospilota, Holothuria scabra, Holothuria percivax, Stichopus chloronotus, Bohadscia marmorata* and *Thenelota annax* were observed at the survey sites.

The average number of sea cucumbers was 58 per 1000m^2 and the overall density was estimated at 58 000 individuals/km^2 in the lagoon around the island. The highest density of sea cucumbers

was again found at Grand Gaube (326 per1000m^2). A lower density was observed in most of the regions surveyed except at Le Morne where there was an increase in the number of sea cucumbers. Based on the survey, a total allowable catch (TAC) of 275 tonnes (wet weight) was imposed.

1.8.2 Sea cucumber production

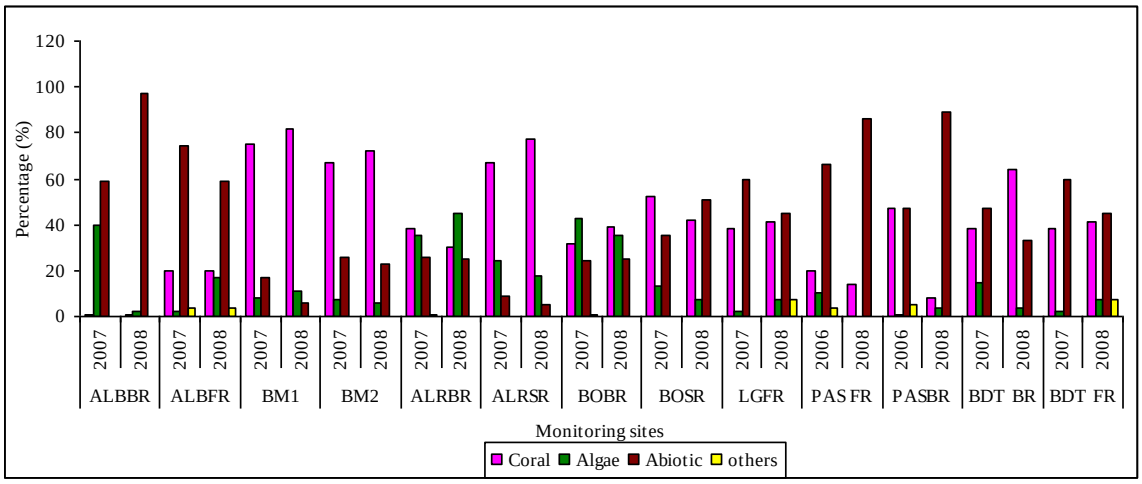
Ten operators were authorised to collect, process and export sea cucumbers on a quota basis for the period 1st August 2008 to 31st July 2009, January to March 2009 being closed season for the collection of sea cucumbers. A quota of 35 tonnes (dry weight) was distributed among the 10 operators. Only 5 operators undertook the collection and export of sea cucumbers. The collection of sea cucumbers amounted to 95.3 tonnes (wet weight).

2. MARINE SCIENCE

2.1 Coastal ecosystem research

2.1.1 Long-term monitoring of the coral reef ecosystem

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



ALBBR – Albion back reef, ALBFR – Albion fore reef, BM1- Belle Mare site 1, BM2 – Belle Mare site2, ALRBR – Anse la Raie back reef, ALRSR – Anse la Raie shore reef, BOBR – Bel Ombre back reef, LGFR- Le Goulet fore reef, PASFR- Pte aux Sables fore reef, PASBR- Pte aux Sables back reef, BDT BR – Baie du Tombeau back reef, BDT FR – Baie du Tombeau fore reef

Figure 2.1: Percentage of substrate cover at monitoring stations

Table 2.1: Average percentage cover of substrate at monitoring stations

Site	Stations	Year	Coral	Algae	Abiotic	Others
Le Goulet	fore reef	2007	38	2	60	*
		2008	41	7	45	7
Baie du Tombeau	back reef	2007	38	15	47	*
		2008	64	3	33	*
Bel Ombre	back reef	2007	32	43	24	1
		2008	39	35	25	1
	shore reef	2007	52	13	35	*
		2008	42	7	51	*
Anse la Raie	back reef	2007	38	35	26	1
		2008	30	45	25	*
	shore reef	2007	67	24	9	*
		2008	77	18	5	*
Albion	fore reef	2007	20	2	74	4
		2008	20	17	59	4
	back reef	2007	1	40	59	*
		2008	1	2	97	*
Belle Mare	site 1	2007	75	8	17	*
		2008	82	12	6	*
Belle Mare	site 2	2007	67	7	26	*
		2008	72	5	23	*
Bambous Virieux	back reef	2007	52	19	29	*
		2008	65	11	24	*
	shore reef	2007	28	64	8	*
		2008	37	51	10	2
Ile aux Benitiers	fore reef	2007	20	12	66	2
		2008	19	25	51	5
	back reef	2007	6	2	92	*
		2008	7	18	75	*
	shore reef	2007	0.5	*	99.5	*
		2008	0	32	68	*
Trou aux Biches	fore reef	2007	24	19	57	*
		2008	26	27	46	1
	back reef	2007	45	4	51	*
		2008	32	4	64	*
Pointe aux Sables	fore reef	2006	20	10	66	4
		2008	14	0	86	*
	back reef	2006	47	1	47	5
		2008	8	3	89	*
Poudre d'Or	site 1	2007	18	38	44	*
		2008	8	49	40	3

Poudre d'Or	site 2	2007	54	1	45	*
		2008	56	3	41	*
Trou d'Eau Douce	back reef	2007	30	46	23	1
		2008	38	32	29	1
	shore reef	2007	64	2	30	4
		2008	52	6	39	3

Others: sponges, crown of thorns, soft corals, giant clams, * - Not Observed

Observations showed a variation in the percentage of coral cover, with an increase in coral cover at certain monitoring stations which may be attributed to coral recruitment while a decrease at some of the monitoring stations may be due to an increase in the abiotic component and algal cover. The increase in abiotic component may be attributed to the combined effects of previous coral bleaching and siltation in the region. During the year no coral bleaching was observed at any of the sites surveyed.

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
Le Goulet	fore reef	2007	XXXX	XX	X	X	*	X
		2008	XXXX	XX	X	XX	*	*
Baie du Tombeau	back reef	2007	XXXX	*	*	X	*	*
		2008	XXXX	X	X	-	*	*
Bel Ombre	back reef	2007	XXXX	XX	XX	XX	X	XX
		2008	XXXX	-	X	-	*	*
	shore reef	2007	XXXX	XX	X	X	X	X
		2008	XXX	XX	X	XX	*	*
Anse la Raie	back reef	2007	XXXX	XX	XX	XX	*	*
		2008	XXXX	XX	X	X	*	*
	shore reef	2007	XXXX	XX	X	X	*	*
		2008	XXXX	*	*	*	*	*
Trou aux Biches	fore reef	2007	*	*	*	X	*	X
		2008	X	*	X	*	*	*
	back reef	2007	XXXX	XXX	X	XX	*	X
		2008	XXXX	XX	*	X	*	*
Albion	fore reef	2007	X	XX	XX	XX	*	XXXX
		2008	XX	XX	X	X	*	XXXX
	back reef	2007	XXX	*	*	*	XX	XXX
		2008	XXX	*	XXX	XX	XX	XXX
Belle Mare (Site I)	back reef	2007	XXXX	XX	*	*	*	*
		2008	XXXX	XX	*	*	*	*
Belle Mare (Site II)	back reef	2007	XXXX	XX	X	X	*	XX
		2008	XXXX	XXXX	*	X	*	*

Trou d'Eau Douce	back reef	2007	XXXX	XX	X	*	*	*
		2008	XXXX	*	*	*	*	*
	shore reef	2007	XX	*	*	X	*	*
		2008	XX	XX	X	*	*	*
Ile aux Benitiers	back reef	2007	XXXX	XXX	X	X	*	*
		2008	XXXX	XX	X	X	*	*
	shore reef	2007	X	XX	X	XX	X	XX
		2008	XX	XX	X	XX	*	*
	fore reef	2007	X	XXX	XX	*	*	XXX
		2008	X	XX	X	XX	*	XXXX
Bambous Virieux	back reef	2007	XXXX	*	X	X	X	XX
		2008	XXXX	XX	X	X	*	*
	shore reef	2007	XXXX	XXX	X	XX	*	*
		2008	XXXX	XX	X	*	*	*
Pointe aux Sables	back reef	2006	XXX	XX	X	XX	X	XXXX
		2008	XXX	XX	X	XX	N/O	XXXX

***– Not observed, X – 0-10, XX- 10-50, XXX – 50-100, XXXX - >100**

The pomacentridae (damsel fish) and acanthuridae (surgeon fish) were dominant at most of the monitoring stations. The most common species of damsel fish recorded were *Stegastes lividus, Stegastes limbatus, Dascyllus aruanus, Chrysiptera unimaculata* and *Chromis viridis*. The surgeon fish was represented by *Ctenochaetus striatus and Acanthurus xanthopterus.* The family Chaetodontidae (butterfly fish) were represented by *Chaetodon trifasciatus*, *Chaetodon trifascialis* and labridae (wrasses) were represented by *Halichoeres hortulanus, Thalassoma hardwicke* and *Thalassoma genivittatum*. The balistidae (trigger fish) was the least represented. Predators such as fish from the families serranidae and lethrinidae were absent and this gives an indication of the fishing pressure in the lagoon.

2.1.2 Other ecological surveys

Apart from the regular long-term monitoring surveys, other ecological surveys were also carried out during the year. The assessment of the status of the two ex-sand mining sites and the lagoon of Poudre d'Or (near Denim de l'Ile) was carried out.

Table 2.3: Other ecological surveys

Date/purpose	Site	Details of survey
January – ecological survey at effluent discharge point.	Poudre d'Or	The survey showed that the water column was clear and the mangrove stands in the area were healthy.
February - monitoring of Ex-Sand Mining sites	Grand Gaube and Poudre d'Or	The seabed has been colonised by seagrass, new recruits of corals were encountered and an increase in fish abundance was also noted.
February - survey for proposed navigation channel	Mongelard, Mahebourg	The survey showed that the site proposed by the fishermen for the navigation channel was rich in marine fauna and flora.
February - construction of a slipway	Grand Baie	The area surveyed in the lagoon was devoid of corals and the substrate was made up of muddy sand and the water was very turbid.
October - survey of site for aquaculture	Est Pointe Bambous	A survey was conducted for the establishment of cage culture for aquaculture purposes by the Fishermen Investment Trust (FIT). The site had a maximum depth of 22 m and the periphery of the channel (10-13m) harboured dense healthy diverse coral colonies. The results for water quality parameters showed no deviation from the Guidelines for Coastal Water Quality. The site is suitable for aquaculture activities.
October and November - collection of seaweeds for nutrient analysis for Mauritius Research Council	The seaweeds were collected at Baie du Tombeau, Palmar, Belle Mare, Poste Lafayette and Grand Gaube.	At the request of MRC, five species of seaweeds, namely *Ulva lactuca, Enteromorpha sp., Padina sp., Gracilaria sp.* and *Sargassum sp*. were collected from the lagoon for nutrient analysis by MSIRI and the University of Mauritius.
December - survey to observe siltation and marine biota	Black River Bay	A survey was conducted to observe the sea bottom conditions in relation to siltation and marine biota distribution. The depth ranges at the site was from 0.5 to 2.5m and no corals were recorded. A few stands of *Rhizophora mucronata* were found on the western side of the area surveyed.

2.1.3 *Biodiversité des Milieux Pélagiques marins de l'Océan Indien (*BIOPS)

Pelagic fish species occupy extensive areas in the open ocean and are usually too loosely aggregated to observe well. The main objective of the BIOPS Project is to observe the biodiversity of pelagic fish species around anchored fish aggregating devices (FADs) in the Indian Ocean region.The training for visual census of fish around four designated fish aggregating devices (FADs) was dispensed by IFREMER (figures 2.2 and 2.3). The fish biodiversity around the FADs would be monitored for a period of 18 months and will commence in early 2010.

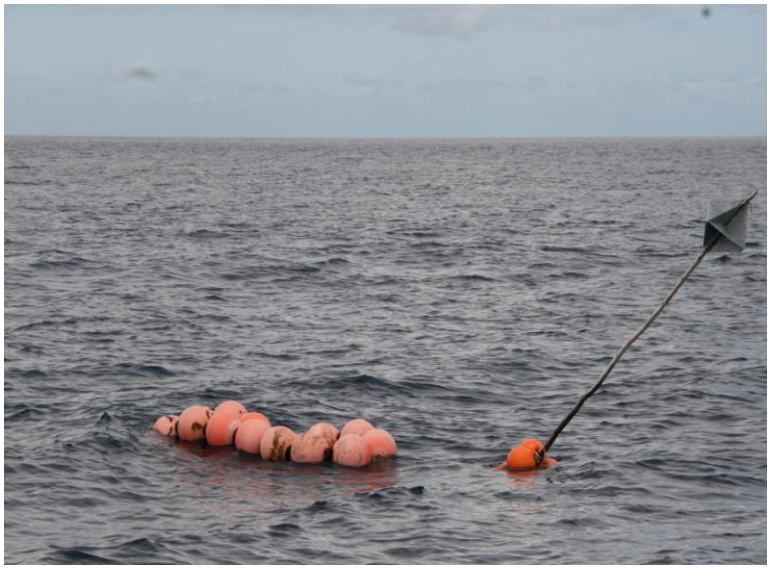


Figure 2.2: FAD at Baie du Tombeau

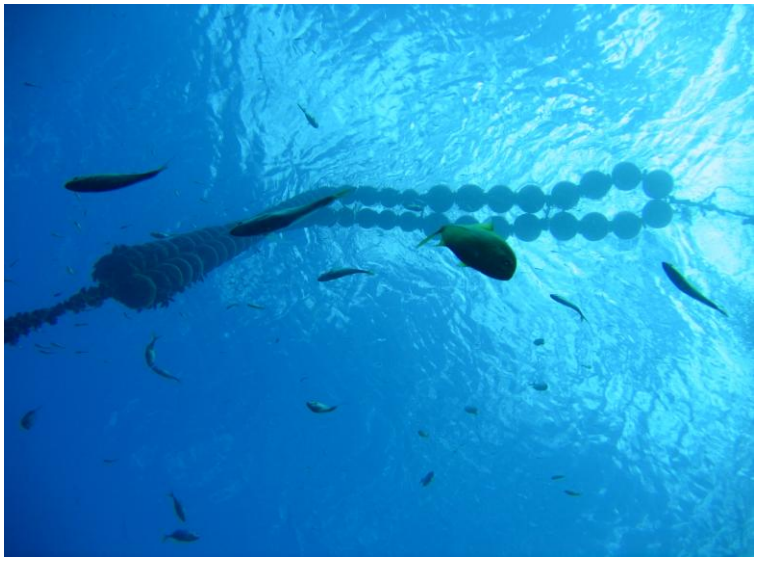


Figure 2.3: FAD as seen from underwater

2.1.4 Coral farming trial

The project undertaken by AFRC mainly aims at carrying out trials on farming of corals in the lagoon at Albion using simple and inexpensive equipment. The farmed corals would then be used to rehabilitate degraded areas in the lagoon.

Five basal plates were deployed in the Albion lagoon at a depth of about two metres in July. Coral fragments from different species were collected and attached to the basal plates. The coral fragments have settled successfully and were growing well (figure 2.4). Monitoring is ongoing.

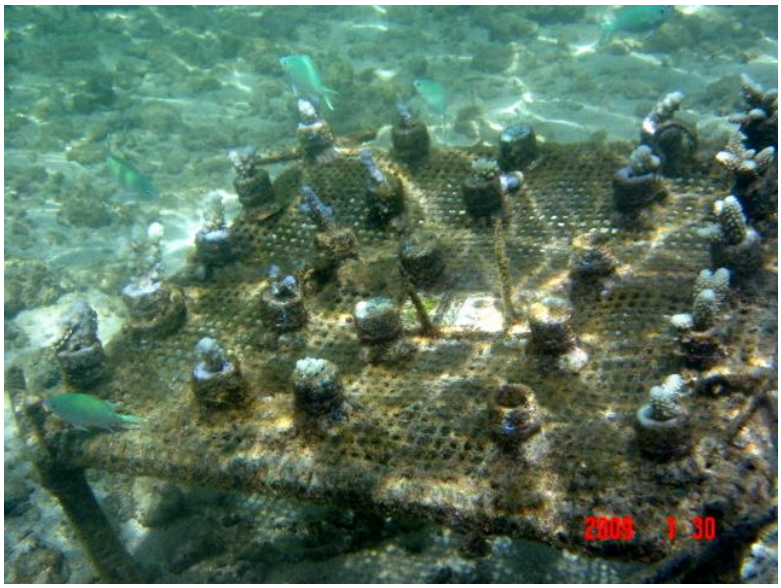


Figure 2.4: Basal plate with coral fragments in the lagoon at Albion

2.1.5 Coral Reef Monitoring Network

2.1.5.1 Focal point meeting

The principal objective of the focal point meeting was to compile the WIO Node's 2007 Annual Report, for submission to the Global Coral Reef Monitoring Network (GCRMN). The meeting also provided an opportunity to discuss strategic issues related to sustainable funding and capacity-building.

