

1. Fisheries Research

1.1 Coastal (artisanal) fishery

The monitoring of the artisanal fishery for the island of Mauritius was pursued and data on catch, effort, fish species and gear type were collected. Out of the 61 fish landing stations, around 25 fish landing stations were randomly selected on a monthly basis for data collection.

1.1.1 Catch, effort and catch per fisherman day

The estimated total production was 950 tonnes of fresh fish comprising 579 tonnes from the lagoon and 371 tonnes from off-lagoon areas. The catch from the lagoon was slightly higher compared to last year whereas that of the off-lagoon showed a slight decrease and the overall mean catch per fisherman-day (CPFD) increased from 4.1 to 4.4 kg with a corresponding decrease in fisherman days. Table 1.1, 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
2002	704	598	1 302	192 116	108 708	300 824	3.7	5.5	4.3
2003	704	462	1 166	189 988	83 362	273 350	3.7	5.5	4.3
2004	699	344	1 043	195 087	68 516	263 603	3.6	5.0	4.2
2005	545	402	947	153 771	77 429	231 200	3.5	5.2	4.1
2006	579	371	950	145 089	68 961	214 050	4.0	5.4	4.4

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

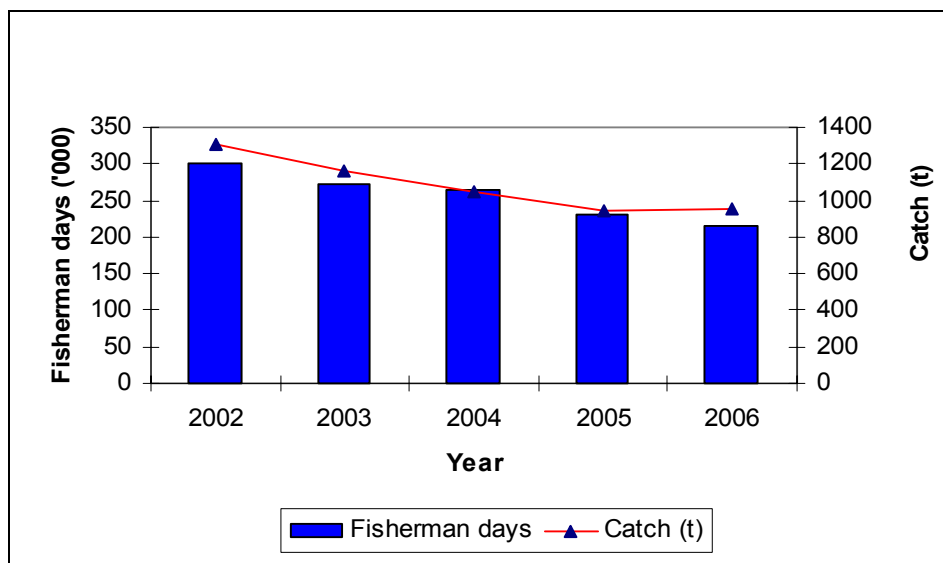


Figure 1.1: Fisherman days and total catch

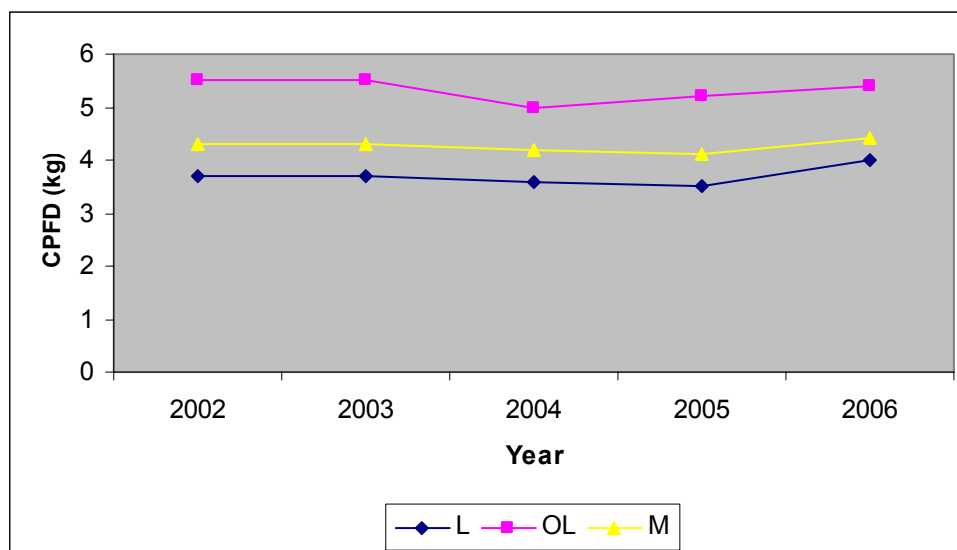


Figure 1.2: Catch per fisherman day

1.1.2 Monthly landings

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

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	30	33	63	11.8	16 700	3.3	4.4	3.8
February	36	31	67	8.5	16 349	3.4	5.4	4.1
March	95	24	119	12.9	19 916	6.2	5.0	5.9
April	55	40	95	11.4	22 852	3.4	5.8	4.2
May	103	47	150	18.3	25 606	6.0	5.6	5.9
June	53	39	92	10.3	22 118	3.5	5.7	4.2
July	31	15	46	5.0	13 195	3.0	5.4	3.5
August	48	23	71	8.1	19 186	3.5	4.4	3.7
September	46	14	60	6.7	16 237	3.8	3.5	3.7
October	24	22	46	5.8	13 428	3.0	4.3	3.5
November	32	39	71	8.7	14 319	3.7	6.9	4.9
December	26	44	70	8.3	14 144	3.1	7.4	3.5
Total	579	371	950	115.8	214 050			

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

1.1.3 Catch by gear

Seventeen large nets and four gill nets were operational during the year. Other gears used were basket traps, hooks and lines, harpoons, a combination of basket traps and hooks and lines. 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
2002	429 289	450 829	91 787	183 405	25 271	121 095	1 301 676
2003	373 439	492 561	17 539	160 636	13 585	108 103	1 165 863
2004	285 832	425 327	54 874	168 069	11 300	97 402	1 042 804
2005	288 818	433 832	16 786	121 521	8 196	78 165	947 318
2006	303 675	343 794	19 608	201 122	11 298	70 501	949 998

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 2 312 fishermen out of 2 365 registered fishermen was actively involved in fishing activities. The number of active fishermen by gear type for the past five years is presented in table 1.4.

Table 1.4: Number of active fishermen by gear type

Year	BT	L/H/OF	BT/L	LN	GN	Total
2002	501	734	600	165	28	2 028
2003	473	749	670	177	17	2 086
2004	445	896	736	159	20	2 256
2005	493	789	689	189	14	2 174
2006	275	764	1 111	149	13	2 312

BT = basket trap; **L/H/OF**= line, harpoon, on foot;

BT/L = basket trap and line, **LN** = large net; **GN** = gill net

1.1.5 Boats

The number of fishing boats was 1 852 indicating an increase of 20% when compared to 2005. The engine capacity of the motors used by the artisanal fishermen ranged from 8 to 25 HP. The number of fishing boats with mode of propulsion is presented in table 1.5 and figure 1.3.

Table 1.5: Number of fishing boats

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

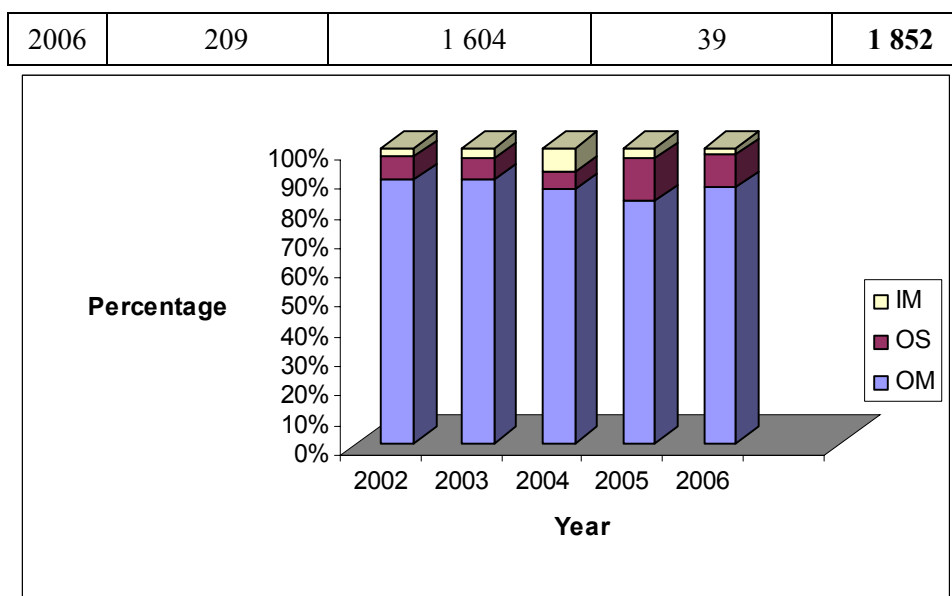


Figure 1.3: Percentage of modes of propulsion

1.1.6 Price of fish

The price of fresh fish in 2006 showed a slight increase at consumer level as shown in table 1.6.