2.1.5.2 Workshop on COREMO III software

COREMO is the software used in the SWIO region for analysis of data collected during the monitoring of coral reefs. A workshop funded by RECOMAP (COI) was held in May for the presentation of the COREMO III software to the member countries of the COI.

2.1.6 Mangrove propagation

Two NGOs were given assistance for mangrove propagation at three sites namely, Estuary Terre Rouge Bird Sanctuary, Barachois Le Blanc at Roches Noires and Champagne Bridge, Ferney.

2.1.7 Marine turtle nesting at Gris Gris

Following the nesting event of a green turtle at Gris Gris public beach in October 2007, 85 eggs were found to have hatched in January. One of the hatchlings, weighing 32.4g and measuring 9.3cm was recuperated from the nesting site and was being reared at AFRC. After spending about 6 months in a fibre-glass tank, the turtle was transferred to the Centre's ecological observation room. By December, the turtle weighed 390g and measured 28cm (figure 2.5).

Figure 2.5: Turtle hatchling

2.2 Coastal water quality

2.2.1 Monitoring of chemical parameters

Water quality monitoring was continued at the 76 established stations of the nineteen sites around the island. Over 330 samples were analysed for chemical oxygen demand (COD), nitrate-nitrogen (NO_3^--N) and phosphate (PO_4^{3-}). Physical parameters recorded were temperature, sea state, weather conditions, conductivity and pH. The range of values for results of the analyses over the last three years is shown in table 2.4.

The processed data at four of these sites were submitted to the Ministry of Environment and National Development Unit as part of the contribution to the Western Indian Ocean Land-based Project (WIOLaB). The lagoon of Rivière Noire was included as a new monitoring site for water quality and ecology.

Table 2.4: Range of values for results of water analyses (2006-2008)

Site	Year	Nitrate-Nitrogen (mg/l)	Phosphate (mg/l)	Chemical Oxygen Demand (mg/l)
Ile aux Benitiers	2006	<0.1	<0.01 - 0.02	<0.1 - 0.4
	2007	<0.1	0.01 - 0.03	<0.1 - 1.4
	2008	<0.1	<0.01 - 0.02	0.1 - 0.6
Bel Ombre	2006	<0.1	<0.01 - 0.02	<0.1 - 0.3
	2007	<0.1	<0.01 - 0.06	0.2 - 0.7
	2008	<0.1	0.01 - 0.06	0.1 - 0.5
Bambous Virieux	2006	<0.1	0.01 - 0.04	0.2 - 0.8
	2007	<0.1	<0.01 - 0.01	0.1 - 1.0
	2008	<0.1	0.02 - 0.08	<0.1 - 0.5
Trou d'Eau Douce	2006	<0.1	0.01 - 0.02	0.2 - 1.0
	2007	<0.1	0.01 - 0.02	0.3 - 0.6
	2008	<0.1	<0.01 - 0.05	0.1 - 0.8
Anse la Raie	2006	<0.1	0.02 - 0.04	0.2 - 0.5
	2007	<0.1	0.01 - 0.04	0.4 - 0.8
	2008	<0.1	0.02 - 0.08	0.1 - 1.5
Trou aux Biches	2006	<0.1	0.01 - 0.08	0.1 - 0.4
	2007	<0.1	<0.01 - 0.04	0.1 - 1.2
	2008	<0.1	0.01 - 0.07	0.2 - 2.1
Pointe aux Sables	2006	<0.1	0.01 - 0.06	0.2 - 0.6
	2007	<0.1	0.01 - 0.06	0.1 - 0.5
	2008	<0.1	<0.01 - 0.07	0.1 - 1.1
Bain des Dames	2006	<0.1	0.01 - 0.08	<0.1 - 0.6
	2007	<0.1	0.01 - 0.05	0.3 - 1.0
	2008	<0.1	0.01 - 0.07	0.2 - 1.0
Grand Baie	2006	<0.1	<0.01 - 0.08	0.1 - 0.7
	2007	<0.1	<0.01 - 0.05	0.1 - 2.7
	2008	<0.1	0.01 - 0.06	<0.1 - 1.4

Baie du Tombeau	2006	<0.1	0.01 - 0.05	0.2 - 1.1
	2007	<0.1	<0.01 - 0.08	<0.1 - 1.5
	2008	<0.1	0.01 - 0.08	0.1 - 1.7
Harbour	2006	<0.1	0.01 - 0.09	0.1 - 0.7
	2007	<0.1	0.03 - 0.09	<0.1 - 1.3
	2008	<0.1	0.01 - 0.13	0.1 - 1.7
Poudre d'Or	2006	<0.1	0.01 - 0.07	0. 1 - 1.8
	2007	<0.1	<0.01 - 0.12	<0.1 - 2.2
	2008	<0.1 - 0.8	0.01 - 0.17	<0.1 - 3.8
Balaclava	2006	<0.1	0.01 - 0.04	0.1 - 0.9
	2007	<0.1	0.01 - 0.06	0.4 - 1.2
	2008	<0.1 - 0.9	0.01 - 0.15	0.4 - 1.8
Blue Bay	2006	<0.1	<0.01 - 0.22	<0.1- 0.5
	2007	<0.1 - 0.3	0.01 - 0.18	<0.1- 0.9
	2008	<0.1	0.01 - 0.02	<0.1- 0.3
Belle Mare	2006	<0.1	0.01 - 0.04	0.2 - 1.2
	2007	<0.1	<0.01 - 0.01	0.2 - 1.3
	2008	<0.1	0.01 - 0.06	<0.1- 0.6
Albion	2006	<0.1	0.01 - 0.02	0.1 - 0.2
	2007	<0.1	<0.01 - 0.05	<0.1 - 0.1
	2008	<0.1	0.01- 0.07	0.1 - 2.1
Flic en Flac	2006	<0.1	0.02 - 0.05	0.1 - 0.4
	2007	<0.1	<0.01 - 0.02	<0.1 - 0.1
	2008	<0.1	0.1 - 0.07	<0.1 - 0.5
Palmar	2006	<0.1	0.01 - 0.03	0.1 - 0.4
	2007	<0.1	0.01 - 0.08	0.9 - 2.6
	2008	<0.1	0.01 - 0.08	0.1 - 0.9
Bird Sanctuary	2006	<0.1	0.01 - 0.15	0.9 - 2.5
	2007	<0.1	0.03 - 0.12	0.8 - 3.8
	2008	<0.1	0.04 - 0.13	0.6 - 2.1
Rivière Noire	2008	<0.1	0.06 - 0.11	0.2 - 1.9

Note: Detection limit for phosphate – 0.01 mg/l
Detection limit for nitrate-nitrogen – 0.1 mg/l
Coastal Water Quality Guideline limits (Conservation): Nitrate – nitrogen - 0.3mg/l, phosphate - 0.05 mg/l and COD - 3mg/l
Coastal Water Quality Guideline limits (Recreation): Nitrate – nitrogen - 0.8mg/l, phosphate - 0.08mg/l and COD - 5mg/l

The levels of nitrate were <0.1 mg/l while those of phosphate ranged between <0.01 and 0.17 mg/l and COD between <0.1 and 3.8 mg/l. The results of the water quality analyses were within the *Guidelines for Coastal Water Quality Requirements for various categories Govt. Notice No. 620 of 1999 (CWQG)* except at one station at Balaclava, Poudre d'Or and Rivière Noire and at two stations at Terre Rouge Bird Sanctuary where higher levels of phosphate were recorded. The COD level was exceeded at one station at Poudre d'Or while nitrate level was exceeded at one station at Balaclava and at one station at Poudre d'Or. The high levels of nitrate and phosphate recorded at these stations could be attributed to influx of fresh water from the nearby rivers, while the COD which exceed only once at one station at Poudre d'Or could be due to the effect of the torrential rainfall recorded in March.

2.2.2 Analysis for trace metals

The concentrations of lead and cadmium were determined in water samples collected near river mouths at Grand River North West, Rivière Lataniers, Pointe Roches Noires, Grand River South East, Mahebourg, l'Escalier, Baie du Cap and Tamarin. No detectable levels of these two trace metals were recorded in any of the samples analysed.

Note: Detection limit for lead – 0.013 mg/l
Detection limit for cadmium – 0.0028 mg/l

2.2.3 Fish mortality and water quality

Samples of seawater and freshwater were collected for analysis in relation to cases of alleged pollution and fish mortality. Details are given in table 2.5. Results showed that parameters analysed were within norms.

Table 2.5: Sites of alleged pollution and fish mortality

Date	Site	Event
01 January	Le Méridien, Morne	Fish mortality
04 April	La Preneuse	Disposal of soil materials on the beach
01 September	Bénares, Britannia Sugar Estate	Fish mortality in aquaculture pond
11 September	Macondé	Alleged pollution
17 December	Baie du Cap	Fish mortality

2.2.4 Independent Environmental Audit on Wastewater Projects

The monitoring of seawater quality at the three outfalls namely, Pointe Moyenne, Montagne Jacquot and Baie du Tombeau were continued. Results of analyses of water samples were within the norms set under the *Regulation for Effluent Discharge into the Ocean as per GN No 45 of 2003 of the Environment Protection Act 2002* as shown in table 2.6.

Table 2.6: Water quality at the three outfalls (2006 – 2008)

Site	Year	Nitrate-Nitrogen (mg/l)	Phosphate (mg/l)	Chemical Oxygen Demand (mg/l)
Pointe Moyenne	2006	<0.1	0.01 - 0.05	0.2 - 1.1
	2007	<0.1	<0.01 - 0.09	0.1 - 1.0
	2008	<0.1	0.06 - 0.13	0.2 - 0.5
Montagne Jacquot	2006	<0.1	0.01 - 0.05	0.1 - 1.2
	2007	<0.1	<0.01 - 0.04	0.1 - 1.3
	2008	<0.1	0.01 - 0.08	<0.1 - 0.6
Baie du Tombeau	2006	<0.1	0.01 - 0.08	0.1 - 0.7
	2007	<0.1	<0.01 - 0.05	0.2 - 2.1
	2008	<0.1	0.1 - 0.08	0.2 - 1.7
CWQG limit (Industrial)		**1.0**	**0.10**	**5.0**
Standards for Effluent Discharge into the Ocean		**-**	**-**	**750.0**

A report on the Independent Environment Audit on Wastewater Projects from October 2007 to September 2008 was prepared in collaboration with the Ministry of Environment & National Development Unit, Ministry of Renewable Energy and Public Utilities and Ministry of Health and Quality of Life (Environmental Health Engineering Unit). The report gives the findings of the monitoring exercises during the period October 2007 to September 2008.

2.2.5 Monitoring of mercury level

The level of mercury in estuaries was monitored at eight sites namely, Rivière Lataniers, Grand River North West, Tamarin, Baie du Cap, l'Escalier, Mahebourg, Grand River South East and Pointe Roches Noires. Results of analyses indicated that levels of mercury in the water samples were below the detection limit*. Data were submitted twice yearly to the technical committee set up by the Ministry of Environment and National Development Unit for the UNEP Global Mercury Assessment Programme.

**Note: Detection limit for mercury – 0.03 µg/l*

2.3 Monitoring of coliform bacteria at public beaches

Monitoring of the levels of total coliform (TC) and faecal coliform (FC) in seawater at selected public beaches was continued on a monthly basis at 10 sites namely, Flic en Flac, Albion, Pointe aux Sables, Trou aux Biches, Mon Choisy, Le Goulet, Grand Baie, Blue Bay, Pereybere and Belle Mare. The Blue Bay and Balaclava Marine Parks were sampled once during the year.

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). Table 2.7 shows level of TC and FC at the various sites for the last three years.

Table 2.7: Results of coliform analysis at the monitoring sites

Beach	Station No.	Average colony count per 100ml					
		2006		2007		2008	
		TC	FC	TC	FC	TC	FC
Flic en Flac	1	42	13	23	9	39	9
	2	70	16	36	8	55	15
	3	27	6	20	3	32	7
	4	126	38	42	14	71	21
	5	119	46	62	14	93	23
Trou aux Biches	1	20	6	33	10	36	7
	2	19	7	30	11	61	13
Mon Choisy	1	21	6	35	11	47	12
	2	38	11	27	7	26	7
	3	24	10	24	6	27	6
	4	27	8	32	8	39	10
Blue Bay	1	148	39	14	3	16	4
	2	129	31	20	6	27	6
	3	56	18	34	8	42	10
Albion	1	163	41	29	9	39	10
	2	558	136	83	24	172	36
Pointe aux Sables	1	61	11	763	148	624	117
	2	21	7	740	146	541	114
	3	30	8	25	7	101	24
	4	26	7	384	80	154	42
Grand Baie	1	49	22	21	5	55	20
	2	54	16	32	10	70	21
	3	34	11	14	4	54	14
	4	385	92	138	37	309	69
	5	499	90	298	67	332	72
Le Goulet	1	80	36	21	7	25	6

Belle Mare	1 2 3 4 5	66 56 92 25 67	9 12 29 10 13	34 26 21 24 16	8 7 6 6 4	35 58 50 58 65	10 13 12 12 15
Pereybere	1 2 3 4	61 21 30 26	11 7 8 7	27 43 126 164	8 15 29 34	26 7 55 63	7 7 12 14
Blue Bay Marine Park	1 2 4	ND ND 32	ND ND 8	ND ND ND	ND ND ND	4 ND 2 6	ND ND ND 2
Balaclava Marine Park	2 3 4 6	ND ND 10 ND	ND ND 2 ND	ND ND ND ND	ND ND ND ND	16 10 4 ND	3 3 1 ND
Coastal Water Quality Guideline limits (CWQG)	**TC:** 1000 CFU/100ml **FC:** 200 CFU/100ml						

ND: Not Detected

The data collected on the total and faecal coliforms are provided to the Ministry of Environment and NDU and to the Beach Authority for purposes such as, assessment of coastal development projects, public health aspects and issues related to pollution as shown below:

- Committee on Lagoonal Pollution in Port Louis Region (Ministry of Environment and NDU)
- Coordination committee for the implementation of the recommendations of the study 'Environmental Risks Assessment in Grand Bay' (Ministry of Environment and NDU)
- 'Level of Coliform Bacteria at selected Public Beaches' (Beach Authority)
- Historical data from 1996 to 2007 on level of coliform bacteria at selected public beaches (Ministry of Environment and NDU, for the Environment Information System project)

2.4 Environment Information System (EIS)

The Memorandum of Understanding for the setting up of the Environment Information System (EIS) was signed in April between the Fisheries Division and the Ministry of Environment and NDU for the submission of environmental indicators namely marine fish biodiversity, degradation of coastal zone - status of coral and mangroves, state of fish stocks and water quality. Two half-day training sessions on the EIS software were dispensed in April to four officers of AFRC by the State Informatics Ltd. Information pertaining to the four indicators and trends

observed on a specific parameter and historical data from 1996 to 2007 were submitted to the M/Environment and NDU to be uploaded under the section EIS news and to the metadata file on its website.

2.5 Accreditation of Laboratories

Under the component "Assistance and support to the quality control of laboratories in Mauritius" of the "Strengthening Fishery Production Programme", an EU consultant on laboratory accreditation carried out an audit of the three laboratories at AFRC. He made recommendations which included renovation and upgrading of the laboratory facilities, recruitment of qualified personnel, funds needed and capacity building in order to start the accreditation process. An action plan was prepared setting out the activities to be carried out within the next five years for the accreditation process of the AFRC laboratories.

Action was initiated for the implementation of the recommendations. Designs and layout for the renovation and upgrading of the Fish Toxicity, Chemistry and Bacteriology laboratories as well as the animal house were prepared and tenders launched.

3. AQUACULTURE

Aquaculture activities were geared towards the seed production of berri rouge, *Oreochromis* sp. of the Malaysian variety, freshwater ornamental fish namely gold fish *(Carassius auratus)*, platy (*Xiphophorus maculatus*) and molly (*Poecilia latipinna*) and giant freshwater prawn (*Macrobrachium rosenbergii)*.

3.1 Plankton culture

Pure cultures of the phytoplankton species namely *Nannochloropsis* sp., *Tetraselmis* sp. and *Chaetoceros calcitrans* were maintained in the phytoplankton room. Mass production of *Nannochloropsis* sp. was undertaken during the seed production of *Macrobrachium rosenbergii*.