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

Fish	2002	2003	2004	2005	2006
Homard	475	480	495	515	550
Crabe & crevette	295	285	275	290	275
Vieille rouge	185	180	190	215	230
Vacoas, sacré chien	150	150	160	160	175
Capitaine	145	140	155	170	170
Dame berri	135	130	140	150	170
Octopus	100	100	105	125	130
Carangue	110	100	115	115	120
Cordonnier	85	90	100	105	115
Rouget, tuna	80	85	90	95	110
Mullet voilé	75	80	85	95	100
Bordemar	80	85	100	95	90
Licorne	95	95	100	115	115
Cateau	70	75	75	70	85
Shark	35	55	45	45	50
Other fish	45	40	55	65	65

1.2 Banks fishery

Ten vessels were engaged in fishing activities in the shallow water banks of the Saya de Malha, Nazareth and Albatross and in the Chagos Archipelago. 31 fishing trips were carried out and particulars of the fleet 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
Sea Quest	20	59	20	8	7	2004
Noorstar 2	51	300	200	18	54	1992
l'Espoir	50	299	400	33	65	1993
Shandrani	55	398	300	35	60	1994
Hoi Siong 5	45	315	180	20	72	1996
Shandrani 2	42	449	130	30	45	2002
Talbot IV*	44	317	176	28	57	1989
Talbot III*	50	299	200	12	60	1986
Bethu*	55	391	196	17	54	2005
Diego Star*	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 2 612 tonnes of frozen fish was landed and comprised lehrinids (88.2 %), snappers/groupers (10.1 %) and tuna/others (1.7 %). A sharp increase in catch was observed in 2006 mainly due to an increase in the number of active vessels and number of trips on the banks in 2006 as compared to 2005. An increase in fishing effort is also observed in 2006. Table 1.8 shows the annual catch from the different fishing areas and figure 1.4 illustrates the trend in catch. Table 1.9 shows the fishing effort and catch from the different banks.

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

Year	No. of vessels	Catch (t)				Total catch
		Saya de Malha	Nazareth	Chagos	Albatross	
2002	10	2 090	918	223	55	3 286
2003	9	2 354	468	235	37	3 094
2004	8	1 686	855	117	21	2 679
2005	7	1 028	578	0	36	1 642
2006	10	1 645	777	136	54	2 612

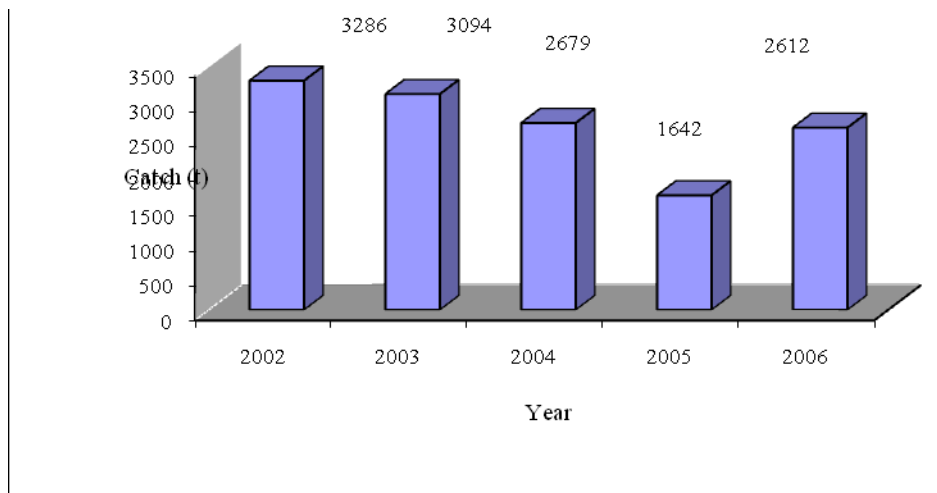


Figure 1.4: Trend in catches

Table 1.9: Fishing effort and catch by the fishing areas

Fishing areas	Fishing days	Bad weather days	Effort (Fdays)	Catch (t)	CPFD (kg)	% Total catch
Saya de Malha	496	167	23 233	1 645	70.8	62.9
Nazareth	194	75	9 627	777	80.7	29.7
Chagos Archipelago	34	10	1 802	136	75.5	5.2
Albatross	16	8	805	54	67.1	2.2
Total	706	250	33 665	2 612		100.0