The zooplankton, *Brachionus rotundiformis* (rotifer), maintained in polycarbonate tanks was fed on *Nannochloropsis* sp.

3.2 Camaron culture

3.2.1 Broodstock

A broodstock of 29 camaron spawners was obtained from Medine Sugar Estate (SODIA) and 318 from Riche en Eau Sugar Estate for the production cycle. The females were conditioned and maintained in black circular polycarbonate tanks in the dark at a water temperature of 28°C. The berried females were fed once daily on chopped frozen mussels.

3.2.2 Seed production

The camaron seed production cycle was undertaken from January to April and from October to December when the average water temperatures were 27°C and 28°C respectively. Three rearing cycles were carried out; a total of 1 945 000 larvae was obtained and stocked in fibreglass and polycarbonate tanks in green water at a salinity of 12 ppt. The camaron larvae were fed daily on brine shrimp nauplii, *Artemia* sp. and "egg custard". The larval stage index was closely monitored. Post-larvae (> stage-12) were obtained after a culture period ranging between 40 and

50 days, after which the salinity of the water was gradually brought down to zero. A total of 264 131 camaron juveniles was produced.

3.2.3 Sale of camaron

A total of 264 131 camaron juveniles was sold to 22 farmers at the rate of Rs. 1.25/unit. Proceeds of sales amounted to Rs.330 163.75

3.3 Berri rouge culture

3.3.1 Broodstock and fingerlings production

The broodstock of berri rouge was maintained in concrete nursery and broodstock ponds. The fish were fed on extruded red snapper pellets. Freshwater from the adjacent Belle Eau River was supplied to all ponds. Reproduction occurred naturally in the ponds round the year. A total of 69 689 fingerlings was collected out of which 3 029 were distributed free of charge to 85 small-scale farmers and 66 660 were sold to 6 large-scale farmers at Rs. 1.25/unit amounting to a sale value of Rs. 83 325.

3.3.2 Pilot project for Small Entrepreneurs and Cooperative Societies

A project for aquaculture to be undertaken by small entrepreneurs and cooperative societies was launched in July. In that context, 3 000 berri rouge fingerlings were provided to the La Ferme St. Martin Multipurpose Cooperative Society Ltd. to carry out a pilot project on culture of berri rouge in ponds used for storing water for irrigation purposes. Technical advice was given to fifteen members of the cooperative society during a half day training session. Mentoring of the farmers was effected regularly. Despite difficulties encountered at the beginning, the farmers have now successfully mastered the culture techniques.

3.4 Breeding and seed production of freshwater ornamental fish

Breeding and seed production techniques of three species of freshwater ornamental fish, sailfin molly (*Poecilia latipinna*), platy (*Xiphophorus maculates)* and goldfish (*Carassius auratus)* have been successfully developed. A practical guide on culture of freshwater ornamental fish was prepared in collaboration with the Human Resources Development Council (HRDC). In

February, 25 entrepreneurs attended a two-day training session in broodstock management, collection of eggs and fry, water quality management and rearing of fry amongst others.

The launching ceremony for the pilot project was held in March at AFRC and on that occasion each trainee was provided with a set of ornamental fish and a practical guide with a view to facilitate them to undertake the project. The pilot project has demonstrated that the culture of freshwater ornamental fish is feasible. Two more training sessions were held in October. A total of 37 persons attended the training sessions which was followed by the distribution of a set of ornamental fish and a practical guide to each trainee. The trainees were provided with technical assistance for their fish culture projects.

3.5 Aquaculture extension service

Technical advice was provided to 350 persons interested in aquaculture. Site visits were undertaken to assist the potential fish farmers.

3.6 Amendments to the Fisheries and Marine Resources Act 2007

The Fisheries and Marine Resources Act 2007 (FMRA) was amended under the Finance (Miscellaneous Provision) Act 2008 to provide the legal framework for fish farming in the sea. The new section 8 (B) consolidates the provisions made in the FMRA 2007 to authorise fish farming at sea. The sites earmarked for fish farming in the sea are located at eight specific zones (*Appendix 10*) as listed in the First Schedule of the FMRA 2007(amended).

3.7 Guidelines for fish farming in the sea

Guidelines to applicants for fish farming at sea were prepared jointly with the Board of Investment, the Prime Minister's Office, the Ministry of Housing and Lands, the Ministry of Environment and National Development Unit, the Ministry of Finance and Economic Empowerment and the Competent Authority of the Division of Veterinary Services of the Ministry of Agro Industry, Food Production and Security. The guidelines define the requirements and conditions for fish farming at sea.

3.8 Commercial aquaculture production

Production of red drum, silver sea bream and rabbit fish for the local market amounted to 181 tonnes from La Ferme Marine de Mahebourg. A total of 60 tonnes of chilled red drum was exported to Dubai, South Africa, Switzerland and the USA.

One tonne of fish and 800 kg of mud crab together with 80 000 units of oysters were harvested from different barachois.

The production of freshwater fish (berri rouge) and freshwater prawn was 56.4 and 5.3 tonnes respectively. The production details are shown in table 3.1.

Table 3.1: Aquaculture production

Species	Quantity
Berri rouge	56.4
Freshwater prawn	5.3
Red drum (floating cages)	175.0
Sea bream (floating cages)	6.0
Marine fish (barachois)	1.0
Mangrove crab (barachois)	0.8
Total	244.5
Oyster	80 000 units

4. MARINE CONSERVATION

The Marine Conservation Division has the responsibility to manage the two marine parks, review Environmental Impact Assessment (EIA) reports and Preliminary Environment Reports (PER), assess coastal development projects and tourism related activities for recommendations and participate in post EIA and post PER monitoring.

4.1 Blue Bay Marine Park (BBMP)

4.1.1 Management

The management of the BBMP involved the monitoring, control and surveillance of permissible activities such as glass bottom boating, snorkelling, diving, water skiing, swimming and non-motorised boating. Seventeen picked up cases of prohibited fishing gear were recorded, *viz*: basket traps (10), underwater fishing equipment (2), fishing nets (1), pole and line (4), and a bundle of fishing line. Eleven contraventions were established including access to the park without a permit (5), discharging polluting substances into the park (2), engaging in commercial activities in the park without a permit (2) and illegal fishing (2).

During the year, 105 new permits were issued to the different users of the park, and 246 permits were renewed against payment of Rs. 852 600. Registered artisanal fishermen were exempted of charges for permits. Details on the various types of permits and fees collected are shown in table 4.1.

Table 4.1: Number of permits issued and fees collected

Type of permit	No. of permits issued				Fee (Rs)	Total (Rs)
	New	Renewal	No charge	Total		
Boat & vessel	17	67	18	102	5 000	420 000
Line fishing	42	70	14	126	200	22 400
Commercial activity	40	15	Nil	55	5 000	275 000
Recreational	6	85	Nil	91	1 000	91 000
Interference	Nil	6	Nil	6	7 000	42 000
Basket trap	Nil	1	13	14	1 000	1 000
					Sub -total	***846 400***
*Boat & vessel (weekly)	Nil	2	Nil	2	100	1 200
					Total	**852 600**

**** A weekly access fee of Rs. 100 was applicable to 2 permits for boats and vessels entering the park. One permit was for a period of two weeks and the other for ten weeks.***

A general increase was noted in the number of permits issued for all categories. However, the number of permits issued for glass bottom boat operators was maintained at 15 in compliance with the limit fixed in 2007. The number of permits issued for pole and line fishing from the shore was 126 in the permissible zones of the park and within the set limit of 150.

The Steering Committee for the management of the BBMP met on four occasions. A tidal gauge was installed in the Strict Conservation Zone of the park by the Meteorological Services as part of the Tsunami Alarm System.

Maintenance work was carried out to ensure that the mooring structures and buoys used to demarcate the different zones were in good condition. The missing and damaged conical demarcation buoys of the traffic lane, the ski lane, the mooring, swimming, conservation and strict conservation zones were ordered for replacement.

4.1.2 Blue Bay Marine Park Ramsar Site

The BBMP was officially designated a Wetland of International Importance in January and included in the List of Wetlands of International Importance established by Article 2.1 of the Ramsar Convention on Wetlands. The official ceremony for the designation of the BBMP Ramsar site was held in September. In that context, an exhibition on Marine Protected Areas (MPAs) was organised by the Fisheries Division and the Indian Ocean Commission. A quiz competition was also organized on the topic "Marine flora and fauna of MPAs in the Western Indian Ocean Eco-region" for students of secondary schools. The Imperial College won the first prize and the DAV College the second prize.

Pamphlets on the BBMP were distributed to sensitise a wider spectrum of visitors on the importance of the conservation of the Park and MPAs. Information boards, funded by the French Embassy, have been placed at the BBMP Patrol and Visitors' Centre.

4.1.3 Coral reef ecosystem monitoring at BBMP

The annual monitoring was carried out at the five established stations. Data were collected on the sea-bottom substrate in terms of corals, macro-algae, marine invertebrates and fish. Table corals were the dominant species in the park (Table 4.2). A slight decrease in the percentage of live corals was noted in comparison to the previous year at station 2. At station 3, the percentage of live coral has considerably decreased due to the increased frequency of diving, snorkelling and anchor damage. The dominant fish species comprised mainly those of families acanthuridae, labridae, scaridae, chaetodontidae and pomacentridae (Table 4.3).

Table 4.2: Percentage substrate cover at BBMP

Life form categories	Station 1		Station 2		Station 3		Station 4		Station 5	
	2007	2008	2007	2008	2007	2008	2007	2008	2007	2008
Acropora branching	0.8	4.9	22.8	14.7	19.1	25.9	0	0	0	0
Acropora digitate	9.3	2.3	6.3	0	0	0	0	0	0	0
Acropora tabular	1.5	0	46.5	39.9	45.3	2.3	0	0	0	0
Coral foliose	0	0	6.1	18.6	8.0	0	0	0	0	0
Coral massive	0	0.3	0	6.9	2.2	1.6	0	0	0	0
Coral submassive	0	0.2	12.1	11.8	2.2	0.2	0	0	0	0
Mushroom coral	0	0	0	0	0	0	0	0	0	0
Coral encrusting	0	0	0	0	0	1.2	0	0	0	0
Total live coral cover	**11.8**	**7.7**	**94**	**91.9**	**76.7**	**31.2**	**0**	**0**	**0**	**0**
Sand	27.4	14.9	2.0	2.1	5.0	4.3	96.0	97.3	10.7	10.7
Rock	21.8	26.7	0	0	1.2	3.0	4.0	2.7	39.4	39.3
Rubble	10.0	30.4	0	0	0.4	4.3	0	0	13.9	13.0
Dead coral	17.0	18.8	4.0	6.0	16.7	43.2	0	0	0	0
Macroalgae	12.0	1.3	0	0	0	8.9	0	0	36.0	37.0
Coralline algae	0	0.2	0	0	0	5.1	0		0	
Sea grass	0	0	0	0	0	0	0	0	0	0
Zoanthid	0	0	0	0	0	0	0	0	0	0

Table 4.3: Number of fish/100m^2 at BBMP

Family	Station 1		Station 2		Station 3		Station 4		Station 5	
Fast fish	**2007**	**2008**	**2007**	**2008**	**2007**	**2008**	**2007**	**2008**	**2007**	**2008**
Acanthuridae	28	15	276	40	38	5	0	0	0	0
Aulostomidae	0	0	0	0	0	3	0	0	0	0
Balistidae	0	0	0	0	0	0	0	0	0	0
Blenniidae	0	0	0	0	0	0	0	0	0	0
Chaetodontidae	0	0	42	12	24	11	0	0	0	0
Gobidae	0	0	0	0	0	0	0	0	0	0
Labridae	18	30	69	7	37	11	0	0	0	0
Lethrinidae	0	0	0	0	0	14	0	0	0	0
Monacanthidae	0	0	0	0	0	0	0	0	0	0
Mugilidae	0	9	0	0	0	0	0	0	0	0
Mullidae	0	0	0	0	0	0	0	0	0	0
Scaridae	13	35	37	16	2	22	0	0	0	0
Serranidae	0	0	0	0	0	0	0	0	0	0
Siganidae	0	0	0	0	0	14	0	0	0	0
Sparidae	0	0	0	0	0	0	0	0	0	0
Zanclidae	0	0	0	0	30	36	0	0	0	0
Total	**59**	**89**	**424**	**75**	**131**	**116**	**0**	**0**	**0**	**0**
Sedentary fish										
Plotosidae	0	0	0	0	0	0	0	0	0	0
Pomacentridae	12	20	277	62	82	211	0	0	0	0
Total	**12**	**20**	**277**	**62**	**82**	**211**	**0**	**0**	**0**	**0**

4.2 Balaclava Marine Park (BMP)

4.2.1 Management

Information on the MPA Regulations and the conservation of the marine ecosystems were disseminated to fishers, boat operators and the public. The number of boats encountered and their activities were recorded monthly. During the year, 108 boats of all categories operated in the park. There were 7 boathouses engaged in recreational activities using glass-bottom boats (7), parasails (2), pedalos (27), kayaks (46), lasers (23), hobbie cats (5), windsurfs (41) and for snorkelling (124 sets).

4.2.2. Construction of the BMP Centre

The consulting engineers for the construction of the BMP Centre submitted the design drawing plans for the building and its associated facilities. Clearances on the drawing plans were being sought from relevant authorities.

4.2.3 Demarcation of the BMP

Funding for the demarcation of the conservation zone and the installation of scattered mooring buoys in the BMP was confirmed in June, under the Indian Ocean Commission (IOC) Project "Marine Protected Areas Network of the IOC Countries" for a sum of 22 000 Euro.

4.2.4. Interference permit

Three interference permits were issued for the demarcation of a swimming zone and the construction of two jetties in the BMP.

4.2.5 Coral reef ecosystem monitoring at BMP

Monitoring was carried out at four of the seven established stations. Results of the survey on the percentage of substrate cover are given in table 4.4. Branching *Acropora* corals were the dominant species in the park while the highest diversity of corals was found at station 3. As compared to 2007, the live coral cover at stations 1 and 2 showed a slight decrease, whilst an

increase was recorded at station 4. The fish count per family at the different stations is presented in table 4.5.

Table 4.4: Percentage of substrate cover at BMP

Lifeform categories	Station 1		Station 2		Station 3		Station 4	
	2007	**2008**	**2007**	**2008**	**2007**	**2008**	**2007**	**2008**
Acropora branching	27.6	25.9	18.1	0.0	0.1	16.8	45.8	51.0
Acropora digitate	0	0.0	4.6	12	0.0	4.0	0.0	0.0
Acropora tabular	2.4	3.3	2.0	0.0	0.0	0.5	1.8	5.6
Coral encrusting	3.5	3.17	5.5	5.8	7.7	2.2	0.0	0.4
Coral foliose	0.0	0.0	4.6	0.0	0.0	0.0	0.0	4.7
Coral massive	1.8	2.6	10.0	22.2	27.4	14.7	2.8	0.6
Coral submassive	1.8	0.17	10.0	13.8	1.0	1.4	1.0	1.5
Mushroom coral	0.0	0.0	0.0	0.2	0.0	0.0	0.0	1.8
Millepora	0.0	0.0	0.0	0.0	0.0	0.2	0.0	0.3
Soft coral	**0.0**	0.0	**0.0**	0.0	**0.0**	0.0	**0.0**	0.0
Total live coral cover	**37.1**	**35.1**	**54.8**	**54.0**	**36.2**	**39.4**	**51.4**	**65.9**
Rubble	7.3	3.9	3.2	6.6	10.2	3.0	1.3	0.7
Rock	2.5	6.8	0.0	13.2	18.1	7.4	0.0	0.0
Sand	0.0	2.9	0.0	5.2	2.3	3.0	0.0	0.0
Turf algae	0.9	0.0	1.9	0.9	0.2	0.0	0.3	9.9
Macroalgae	3.0	0.0	1.3	4.3	2.8	4.0	3.2	1.3
Coralline algae	3.2	5.0	1.4	0.0	3.5	5.3	0.0	0.0
Dead coral	46.0	46.2	37.4	15.9	26.5	38.0	43.8	22.2

Table 4.5: Number of fish/100m^2 at Balaclava

Family	Station 1		Station 2		Station 3		Station 4	
Fast fish	**2007**	**2008**	**2007**	**2008**	**2007**	**2008**	**2007**	**2008**
Acanthuridae	472	253	78	11	68	37	24.5	134
Chaetodontidae	11	3	8	6	0	33	8	0
Labridae	4	56	35	15	21	24	79	40
Scaridae	48	19	26	27	33	0	19	12
Serranidae	5	0	26	2	5	5	0	0
Siganidae	0	0	0	0	0	0	0	0
Total	**540**	**331**	**173**	**61**	**127**	**99**	**351**	**186**
Sedentary fish								
Holocentridae	0	0	0	0	0	0	0	0
Pomacentridae	23.5	572	32	231	>300	56	136	760
Pomacanthidae	0	0	0	0	0	8	0	0
Haemilidae	0	0	0	0	0	0	0	0
Fistulariidae	0	0	0	8	0	0	0	0
Zanclidae	0	0	0	0	0	0	0	2
Total	**563.5**	**572**	**32**	**239**	**>300**	**64**	**136**	**762**

The fish counts show that the families acanthuridae, labridae and pomacentridae were the most abundant.