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

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

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

Year	Nazareth bank			Saya de Malha bank		
	Effort	Catch	CPFD	Effort	Catch	CPFD
2002	9 837	918	93.3	25 083	2 090	83.3
2003	6 426	468	72.9	29 371	2 354	80.1
2004	10 154	855	84.2	23 729	1 686	71.0
2005	7 675	578	75.2	12 663	1 028	81.2
2006	9 627	777	80.7	23 233	1 645	70.8

The CPFD was 80.7 kg on the Nazareth bank compared to 70.8 kg on the Saya de Malha bank, respectively.

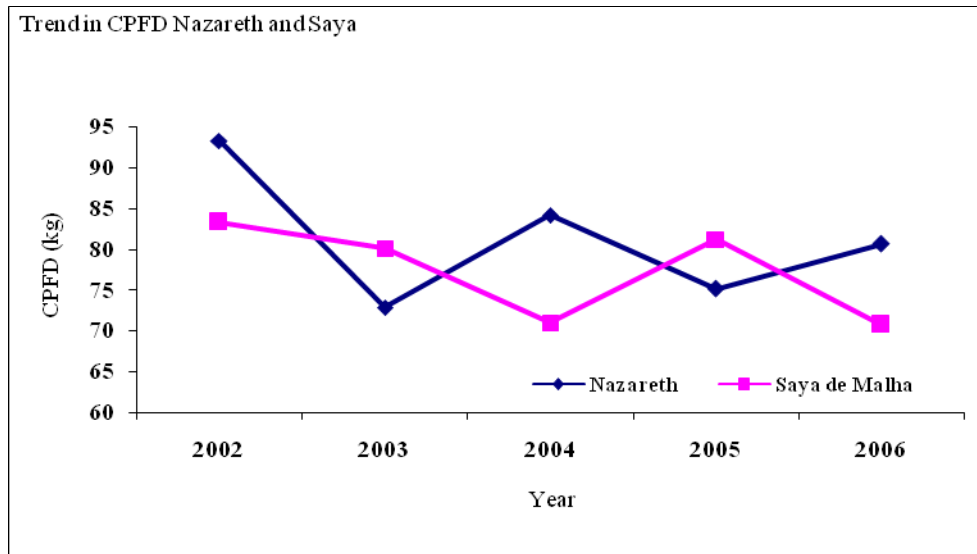


Figure 1.5: Trend in CPF D for the Nazareth and the Saya de Malha banks

The average CPF D on the Saya de Malha bank during the past five years was 77 kg. In 2006 the catch rate on the Saya de Malha was less than the mean observed for the last five years. The average CPF D on the Nazareth bank during the past five years was 81 kg, which is more or less the same as that observed in 2006.

1.2.3 Length frequency distribution of *Lethrinus mahsena*

Length frequency data for the major species of fish, *Lethrinus mahsena*, were collected during unloading of the vessels. The numbers of fishes sampled from Nazareth and Saya de Malha banks were 1 489 and 2 145 and their lengths ranged from 260 to 550 mm and 240 to 570 mm, respectively. The length frequency distributions are shown in figures 1.6 and 1.7.