4.3 Firework displays

Thirty-six authorisations were granted, with a list of conditions for firework displays at 15 sites in the lagoon around the island. Underwater surveys were carried out at these sites, prior to the displays, to identify suitable locations for the placing of barges, from which fireworks were shot.

4.4 Underwater surveys in connection with coastal development projects

Forty eight (48) underwater ecological surveys were carried out in the lagoon at various sites around Mauritius in connection with coastal development projects *(Appendix 8)*

4.5 Environmental Impact Assessment (EIA)

Fifty EIA applications were assessed and recommendations were made to the Ministry of Environment and National Development Unit. Eighteen of the EIA applications involved major coastal projects such as hotel development, integrated resort schemes (IRS), beach re-profiling, dredging works, construction of rock revetments and jetties as indicated at *appendix 9.*

4.6 Undersea walk sites

Underwater ecological surveys were carried out at four sites in the lagoons of GRSE and Black River to assess the area for proposed undersea walk activities. The percentage of live coral cover, the fish species and their abundance, GPS positions of the platform, characteristics of the bottom substrate and visibility at each site were recorded.

4.7 Partnerships for Marine Protected Areas of Mauritius and Rodrigues

The UNDP/GEF/Government of Mauritius Project "Partnerships for Marine Protected Areas in Mauritius and Rodrigues", which started in 2005 was in its fourth year of implementation. The proposal for the gazetting of the demonstration site "The South East Marine Protected Area (SEMPA) – Rodrigues" was finalised.

4.8 Marine Protected Areas Network of the Indian Ocean Commission (IOC) Countries

The third steering meeting for the project "Marine Protected Areas Network of the Indian Ocean Commission Countries" was held in Seychelles in June. Funds earmarked for the different proposals were approved. A biological inventory and the first phase for the demarcation of the BMP were approved for a sum of 36 400 Euro. For Rodrigues, funds to the tune of 51 000 Euro were agreed upon for the development of alternative livelihoods for fishermen operating in the marine reserve of Rivière Banane, the demarcation of the marine reserve and the training of rangers.

5. FISHERIES TRAINING, DEVELOPMENT AND EXTENSION

5.1 Training

After the completion of the training of lagoon fishermen in the FAD fishery, the General Course for Fishermen was resumed. A new module "Basics of Sailing" was included in the course with a view to imparting additional knowledge and skills on safety at sea and alternative and complementary modes of propulsion to cut down on use of fossil fuel. 46 fishermen were trained in 2 batches.

A total of 1 249 fishermen benefited from the various training courses since 1986 as shown in Table 5.1.

Table 5.1: Summary of training courses and number of fishermen trained from 1986 to 2008

Training course	Dispensed by	Year	No. trained
Training of artisanal fishermen	Formation Itinérante de Pêche	1986-1990	150
Deepwater shrimp fishing	AFRC	1988-1991	15
Demersal fishing	AFRC	1992-1994	66
Swordfish fishing	AFRC	1996-1998	26
FAD fishery	AFRC	1994-2003	553
	FITEC	2004-2006	68
General Course for Fisher	FITEC	2004-2006	173
FAD fishery	FITEC	2007	152
General Course for Fisher	FITEC	2008	46
Total			**1 249**

5.1.1 In-service training course for Fisheries Protection Officers

136 Fisheries Protection Officers followed an 8-day in-service training course at FITEC from May to October. The course was organised with the collaboration of the Training Unit of the Ministry of Civil Service and Administrative Reforms. The objectives of the training were to better equip the officers with the necessary knowledge and skills to enable them to perform their duties effectively and efficiently, to better enforce the fisheries legislations and to provide an improved customer service.

5.2 FAD fishery

Activities in relation to the development of the FAD fishery under the International Fund for Agricultural Development Loan 504: MU-Rural Diversification Programme were continued.

5.2.1 FAD deployment and maintenance

Sixteen FADs were replaced and a new one was set off GRNW. An average of twenty FADs was kept active around the island. Table 5.2 gives the particulars of the FADs around the island and figure 5.1 illustrates their locations.

Table 5.2: Location of FADs

Name	Mooring depth (m)	Distance from coast (nm)	Latitude°S	Longitude°E
Pointe aux Sables	300	1.2	20° 09' 562	57° 25' 086
Albion	1 370	2.5	20° 09' 412	57° 23' 251
Port Louis I	3 560	12.2	20° 02' 117	57° 16' 116
Baie du Tombeau	1 050	2.6	20° 04' 413	57° 27' 890
Trou aux Biches I	2 020	4.6	19° 59' 670	57° 27' 950
Trou aux Biches II	2 686	6.7	20° 01' 330	57° 24' 487
Flat Island	750	9.6	19° 49' 434	57° 34' 373
Poudre d'Or II	240	4.2	20° 02' 275	57° 46' 075
Trou d'Eau Douce	992	2.8	20° 13' 884	57° 51' 561
Grand Carreau	260	8.2	20° 21' 622	57° 55' 339
Souillac	1 001	2.1	20° 33' 676	57° 31' 058
Baie du Cap	855	2.7	20° 33' 073	57° 23' 283
Rivière Noire I	914	4.5	20° 23' 596	57° 16' 771
Rivière Noire II	490	2.2	20° 21' 69	57° 19' 780
Rivière Noire III	3 090	9.0	20° 17' 849	57° 12' 118
Tamarin	445	2.2	20° 19' 519	57° 19' 575
Flic en Flac	1 200	2.5	20° 15' 99	57° 19' 39
Medine	2 510	5.2	20° 12' 765	57° 17' 627
La Preneuse	2 500	5.2	20° 17' 724	57° 16' 098
Grand River North West (GRNW)	3 050	7.7	20° 07' 592	57° 17' 447

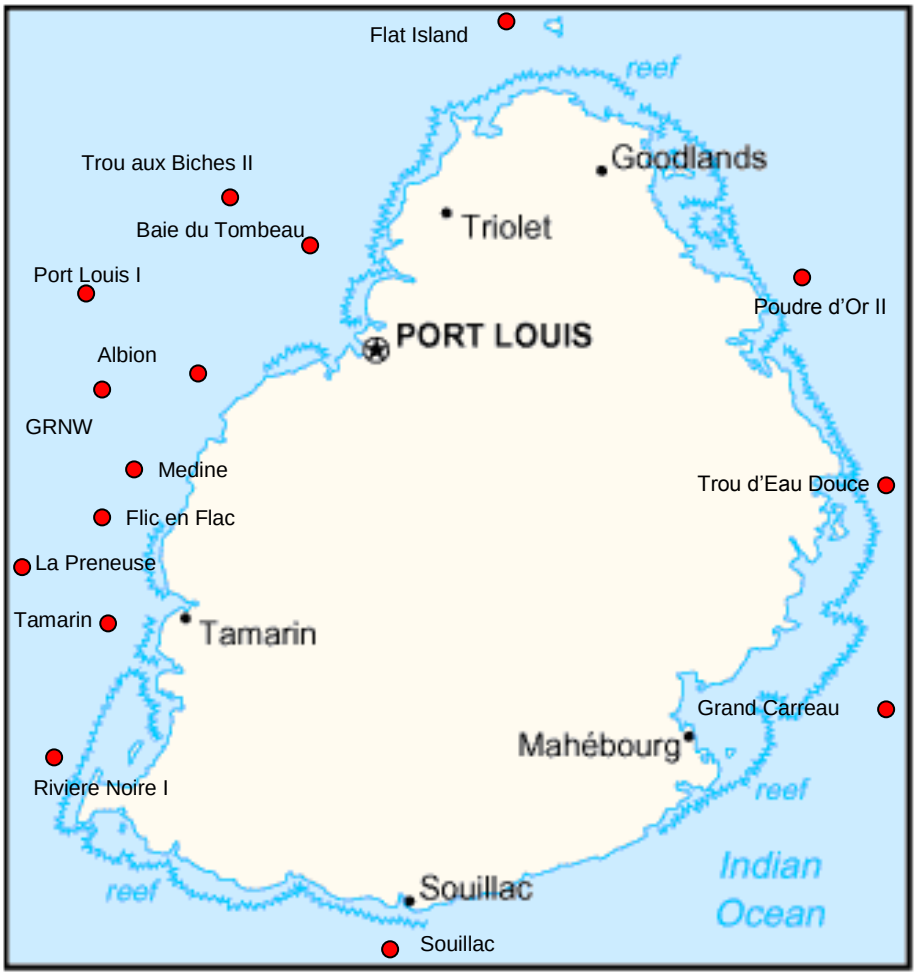


Figure 5.1: FADs around Mauritius

Eighty-eight sea trips were effected by the two research boats, "Sphyrna II and Maustral", for training of fishermen, deployment, verification and maintenance of FADs as shown in table 5.3.

Table 5.3: Sea trips effected

Activity	Number of sea trips
Training at sea	50
FAD development	36
Demonstration fishing	2

5.2.2 FAD fishery monitoring

The software licence for the Statistical Package for Social Sciences (SPSS) and a new computer for FAD monitoring were acquired under the IFAD-RDP programme. Daily catch and related information on the FAD fishery, under the sample based data collection programme, were collected at the fish landing stations. Data from June 2007 to December 2008 were coded and input in the database for later analysis.

5.2.3 Consolidation of control measures

The draft FAD regulations were prepared after consultations with associations of fishermen and other stakeholders. After vetting by the Solicitor General, procedures for its proclamation would be undertaken.

5.2.4 FAD fishery development sub-programme under the Rural Diversification Programme

Two IFAD supervision missions were held in April and August to review the progress achieved in the FAD fishery and to facilitate the completion of the final year activities.

5.3 Demonstration fishing for deepwater shrimp

Two fishing trips for catching deepwater shrimp using traps were undertaken onboard *Sphyrna II* for a private promoter in April. The aim of the trips was to demonstrate the setting and hauling of traps, catch per trap, optimal depth of abundance, handling and preservation methods.

6. FISHERIES MANAGEMENT

6.1 Licensing of fishing vessels

All fishing vessels operating in the Exclusive Economic Zone of Mauritius are required by law to obtain a fishing licence. Licensing of fishing vessels is an important tool in the management of the fishery resources and in the monitoring, control and surveillance of fishing activities.

Licences are issued to local and foreign fishing vessels under a set of conditions and against payment of the appropriate licence fees.

6.1.1 Licences issued under fishing agreements

Mauritius has fishing agreements with the Government of Seychelles and the Federation of Japan Tuna Fisheries Co-operative Associations (FJTFCA). The fishing agreement with the European Community (EC) was not renewed at its expiry in December 2007. Thus, no licences were issued to EC vessels in 2008. Details of licences issued under existing agreements are presented in table 6.1

Table 6.1: Licences issued to foreign fishing vessels under fishing agreements

Fishing agreement	Purse seine licences	Longline licences
Seychelles	16	7
FJTFCA	-	14

6.1.2 Fishing licences for other foreign vessels

Fishing licences are issued to longline fishing vessels of other nationalities. The licence fee for foreign longline fishing vessels (excluding vessels licensed under Fishing Agreements) is US$ 6 000 for an initial 90-day period and US$ 2 000 for any additional 30-day period or part thereof. A deposit fee of US$ 500 is also payable and is refundable upon submission of properly filled logbooks. A non-refundable fee of US$ 500 is charged for reporting through the Vessel Monitoring System (VMS) for the period of 90 days.

Sixty licences were issued to longliners of various nationalities. In addition, 24 extensions of licences were granted to some of these vessels. Five licences were issued to two foreign fishing vessels to fish on the banks for demersal species. Fishing licences were issued to a Cambodia-flagged vessel targeting deep-sea demersal species and a Kiribati-flagged vessel targeting sea cucumber in the St Brandon area. Details are given in table 6.2.

Table 6.2: Licences issued to foreign fishing vessels not falling under fishing agreements

Nationality	Longline	Banks fishing	Bottom Longline	Sea cucumber
Belize	5	-	-	-
China	3	-	-	-
Indonesia	2	-	-	-
Taiwan Province of China	50	-	-	-
Madagascar	-	2	-	-
Cambodia	-	-	1	-
Kiribati	-	-	-	1

6.1.3 Licence fees from foreign vessels

Licence fees obtained from foreign fishing vessels amounted to US$ 765 000 and Rs. 25 000.

6.1.4 Licences issued to foreign fishing vessels over the last five years

Table 6.3 shows the categories and number of licences issued to foreign fishing vessels over the last five years.

Table 6.3: Licences issued to foreign vessels by category (2004 – 2008)

Year	Surface Longliner	Purse seiner	Handline	Trawler	Banks	Bottom longliner	Sea cucumber	Total
2004	181	34	1	0	0	0	0	**216**
2005	175	39	0	0	3	0	0	**217**
2006	183	43	0	2	3	0	0	**231**
2007	141	59	0	0	3	0	0	**203**
2008	81	16	0	0	3	1	1	**102**

The decrease in the number of foreign licences issued in 2008 as compared to previous years can be attributed mainly to EU fishing vessels not being issued fishing licences in 2008.

6.1.5 Licensing of Mauritian fishing boats and vessels

Local fishing vessels operate mainly in the banks fishery and the chilled fish fishery. Vessels operating in the banks fishery are vessels above 24m in length and undertake fishing campaigns averaging 45 days at sea. Boats in the chilled fish sector are usually less than 24m in length and undertake fishing campaigns of about 12 days.

Boats operating in the chilled fish fishery target different types of fishes. Table 6.4 gives details of the number of local vessels and the different fisheries in which they are operating.

Table 6.4: Categories of local vessels

Category	Number
Banks fishing	5
Carrier	1
Demersal species	1
Demersal and slope species	8
Pelagic, demersal and slope species	2
Pelagic, demersal and slope species and carrier	2
Pelagic and demersal species	4
Total	**23**

6.2 Port State Control

6.2.1 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 and it has the appropriate insurance covers and the required licence.

During the year, 119 clearances were issued to boats and vessels involved in the demersal chilled fish fishery, 92 to boats and vessels involved in the pelagic chilled fish fishery, 9 to carrier boats and vessels from St Brandon, and 16 to banks fishing vessels**.**

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

6.2.2 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, transhipment, bunkering, change of crew, provisions and repairs. During the year, 568 foreign fishing vessels called at Port Louis. Table 6.5 gives details of the different categories of vessels having called at the port.

Table 6.5: Details of calls of vessels

Type of vessel	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Reefers	8	4	5	4	9	16	8	4	9	4	4	8	**83**
Squid vessels	3	0	0	0	0	15	19	0	0	0	1	1	**39**
Bottom gill netters	0	0	0	0	1	0	0	0	0	0	0	0	**1**
Tuna longliners	39	33	31	25	30	30	23	30	49	25	33	41	**389**
Trawlers	0	1	7	0	1	1	1	2	1	0	1	0	**15**
Patagonian toothfish	0	1	4	1	2	3	2	3	1	0	2	6	**25**
Purse seiners	0	0	1	3	2	2	0	0	4	1	1	0	**14**
Others (lobster, trap)	0	1	0	0	0	0	0	0	0	0	1	0	**2**
Total	**50**	**40**	**48**	**33**	**45**	**67**	**53**	**39**	**64**	**30**	**43**	**56**	**568**

The nationalities and the number of calls of fishing vessels at Port Louis are given in tables 6.6 and 6.7, respectively.

Table 6.6: Details of vessels calling at Port Louis

Type of vessel	Flag country	Number of calls
Reefer	Mauritius	10
	Panama	29
	Taiwan	4
	Netherlands Antilles	8
	Malaysia	19
	Indonesia	7
	Spain	1
	Cambodia	1
	Kiribati	1
	Lithuania	1
	Liberia	1
	Thailand	1
Squids	Taiwan	38
	Vanuatu	1
Bottom gill nets	Panama	1
Tuna longliners	Mauritius	5
	Taiwan	200
	Spain	21
	Indonesia	23
	Japan	50
	Portugal	4
	United Kingdom	4
	Seychelles	17
	Belize	19
	Oman	6
	Korea	11
	Madagascar	2
	Malaysia	8
	Philippines	6
	Thailand	2
	France	3
	Vanuatu	2
	China	4
	Vietnam	2
Trawler	Cooks Islands	6
	Australia	3
	china	6
Patagonian toothfish	France	18
	Australia	7
Purse seiners	France	12
	Italy	1
	Seychelles	1
Other (trap)	France	2
	TOTAL	**568**
Banks fishing vessels (Mauritian vessels with foreign flag)	Madagascar	3
Banks fishing vessels (Mauritian vessel)	Mauritian	3

Table 6.7: Calls of foreign vessels at Port Louis

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
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**
2006	78	86	36	41	59	66	79	59	109	68	44	76	**801**
2007	82	44	29	47	48	50	66	41	79	52	51	75	**664**
2008	50	40	48	33	45	67	53	39	64	30	43	56	**568**

During 2008, two vessels were denied unloading namely "Sibley" and "Lingsar 17". "Sibley" under a Panama flag was denied unloading as the vessel was listed as an IUU vessel on the CCAMLR Blacklist as "Red Lion".

"Lingsar 17" of Indonesian registry was denied unloading on two occasions. The vessel called in port on 24 November with 20 tonnes of fish which were caught by the vessel and 130 tonnes which were loaded from four vessels from the high seas. Since the vessel name did not appear on the list of carrier vessels for at-sea transhipment in the IOTC Area, unloading was denied. The vessel was denied unloading again when it called into port on 13 December 2008 with only 20 tons of fish after having unloaded the 130 tonnes on the high seas. The CCAMLR and IOTC were informed accordingly.

6.2.3 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 fishing vessel calling into port.

During the year, there were 25 calls of toothfish fishing vessels out of which only five called for transhipment. The others did not have any toothfish on board. The amount of toothfish transhipped was 1 765 tonnes. The quantities of toothfish transhipped during the past five years are presented in table 6.8.

Table 6.8: Transhipment of patagonian toothfish (tonnes)

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
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**
2006	0	46	0	0	18	0	177	0	0	0	0	0	**241**
2007	0	0	0	0	551	0	213	556	0	0	595	0	**1 915**
2008	0	0	0	0	527	0	218	200	136	0	0	684	**1 765**

6.2.4 Calls and transhipment of deep-sea trawlers

Fifteen calls were made by trawlers of different nationalities (Cook Islands, Australia and China) in 2008. A total of 1 901 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 6.9.

Table 6.9: Transhipment by trawlers (tonnes)

Year	Quantity transhipped
2004	3 463
2005	4 395
2006	3 883
2007	1 826
2008	1 901

6.3 Tuna fisheries

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

6.3.1 Sampling of catch from licensed purse seiners

Length frequency data were obtained from the catches of licensed purse seiners. A total of 2 725 tuna comprising 1 836 skipjack, 575 yellowfin and 314 bigeye were sampled.

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

The length frequency distribution of skipjack tuna is shown in figure 6.1. The length of the fish ranged from 39 to 70cm with the mode at around 49cm.

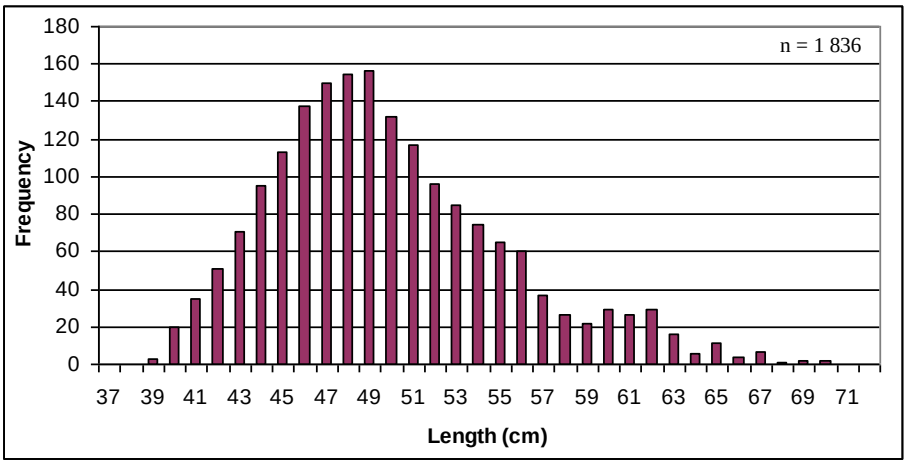


Figure 6.1: Length frequency distribution of skipjack tuna

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

The length frequency distribution of yellowfin tuna is presented in figure 6.2. The fish had a length range between 49 and 173cm. Most of the fish sampled was below 112 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 catches made on schools associated with drifting logs.

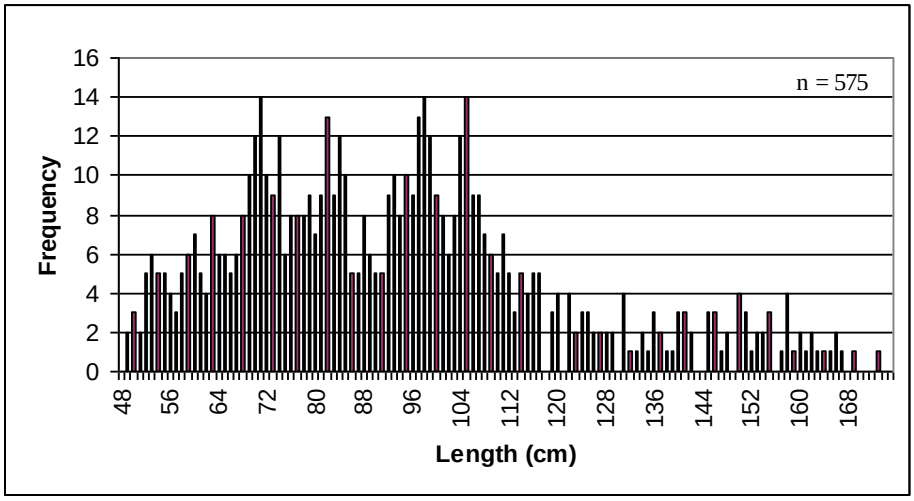


Figure 6.2: Length frequency distribution of yellowfin tuna

6.3.1.3 Length frequency distribution of bigeye tuna (*Thunnus obesus*)

The length of the bigeye tuna ranged between 49 and 159 cm and the length frequency distribution is presented in figure 6.3. The bigeye tuna caught by the purse seiners was mostly juvenile fish measuring less than a metre, typical of catches made on log schools.

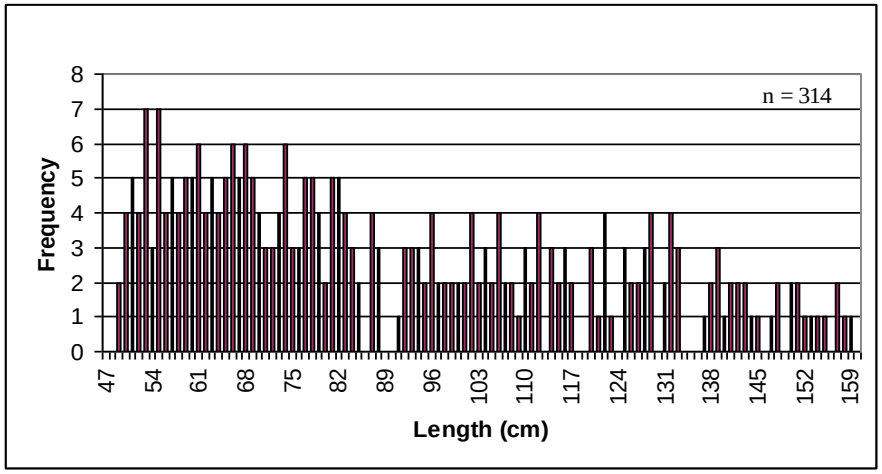


Figure 6.3: Length frequency distribution of bigeye tuna

6.3.2 Species composition

The catch was composed of 54% skipjack, 38% yellowfin, 7% bigeye and 1% miscellaneous fish. The species composition of the purse seine catch unloaded in Mauritius for the past five years is presented in table 6.10

Table 6.10: Species composition of purse seiners catch (%)

Year	Species			
	Skipjack	**Yellowfin**	**Bigeye**	**Miscellaneous**
2004	60	31	8.0	1.0
2005	55	38	5.0	2.0
2006	63	33	3.5	0.5
2007	74	21	4.0	1.0
2008	54	38	7.0	1.0

6.3.3 Reproductive biology of skipjack tuna

514 samples for the studies on reproductive biology of skipjack tuna were obtained at the local cannery. Gonad and liver from skipjack tuna were removed for determining maturity stage, spawning period, reproductive index, sex ratio, seasonal sexual variation and length at first maturity. These samples were collected during 2007 and 2008.

6.3.3.1 Gonado-somatic Index (GSI)

The GSI for both males and females was maximum during January, April, and September and minimum during February, May and October. The monthly variations of the GSI are presented in figure 6.4, showing three peaks of intense sexual activity and spawning. The reproductive cycles of the males and females were synchronous as observed in previous years.

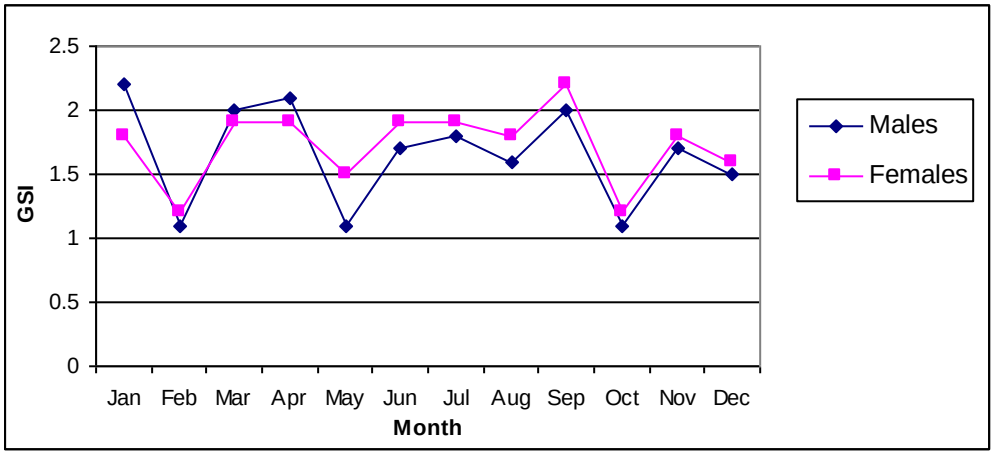


Figure 6.4: Gonado-somatic index (GSI) of skipjack tuna

6.3.3.2 Spawning period

The skipjack tuna spawned throughout the year with certain periods of intense sexual activity. More than 70 % of females had ovaries in the terminal stage of maturation during the different months of the year except in October and December when it was 57% and 65% respectively.

6.3.3.3 Sex ratio

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

6.3.3.4 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 6.5. Lm_{50} for males and females was found to be at 44 cm and 43 cm respectively.

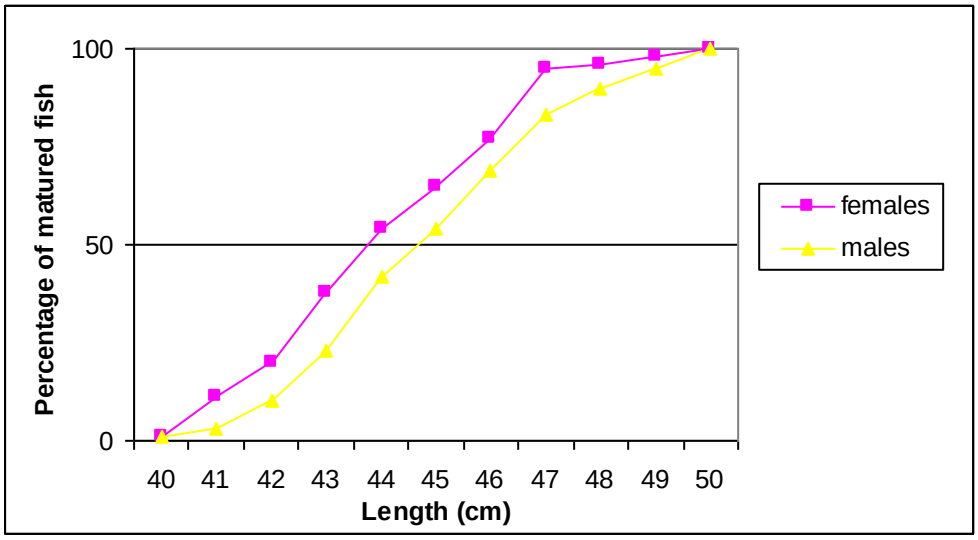


Figure 6.5: Length of skipjack tuna v/s percentage maturity

6.3.4 Monitoring of the catch of licensed longliners

Logbook returns were collected from licensed vessels. A total of 110 logbooks was received, of which 91 were considered for processing; the remaining contained inconsistencies. The vessels transhipped 7 966 tonnes. The catch included 1 364 tonnes caught by European longliners which were licensed in 2007 and 476 tonnes caught by two Mauritian flagged vessels. The catches made in the Mauritian EEZ amounted to 3 600 tonnes.

6.3.4.1 Species composition of the catch of licensed longliners

The species composition of the catch of the licensed foreign longliners is shown in table 6.11

Table 6.11: Species composition of the catch of licensed foreign longliners

Species	Scientific name	Catch (t)	%
Albacore	*Thunnus alalunga*	2 024	25
Yellowfin	*Thunnus albacares*	1 736	22
Swordfish	*Xyphias gladius*	1 273	16
Bigeye	*Thunnus obesus*	1 070	13
Skipjack	*Katsuwonus pelamis*	76	1
Sailfish	*Isthiophorus albicans*	115	2
Sharks		669	8
Others		781	10
Other billfishes		222	3
	Total	**7 966**	**100**

The major part of the catch composed of albacore and yellowfin tuna which were the target species of most of the Asian longliners.

6.3.4.2 Spatial distribution of the catch of licensed longliners

The fishing area of the licensed longliners was spread widely in the Western Indian Ocean; between 09º N and 35º S and 40º E and 90º E as depicted in figure 6.6.

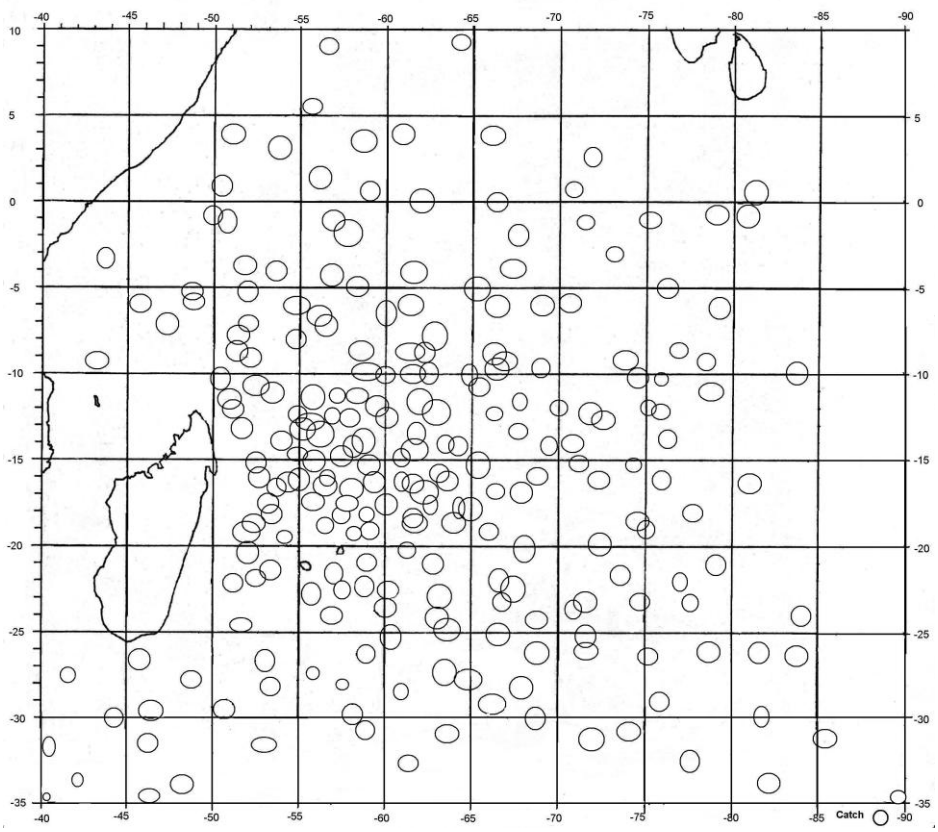


Figure 6.6: Catch distribution of licensed longliners

6.3.5 Sampling of albacore tuna of licensed longliners

Length frequency data of albacore tuna were obtained during regular sampling carried out on the catches of licensed longliners. A total of 3 685 albacore tuna was sampled. The length frequency distribution is shown in figure 6.7. The length varied from 74 to 126 cm. The major part of the catch comprised fish in the range of 98 to 114 cm.

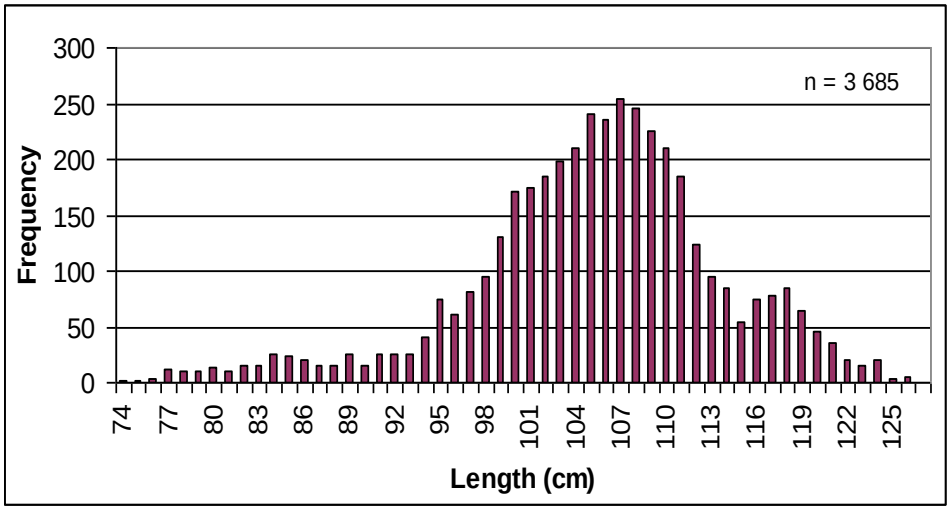


Figure 6.7: Length frequency distribution of albacore tuna

6.3.6 The local longline fishery

Two vessels operating under the Mauritian flag were engaged in the fishery. They undertook 4 fishing trips and unloaded 476 tonnes of fish. The species composition of the landings is shown in figure 6.8. Most of the catch was composed of swordfish (52%). The catch per unit effort was 1.03 kg per hook. The fishing area was between latitudes 24º S and 35º S and longitudes 32º E and 68º E.

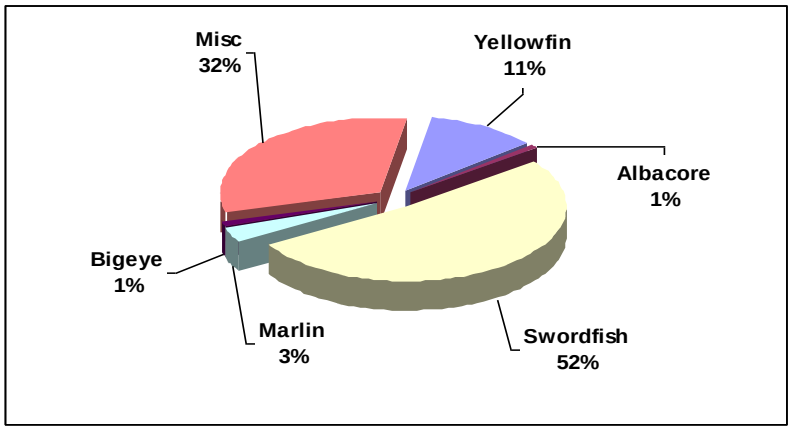


Figure 6.8: Catch composition of Mauritian longliners

6.3.7 Transshipment by tuna longliners

A total of 20 250 tonnes of tuna and tuna-like species was transhipped at Port Louis by licensed and non-licensed longliners which effected 375 calls. The species composition of the fish transhipped is shown in table 6.12. Albacore tuna constituted 54% of the total catch. It was observed that there was a sharp decrease in the volume of yellowfin tuna transhipped and this was mainly due to a fall in the number of Japanese vessels calling at Port Louis.

Table 6.12: Species composition of fish transhipped (t)

Year	Albacore	Yellowfin	Bigeye	Skipjack	Swordfish	Bluefin	Marlin	Sailfish	Shark	Misc.	Total
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**
2006	20 307	1 995	358	127	1 934	230	242	131	1 890	2017	**29 232**
2007	12 182	3 281	494	134	2 305	8	67	486	1 881	3 110	**23 948**
2008	11 060	1 307	481	134	3 297	8	140	168	1 715	1 940	**20 250**

The percentage of the three main species which were transhipped is shown in figure 6.9.

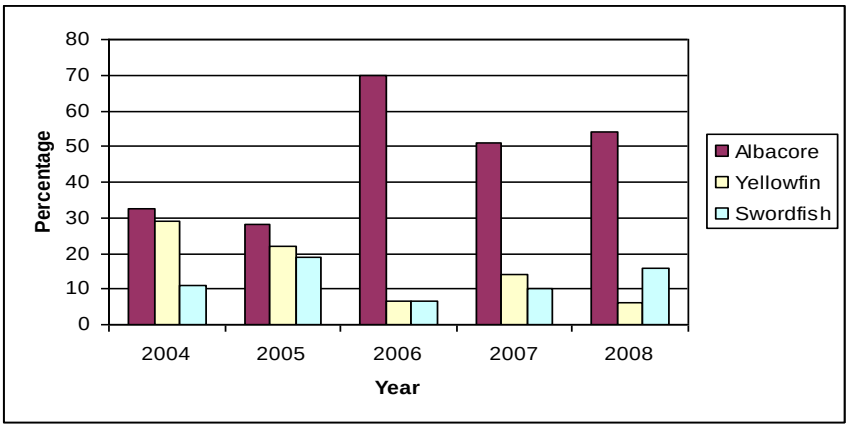


Figure 6.9: Percentage of the three main species transshipped by longliners

6.3.8 Swordfish fishery

Five fishing vessels targeting swordfish effected 23 trips and landed 41.37 tonnes of chilled fish. The catch composed mainly of 35.2% albacore and 34% yellowfin. The fishing areas were around Mauritius, between latitudes 10^0S and 23^0S and longitudes 56^0E and 61^0E. The catch and species composition are shown in table 6.13 and figure 6.10.

Table 6.13: Catch composition of the local swordfish fishing vessels (kg)

Year	Swordfish	Yellowfin	Bigeye	Albacore	Marlin	Shark	Sailfish	Misc.	Total
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**
2006	74 157	102 632	15 444	40 840	6 508	1 212	1 590	4 873	**247 256**
2007	45 913	65 924	-	56 416	6 597	1 056	2 156	6 264	**184 326**
2008	8 858	14 076	-	14 570	2 183	67	163	1 462	**41 379**

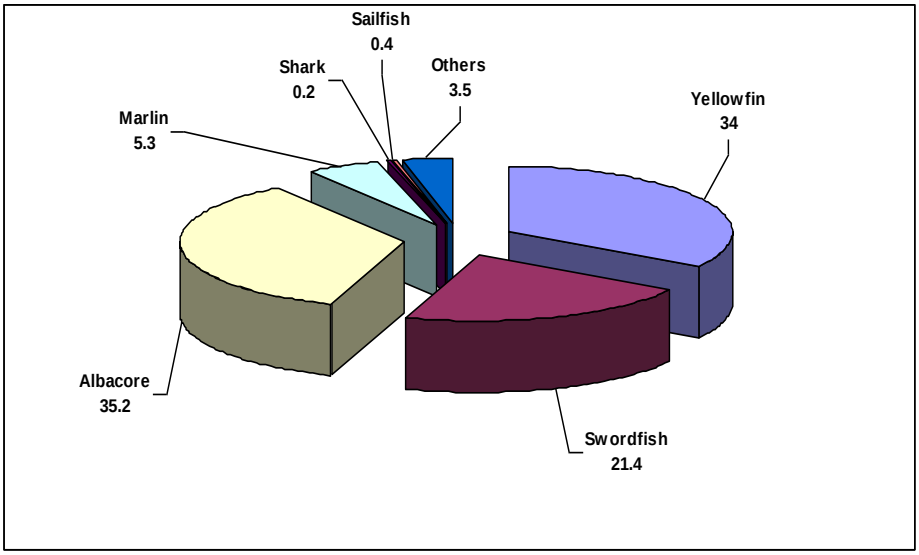


Figure 6.10: Species composition of the catch

6.3.8.1 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 6.11. The length of the swordfish measured from the operculum to keel ranged between 43 to 172cm with the majority between 69 and 120cm.

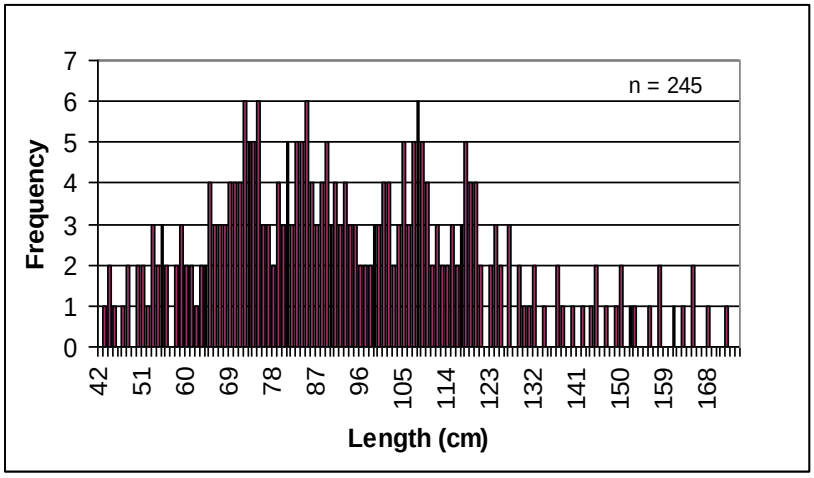


Figure 6.11: Length frequency distribution of swordfish

6.3.9 Length frequency distribution of albacore

The lengths of the albacore tuna were measured during the landings of the local vessels. The length frequency distribution is shown in figure 6.12. The length of the albacore tuna measured ranged from 95 to 124cm with a uni-modal class of 105cm

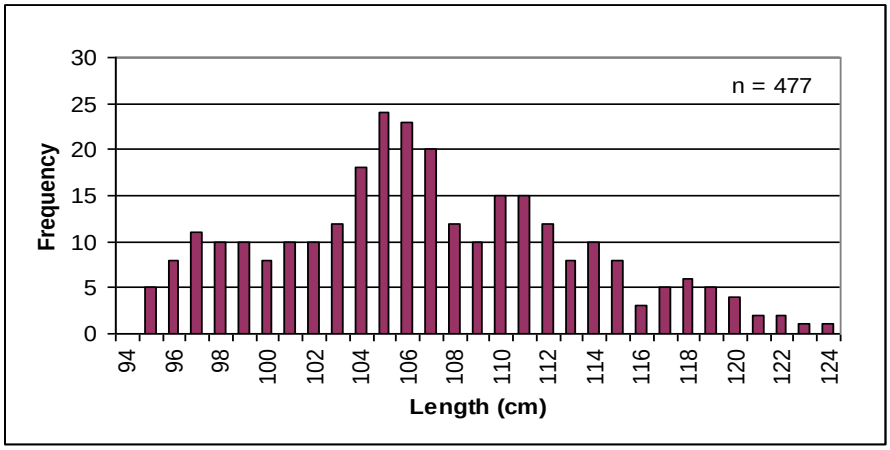


Figure 6.12: Length frequency distribution of albacore

6.4 Vessel Monitoring System

A total of 267 logbooks were checked against data reports received at the Fisheries Monitoring Centre (FMC). 250 fishing vessels reported to the FMC, comprising 31 local and 219 foreign vessels. Table 6.14 shows a breakdown of the fishing vessels by nationality and transponder type.

Table 6.14: Vessels reporting to the FMC

Vessel	Inmarsat	Argos	Total
Local	**27**	**4**	**31**
Foreign			
Taiwanese	45	53	98
Japanese	0	18	18
Malaysian	13	1	14
Indonesian	8	0	8
Malagasy	3	0	3
Belize	4	1	5
Seychelles	0	5	5
Korean	0	1	1
China	0	2	2
Cambodia	0	1	1
Kiribati	1	0	1
Sub total	***101***	***86***	***187***
French	*	*	37
Spanish	*	*	23
Portuguese	*	*	2
Italian	*	*	1
Total			**250**

**Information available through the flag state FMC but not directly available through the Inmarsat or Argos tracking system*

6.5 Import and export of fish and fish products and fish processing

6.5.1 Import of fish and fish products

During the year, 2 041 permits were issued for the import of fish and fish products, including 13 permits for the import of fish samples and fish bait. Proceeds from permits amounted to Rs. 4 088 500.

The import of fish and fish products for direct consumption amounted to 10 984 tonnes representing about 8.8% of the total imports for the year. The two main tuna processing plants imported 113 443 tonnes of raw materials. 956 tonnes of frozen barracouta were imported from New Zealand, Namibia and South Africa for the production of salted snoek while tuna for the processing plants was obtained from French and Spanish vessels mainly transhipping in Seychelles and also from few direct unloadings at Port Louis by purse seiners.

6.5.1.1 Imports for direct consumption

Fish and fish products imported for direct consumption have been classified into four categories, namely fish, crustacean, cephalopod and shellfish. Crustaceans consisted of prawn, shrimp, crab and lobster; Cephalopods of octopus, squid and cuttlefish. Shellfish comprised mussels, oysters, clams and scallop. Details are given in figure 6.13.

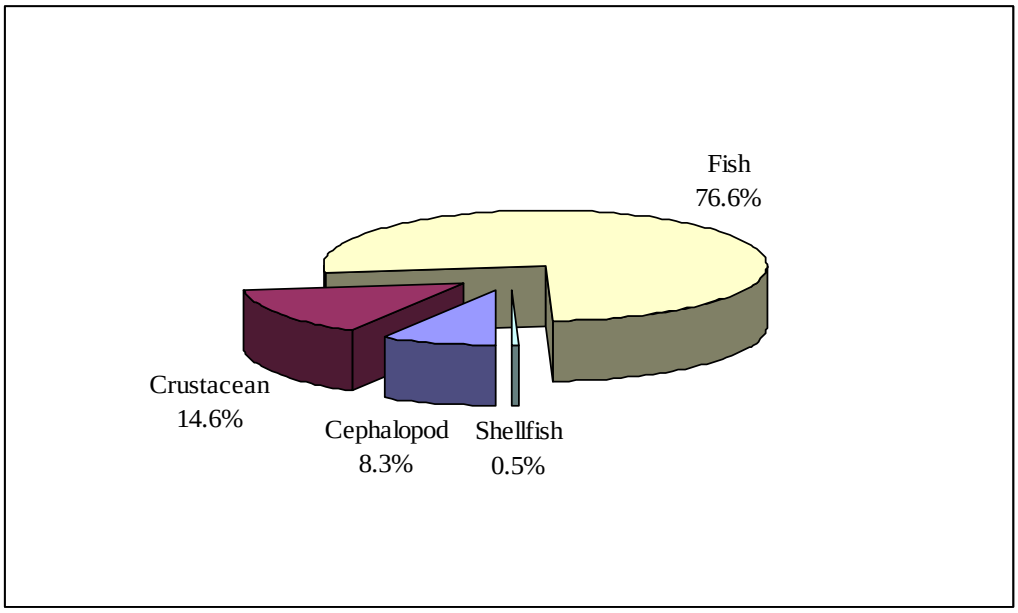


Figure 6.13: Imports per category

Fish and fish products were imported in different forms of preservation, namely, frozen, chilled, canned, dried, smoked and live crustaceans. Frozen and canned products constituted the main imports with 7 315 and 3 210 tonnes, respectively as shown in figure 6.14.

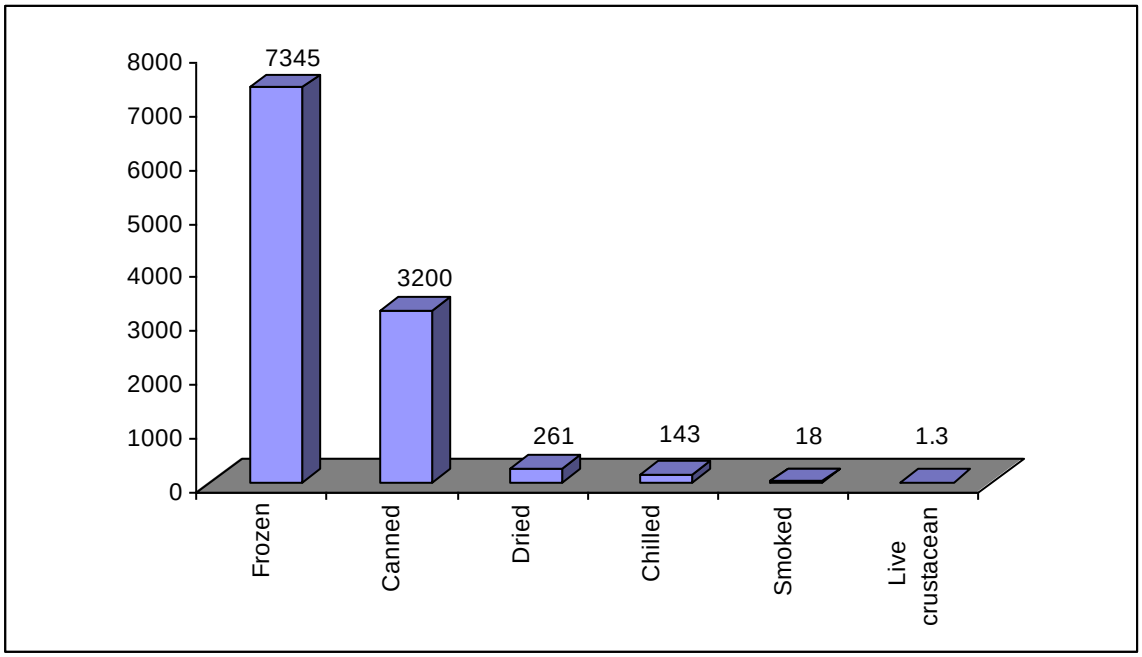


Figure 6.14: Categories of fish and fish products for direct consumption

Imports were mainly from India, China, South Africa, Madagascar, Thailand, Indonesia, Morocco, Chile, the high seas and the Freeport. Import of canned fish was mainly from Morocco and Chile while frozen fish was from India, South Africa, Madagascar, Thailand, Indonesia, the high seas and the Freeport. Dried bombay duck and some dried prawn were mainly from India. Details on import of fishery products for consumption by origin are presented in figure 6.15.

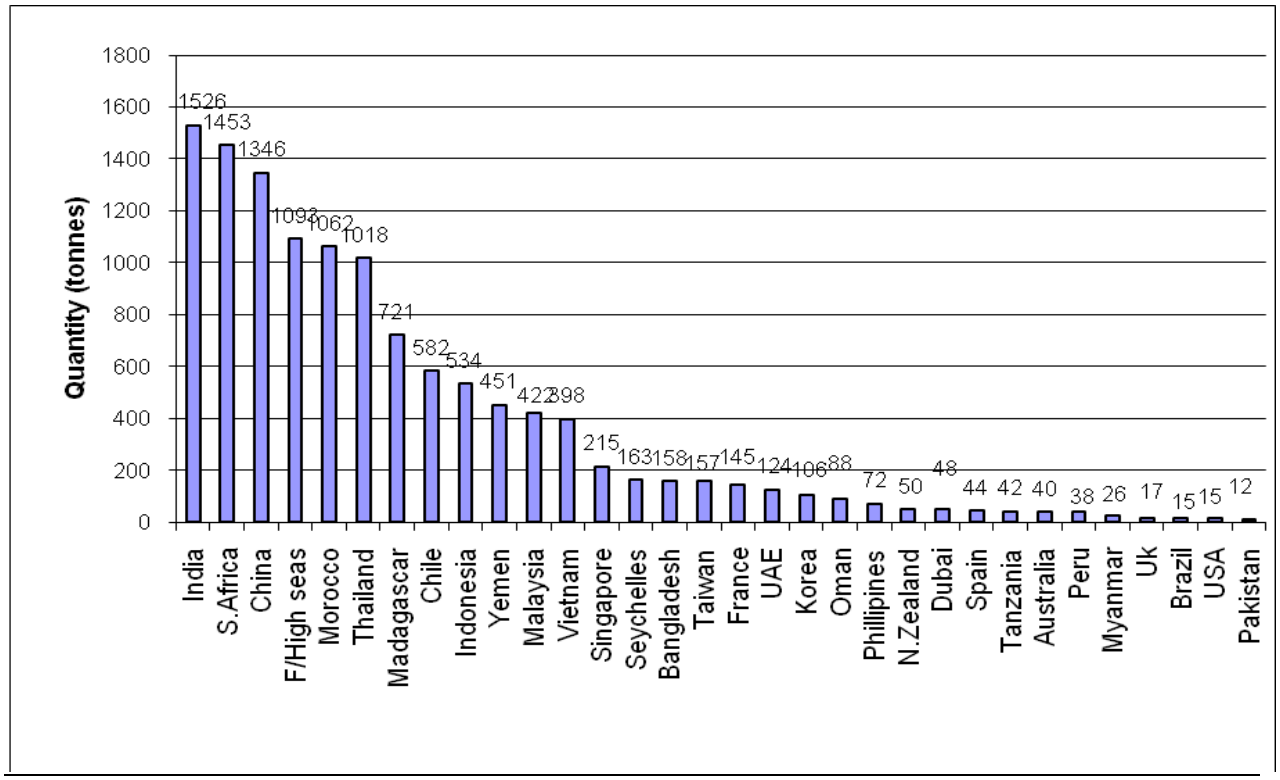


Figure 6.15: Import of fish and fish products by country of origin

6.5.1.1.1 Chilled fish and fish products

Chilled fish and fish products, amounting to 143 tonnes, were mainly imported from Seychelles, India and France. A total of 64 tonnes of fish was imported from Seychelles and it comprised mainly 'capitaine', 'sacréchien', 'vacoas' and 'bourgeois'. 'Bourgeois' was supplied only to hotels. The main imports from India were lobsters and prawns and they amounted to 20 tonnes. The imports from France amounted to 35 tonnes and consisted of 16 tonnes of salmon, 1 tonne of cooked shrimp, 248 kg of tarama, 7 tonnes of oysters, mussels and 'noix St. Jacques', 600 kg of fish egg in the form of 'oeuf de lompe', 'oeuf de cabillaud' and salmon egg. The other species were trout, turbot, sardine, 'dorade', 'bar', rollmops (herring), sole, 'encre de seiche', anchovy, 'miettes de crabe', mackerel and 'morue'. Details of the import of chilled fish and fish products as per categories are shown in table 6.15.

Table 6.15: Imports of chilled fish and fish products (tonnes)

Year	Fish	Crustacean	Shellfish	Total
2004	48	27	0	**75**
2005	95	10	15	**120**
2006	110	22	5	**137**
2007	79	11	8	**98**
2008	123	10	10	**143**

6.5.1.1.2 Frozen fish and fish products

Imported frozen fish and fish products amounted to 7 345 tonnes. These products were imported mainly from India, South Africa, Madagascar, Thailand, Malaysia, Indonesia, Oman, Philippines, France, Taiwan, China, the Freeport and fishing vessels calling at Port-Louis. Details of imports for the past five years are presented in table 6.16.

Table 6.16: Imports of frozen fish and fish products (tonnes)

Year	Fish	Crustacean	Cephalopod	Shellfish	Total
2004	3 497	1 216	822	21	**5 556**
2005	4 721	1 326	1 174	55	**7 276**
2006	4 848	1 061	696	49	**6 654**
2007	4 473	1 298	907	42	**6 720**
2008	4 937	1 486	878	44	**7 345**

The species composition of frozen fish imported is shown in figure 6.16. Fish commonly imported were 'capitaine', 'cateau', 'vacoas', catfish, marlin, 'vieille', sailfish and tuna. By-catch from tuna longliners, purchased by the Agricultural Marketing Board and sold to fishermen cooperatives, amounted to 384 tonnes and comprised tuna, oil fish, sailfish, moonfish, marlin, becune, angelfish, shark and 'dorade'. Other fish products mainly in the form of fish fingers, fish cakes and fish balls amounted to around 714 tonnes.

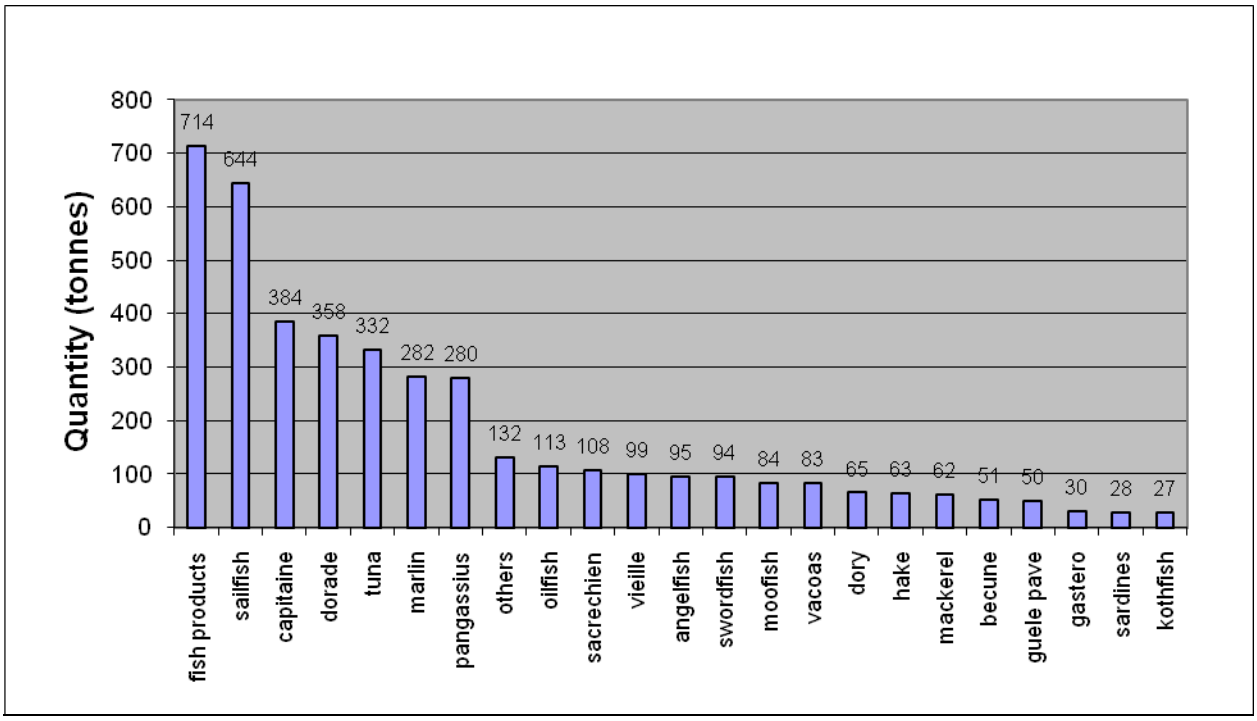


Figure 6.16: Import of frozen fish

6.5.1.1.3 Dried fish and fish products

Dried fish and fish products were imported from India, China, Malaysia, Indonesia, Pakistan and Singapore. The total import amounted to 261 tonnes. Details are presented in table 6.17.

Table 6.17: Import of dried fish and fish products (tonnes)

Year	Fish	Bombay duck	Squid, cuttlefish	Prawn	Others	Total
2004	2	189	2	127	2	**322**
2005	23	136	1	97	0	**257**
2006	2	175	0	109	0	**286**
2007	2	104	0	93	0	**199**
2008	0	171	0	87	3	**261**

6.5.1.1.4 Smoked fish and fish products

Smoked fish and fish products were imported from France, Denmark, South Africa, Australia and the United Kingdom for supermarkets, hotels and restaurants. Smoked fish and fish products amounting to 18 tonnes, comprised herring, trout, salmon, haddock, surimi, cod and mackerel.

6.5.1.1.5 Canned fish and fish products

Canned fish and fish products such as sardines, mackerels, anchovy, 'foie de morue', salmon, tuna, crabmeat, prawn and mussels were imported from Morocco, Chile, Peru, South Africa, Thailand, Indonesia, India, Malaysia, China, France and the United Kingdom. With the exception of tuna, these products are not produced locally. The main country for the supply of sardines and mackerel were Morocco, South Africa and Chile respectively. A total of 3 200 tonnes of canned fish and fish products were imported for consumption during the year and details are presented in table 6.18.

Table 6.18: Import of canned fish (tonnes)

Year	Sardines	Pilchards	Mackerel	Tuna	Others	Total
2004	1 022	1 102	994	107	193	**3 418**
2005	804	624	1 015	118	63	**2 624**
2006	900	889	838	230	40	**2 897**
2007	630	967	1 166	171	12	**2 946**
2008	1 015	1 342	641	185	17	**3 200**

6.5.1.6 Live crustaceans

1 332 kg of live lobster and crab were imported from South Africa and Madagascar.

6.5.1.2 Live ornamental fish

A total of 882 987 units of live fresh water ornamental fishes were imported from Singapore and Malaysia. Common aquarium fish include gold fish, koi, tetra, guppies, mollies, cichlids, arrowana, fresh water turtles and others.

6.5.1.3 Live fish for culture

120 000 units of fingerlings *(Oreochromis mozambicus* and *O. niloticus)* were imported from Mayotte for culture purposes.

6.5.1.4 Fishmeal

A total of 244 tonnes of dried fishmeal and 26 tonnes of fish soluble were imported from France and Ecuador. These products were used in the manufacture of animal feed.

6.5.1.5 Pet food

A total of 162 tonnes of pet food was imported from Thailand for sale on the local market.

6.5.1.6 Seashells

A total of 72 865 units of seashells were imported from Philippines and Madagascar.

6.5.2 Export of fish and fish products

6.5.2.1 Export of chilled fish

Two companies exported a total of 23 843 kg of chilled fish to Reunion. The species exported were 'vieille rouge' (*Epinephelus fasciatus*), 'croissant queue blanc' (*Variola albimarginata*), 'vieille maman rouge' (*Cephalopolis sonnerati*), 'vivano' (*Pristipomoides zonatus*) and 'cabot' (*Epinephelus multinotatus*).

6.5.2.2 Export of marine ornamental fish

Two companies exported live ornamental marine fish to USA, Hong Kong, United Kingdom, Germany, Israel, France and Spain. A total of 3 348 units were exported.

6.5.2.3 Re-export of freshwater ornamental fish

One company re-exported 1 545 units of freshwater ornamental fish to Madagascar and Reunion.

6.5.3 Fish processing

6.5.3.1 Canned tuna

The local cannery imported 56 720 tonnes of raw tuna from European vessels. 32 977 tonnes of canned tuna were exported to European countries and 935 tonnes were put on sale on the local market. Export and local sale of the produce for the past five years is presented in table 6.19. Pet food was not produced during the year.

Table 6.19: Export and local sale of canned tuna and pet food (tonnes)

Product / Year	2004		2005		2006		2007		2008	
	Local	**Export**	**Local**	**Export**	**Local**	**Export**	**Local**	**Export**	**Local**	**Export**
Canned tuna	1 005	30 555	1 142	31 674	1 278	34 463	1 131	32 575	935	32 977
Pet food	231	3 070	195	2 394	201	4 470	0	0	0	0
Total	**1 236**	**33 625**	**1 337**	**34 068**	**1 479**	**38 933**	**1 131**	**32 575**	**935**	**32 977**

6.5.3.2 Tuna loin production

One processing plant, engaged in the production of tuna loins for export, imported 56 723 tonnes of raw frozen tuna. A total of 48 881 tonnes of tuna loins/chunks/flakes were produced out of which 38 382 tonnes were exported to Spain, Italy, France, Greece , Portugal, Belgium, Israel, Denmark, Germany, Netherlands, South Africa, the United Kingdom and USA.

6.5.3.3 Salted fish

Two companies are engaged in the production of salted snoek from frozen barracouta (*Thyrsites atun*). A total of 516 tonnes of salted snoek were sold on the local market while 27 tonnes were exported. Details of the import of raw materials, production of snoek and their sale for the past five years are presented in table 6.20.

Table 6.20: Import, production and sale of salted fish (tonnes)

Year	2004	2005	2006	2007	2008
Import of barracouta	1 183	1 126	962	1 066	956
Production of snoek	958	772	644	651	613
Local sale of snoek	672	570	486	491	516

6.5.3.4 Fish meal production

One company was involved in fishmeal production. The raw materials (tuna offal) were obtained from the fish processing factories. A total of 9 587 tonnes of fishmeal was produced during the year; 9 198 tonnes were sold on the local market and 389 tonnes were exported to Taiwan Province of China, Sri Lanka and Madagascar. The production for the last five years is given in table 6.21.

Table 6.21: Production of fish meal (tonnes)

Year	2004	2005	2006	2007	2008
Production	5 263	6 584	10 265	10 393	9 198

6.5.3.5 Re-export of canned products

Two companies were involved in the import and re-export of canned products namely sardines, pilchards, mackerel and tuna meat. These products were imported from Morocco and Chile and re-exported to mainly to Madagascar but also to Seychelles and Comoros. The total re-export for the year amounted to 111 tonnes.

6.6 Fish production, consumption and trade balance

6.6.1 Total fish production

The total annual production by the different fisheries is given in table 6.22.

Table 6.22: Total fish production (tonnes)

Sector	2004	2005	2006	2007	2008
Artisanal fishery					
Mauritius	1 043	947	950	640	682
Rodrigues	1 204	1 040	1 067	1 067	1 758
Agalega	30	30	30	30	30
Sports fishery	650	650	650	650	650
Amateur fishery	300	300	300	300	300
Barachois	4	5	4	2	2
Ponds (prawn & fish)	32	23	20	17	62
Marine aquaculture (cage)	325	367	447	550	181
FAD Fishery	-	-	214	164	167
Sub-total	**3 588**	**3 362**	**3 682**	**3 420**	**3 832**
Offshore demersal fishery					
Shallow water banks	3 216	2 178	3 112	2 848	2 428
Banks deep water snappers	7	--	0	0	285
St Brandon inshore	204	414	235	*54	*173
Semi-industrial chilled fish	284	223	311	171	173
Tuna fishery	1 640	1 402	1 380	803	475
Semi-industrial pelagic fish	97	177	247	184	41
Demersal trawlers	1 595	2 584	1 112	0	0
Sub-total	**7 043**	**6 978**	**6 397**	**4 060**	**3 402**
Grand Total	**10 631**	**10 340**	**10 079**	**7 480**	**7 234**

*=only chilled and salted

6.6.2 Per capita consumption of fish

Table 6.23: Per capita consumption of fish (kg)

Year	Quantity
2004	19.8
2005	18.8
2006	19.9
2007	18.3
2008	21.5

Source: Central Statistics Office

6.6.3 Trade balance in relation to total imports and exports

The import of fish and fish products and trade balance are given in table 6.24.

Table 6.24: Import and export of fish and fish products and trade balance

	Import		Export		Balance
Year	**Qty(t)**	**Value(MR)**	**Qty(t)**	**Value(MR)**	**Value(MR)**
2004	80 943	3 170.1	54 241	3 358.1	188
2005	104 830	4 265.7	67 249	4 842.1	580.9
2006	150 728	6 720.9	79 580	7 120.4	395.5
2007	129 085	7 068.0	86 170	8 172.8	1 104.8
2008	113 608	8 547.4	66 205	8 015.2	-532.2

Source: Central Statistics Office; MR* – Million rupees

7 FISHERIES PLANNING

7.1 Fisheries Sector Strategy Paper (2008 - 2015)

The Fisheries Sector Strategy Paper (2008 - 2015) was prepared and the draft submitted in December to be included under the Agriculture Sector Strategy Plan. The main objective of the strategy plan is to incorporate the Medium Term Expenditure Framework (MTEF) within a Programme Based Budgeting (PBB). The activities of the Fisheries Division have been divided into two Sub-programmes with priority objectives and outputs for the different delivery units with well defined performance indicators and annual targets.

7.2 Regional and International Cooperation

7.2.1 Interim Economic Partnership Agreement

Mauritius initialled the interim Economic Partnership Agreement (EPA) for Eastern and Southern Africa (ESA) on 4 December 2007 to prevent trade disruption with the European Union (EU). The Interim EPA for the ESA configuration provides for an automatic derogation amounting to 8 000 tonnes of canned tuna and 2 000 tonnes tuna loins for export annually to the EU and to be shared among three ESA countries namely: Mauritius, Seychelles and Madagascar. Mauritius was granted a derogated quota of 3 000 tonnes for canned tuna and 600 tonnes for tuna loins under the European Union Council Regulation "EC MAR 1528/2007" for a period of one year starting January 2008. The allocated quota was distributed amongst tuna producers exporting to the European market.

7.2.2 Cooperation with Norway

An Agreement for bilateral cooperation programme over a period of three years (2008-2010) was signed in April between the Norwegian Agency for Development Cooperation (NORAD) representing the Kingdom of Norway and Mauritius. A financial grant to the tune of 8.85 million Norwegian Krona (about Rs 45 million) would be made available to finance projects for sustainable utilisation of marine living resources in the waters of Mauritius. The Institutional Cooperation Contract for implementation of the projects was endorsed by both countries in October during the hosting of an inception workshop in Mauritius. The workshop was attended by scientists from the Centre for Development Cooperation in Fisheries (CDCF), Norway, to elaborate and finalise project work plans, budget, timeframe, and milestones.

7.2.3 Cooperation with the Overseas Fishery Cooperation Foundation of Japan

The Overseas Fishery Cooperation Foundation (OFCF) of Japan fielded a project formulation mission in May to investigate the possibility of providing further assistance for the rehabilitation of fisheries facilities in Mauritius. A Memorandum of Understanding on the "Project for the Rehabilitation of Fisheries Facilities for Fisheries Development" was thereafter signed between the Ministry and the OFCF in August. The OFCF would offer assistance in the rehabilitation of the facilities at the FITEC, the AFRC and the Agricultural Marketing Board. The works have been scheduled to start in January 2009.

7.2.4 Cooperation with Greece

Procedures for the construction of a fish auction market, funded by the Hellenic Republic of Greece to the tune of Rs 25 million, were initiated. However, as the initial site was located in the buffer zone of the Aapravasi Ghat World Heritage Site, a new site was identified at Les Salines, adjacent to the Bulk Sugar Terminal in the port area.

7.2.5 Cooperation with Seychelles

The 8th Session of the Seychelles – Mauritius Commission on bilateral cooperation was held in Mauritius in July. In principle Mauritius was agreeable to the proposals formulated by the Seychelles authorities under the exchange programme in fisheries. In this respect, Mauritian and Seychelles officers would follow attachment courses in the following fields: demersal and long line fishing, monitoring, control and surveillance, quality control and inspection and aquaculture development.

7.2.6 Cooperation with Mozambique

Mauritius has entered into a Memorandum of Understanding with Mozambique and cooperation will start through the dispensing of training to two Mozambican technicians in prawn and ornamental fish culture at AFRC.

7.2.7 Cooperation with Pakistan

The 7th Joint Working Group (JWG) meeting was held in April in Islamabad between officials from the Islamic Republic of Pakistan and Mauritius. The JWG reviewed progress on the implementation of the Preferential Trade Agreement (PTA) which came into force on 20 November 2007. Based on the PTA, a Free Trade Agreement (FTA) will be prepared to facilitate trade of products between Mauritius and Pakistan. A Memorandum of Understanding between the two countries for the development of cooperation in the field of fisheries has been prepared and is awaiting finalisation.

8. FISHERIES PROTECTION SERVICE (FPS)

The FPS was placed under the mainstream activities of the Fisheries Division to ensure a coordinated approach in the implementation of fisheries policies in addition to enforcing the fisheries legislation - combating illegal fishing and monitoring fishing activities to protect the fisheries resources.

Officers of the FPS posted at the Albion Fisheries Research Centre, the Fisheries Training and Extension Centre, the Marine Parks and the One Stop Shop work under the supervision of the respective officer-in-charge. However, all matters concerning contravention and prosecution are reported to the Controller through the respective officer-in-charge for necessary action.

8.1 Artisanal fishermen

As at end of December, the number of registered artisanal fishermen was 2 307, compared to 2 300 in 2007. During the year, 52 new fishermen were registered and 45 deregistered. Details of registered fishermen as per gear category are given in table 8.1.

Table 8.1: Details of registered fishermen

Fisheries Post	Net	Basket trap	Line	Basket trap /line/ harpoon	Total
Port Louis	0	2	49	59	**110**
Tombeau Bay	0	12	62	81	**155**
Trou aux Biches	4	1	88	101	**194**
Grand Gaube	29	16	64	192	**301**
Poudre d'Or	0	13	1	131	**145**
Poste la Fayette	17	4	0	76	**97**
Trou d'Eau Douce	19	10	32	62	**123**
G.R.S.E	0	2	4	88	**94**
Bambous Virieux	0	15	20	172	**207**
Mahebourg	30	16	44	255	**345**
Riambel	6	4	4	70	**84**
Baie du Cap	3	7	20	62	**92**
Case Noyale	10	2	5	111	**128**
La Preneuse	19	2	50	71	**142**
Pointe aux Sables	17	4	39	30	**90**
Total	**154**	**110**	**482**	**1 561**	**2 307**

8.2 Registration of boats

All Mauritian fishing boats/vessels are registered with the Permanent Secretary under the Fisheries and Marine Resources Act. As far as artisanal fishing boats are concerned, 77 new ones were registered, bringing the total to 2 468 as at end of December.

Table 8.2: Registration of artisanal fishing boats

Fisheries Post	*AF
Port Louis	206
Tombeau Bay	161
Trou aux Biches	211
Grand Gaube	291
Poudre d'Or	168
Poste la Fayette	107
Trou d'Eau Douce	129
G.R.S.E	153
Bambous Virieux	198
Mahebourg	362
Riambel	32
Baie du Cap	81
Case Noyale	149
La Preneuse	133
Pointe aux Sables	87
Total	**2 468**

***AF** – Artisanal fishing*

8.3 Licences

The number of the different types of licences in the artisanal fishery is given in table 8.3.

Table 8.3: Number of licences

Fisheries Post	Large net	Gill net	Fishmonger	Bait gear*	
				Conical	Rectangular
Port Louis	0	0	168	38	0
Tombeau Bay	0	0	74	36	2
Trou aux Biches	1	0	65	16	6
Grand Gaube	3	0	83	6	2
Poudre d'Or	0	0	44	1	1
Poste la Fayette	2	0	28	1	5
Trou d'Eau Douce	1	1	27	0	20
G.R.S.E	0	0	23	1	5
Bambous Virieux	0	0	16	0	22
Mahebourg	2	2	145	2	51
Riambel	1	0	26	8	2
Baie du Cap	0	1	30	6	4
Case Noyale	1	0	29	7	3
La Preneuse	3	0	51	46	0
Pointe aux Sables	1	0	32	14	2
Total	**15**	**4**	**841**	**182**	**125**

**A bait gear is of two types: (a) a conical net with weights attached to the open circumference of the base and having meshes measuring not less than 1.5 cm and not more than 2.5 cm when stretched diagonally; (b) a rectangular net of 4m X 2m with meshes of 1.5 cm when stretched diagonally when the net is wet.*

8.4 Illegal fishing

The number of interventions and court cases for illegal fishing is given in table 8.4.

Table 8.4: Number of interventions and court cases

Year	Underwater fishing	Net fishing	Others	Length of illegal net seized (m)	Court cases
2006	105	146	83	12 033	31
2007	64	123	49	2 837	27
2008	154	96	47	2 404	9

8.5 Allowances to artisanal fishermen

8.5.1 Bad weather allowance

For the payment of bad weather allowance, the off-lagoon is taken as one zone, whereas the lagoon is divided into 4 zones, namely, zone-1 from Cap Malheureux to Pointe aux Sables, zone-2 from Pointe aux Sables to Le Morne, zone-3 from Le Morne to Blue Bay and zone-4 from Blue Bay to Cap Malheureux.

The number of beneficiaries ranged from 2 048 to 2 208 over the financial year (July 2007 – June 2008), while the rate for a bad weather day increased from Rs. 168 to Rs. 200 in July 2007. An amount of Rs 56 737 336 was thus paid as bad weather allowance. Details are shown in table 8.5.

Table 8.5: Bad weather allowance (Financial year)

Year	No. of days	Rate (Rs)	Beneficiaries	Total (Rs)
2004	118	130 - 135	2 012 - 2 111	**34 357 665**
2005	137	135 - 145	1 978 - 2 247	**41 597 895**
2006	zoning	145 - 155	1 054 - 2 257	**35 890 800**
2007	zoning	155 - 168	1 935 - 2 260	**47 380 770**
2008	zoning	168 - 200	2 048 - 2 208	**56 737 336**

The number of bad weather days by zones from July 2007 to June 2008 is shown in the table 8.6.

Table 8.6: Number of bad weather days by zone (July 2007 to June 2008)

Zoning	No. of bad weather days
Zone 1	28
Zone 2	35
Zone 3	48
Zone 4	47
Off-lagoon	151

8.5.2 Closed season allowance

During the closed season when net fishing is prohibited, net fishermen are entitled to a daily allowance (Rs. 200). A total of Rs. 3 121 216 was paid and details of payments are shown in table 8.7.

Table 8.7: Closed season allowance

Year	No. of days	Rate (Rs)	Beneficiaries	Total (Rs)
2004	121	130-135	179	**2 815 670**
2005	122	135-145	161	**2 763 010**
2006	121	145-155	161-153	**2 852 125**
2007	112	155-168	153-146	**2 565 825**
2008	115	168-200	146-144	**3 121 216**

8.5.3 Sick leave allowance

A registered fisherman is entitled to a sick leave allowance of Rs 200 per day when admitted to a hospital or clinic for 14 days. Such allowance paid is shown in table 8.8.

Table 8.8: Sick leave allowance

Year	Rate (Rs)	Beneficiaries	Total (Rs)
2004	130 - 135	3	**5 670**
2005	135 - 145	6	**11 480**
2006	145 - 155	5	**9 870**
2007	155-168	5	**10 710**
2008	168 - 200	4	**8 540**

8.6 Incentives to registered fishermen

8.6.1 Scholarships to children

The Fishermen Welfare Fund disbursed Rs 1 647 000, as scholarship allowance to children of registered fishermen. Details are shown in table 8.9.

Table 8.9: Scholarship allowance

Education Level	Beneficiaries	Amount (Rs)
Post C.P.E (Form I to V)	230	1 035 000
Post S.C (Lower and upper six)	42	378 000
Post H.S.C (Degree and professional qualifications)	19	225 000
Vocational	2	9 000
Total	**293**	**1 647 000**

8.7 Buy-back scheme for nets

Implementation of the buy-back scheme for the reduction of the number of nets operating in the lagoon was continued. Four net fishermen gave up net fishing and were compensated accordingly. Details of payment effected are shown in table 8.10.

Table 8.10: Amount paid (Rs)

Year	Fishermen		Nets surrendered			Total
	Number	Amount	Large net	Gill net	Amount	
2004	9	250 000	1	1	325 000	**575 000**
2005	2	140 000	0	0	0	**140 000**
2006	7	315 000	1	0	133 000	**448 000**
2007	4	245 000	0	0	0	**245 000**
2008	4	245 000	0	0	0	**245 000**

9. MISCELLANEOUS

9.1 Visits

4 179 persons visited the AFRC. The majority of the visitors were students from primary and secondary schools. Table 9.1 shows the number of visitors by type of institutions.

Table 9.1: Visits to AFRC

Institutions	Number of visitors
Primary Schools	1 834
Secondary Schools	967
Social organizations/welfare centres	624
Pre-primary schools	399
Government/Parastatal organisations	3
Other (tourists, private firms, UoM students)	64
Pre-vocational institutions	288
Total	**4 179**

9.2 Information service

The Documentation Unit/Marine Information Centre continued to provide information and access to reference materials on fisheries and the marine environment to students, stakeholders and the public in general.

9.3 New library holdings

223 publications (local and foreign) and six CDs were received. A monthly acquisition list is circulated to staff.

9.4 Sales and distribution of publications

Sales of posters, charts, maps and books published by the Fisheries Division amounted to Rs. 98 615.

9.5 The Fisheries and Marine Resources Act

The Fisheries and Marine Resources Act was proclaimed and enforced as from 08 May.

9.6 South West Indian Ocean Fisheries Project (SWIOFP)

The SWIOFP, a regional fisheries project with nine participating countries; namely Comoros, France (Reunion), Kenya, Madagascar, Mauritius, Mozambique, Seychelles, South Africa and Tanzania, became effective in June.

The project aims at assessing the offshore fishery resources within the South West Indian Ocean region and to develop institutional and human capacity. One participant from each country was trained in the preparation of the metadata format and StatBase and Weblis softwares. The metadata would be for the Data Gap Analysis while the Weblis software would be used for bibliographic records.

9.7 "Plan Regional de Surveillance des Peches dans le Sud-Ouest de l'Ocean Indien''

A surveillance mission was organized in the waters of Mauritius and Madagascar from 04 to 15 February 2008. The Mission Coordination Centre (MCC) was based at the FMC and the latter was required to give VMS information as well as weather conditions to the MCC.

A joint fisheries patrol was held in the waters of Mauritius and Seychelles from 23 to 30 May 2008. The French PV OSIRIS equipped with French, Seychelles and Mauritian inspectors undertook a patrol mission in the northern part of the EEZ of Mauritius. The Mission Coordination Centre [MCC] was based at the FMC, Mauritius.

The FMC was used as the Mission Coordination Centre (MCC) from 02 to 16 October 2008. In this connection the FMC was required to provide VMS data to the Coordination team. A joint fisheries patrol was held in the waters of Seychelles and Mauritius using patrol boats Osiris and Guardian and the NCG aircraft Dornier.