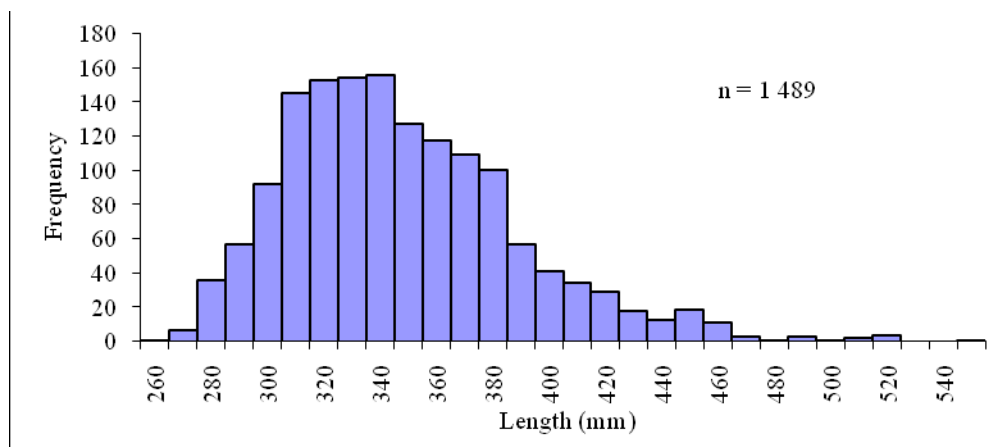


Figure 1.6: Length frequency of *Lethrinus mahsena* from the Nazareth bank

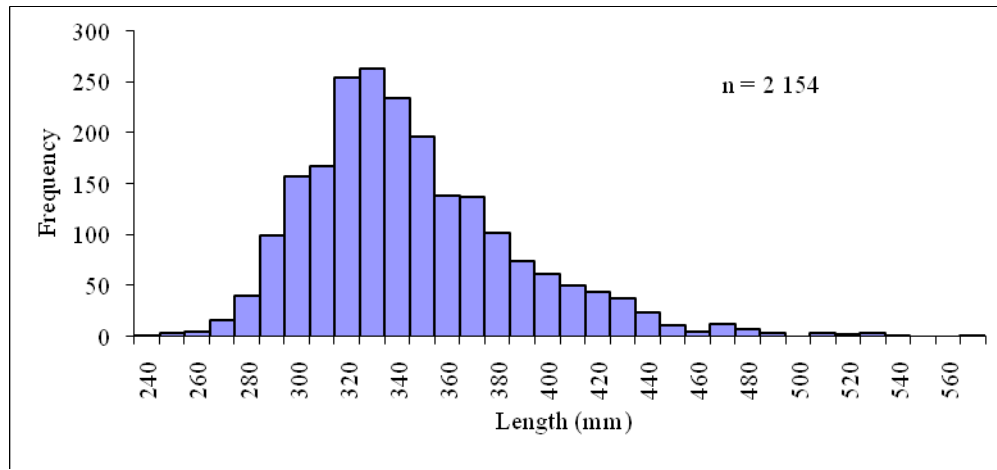


Figure 1.7: Length frequency of *Lethrinus mahsena* from the Saya de Malha bank

1.2.4 Fishing in the waters of the Chagos Archipelago

One fishing vessel was engaged in fishing activities in the Chagos Archipelago. Details on the catch and effort during the past five years from the Chagos Archipelago are given in table 1.11.

Table 1.11: Details of fishing trips to the Chagos Archipelago

Year	No. of trips	No. of vessels	Fishing days	Bad weather days	Catch (t)	Fisherman days	CPFD (kg)
2002	2	2	73	35	223	3 937	56.6
2003	2	2	77	40	235	4 068	57.7
2004	2	2	34	26	117	1 761	66.4
2005	nil	nil	nil	nil	nil	nil	nil
2006	1	1	34	10	136	1 802	75.5

1.3 St. Brandon fishery

The catch from the St. Brandon fishery comprised frozen fish, chilled fish, salted fish, octopus and lobsters. Vessels La Derive, Eliza, l'Espoir and KingFish II were involved in the fishery. The different products landed from St. Brandon are presented in table 1.12.

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

Vessel	Trips	Frozen fish	Chilled fish	Salted fish	Octopus	Lobster	Total
l'Espoir	3	116 831	-	-	2 111	344	119 286
La Derive	19	-	43 182	34 509	-	782	78 473
Eliza	6	-	13 947	10 730	-	-	24 677
KingFish II	1	-	2 100	-	-	-	2 100
Total	29	116 831	59 229	45 239	2 111	1 126	224 536

1.3.1 Sampling of fish from St. Brandon

Sampling of the two main fish species, *Lethrinus mahsena* and *Lethrinus nebulosus* was carried out at the fishing port during unloading of fishing vessels. Length-weight data of 711 units of *L. mahsena* and 98 *L. nebulosus* were collected. The lengths varied from 240 to 530mm and from 260 to 490mm respectively while the weight ranged from 220 to 2 250g and from 240 to 1 500g respectively. A total of 54 spiny lobsters, *Panulirus argus*, was also sampled; the weight ranged from 170 to 1 100g. Figures 1.8 and 1.9 show the length-weight relationship and the length frequency distribution of the *L. mahsena* from the St. Brandon area, respectively.

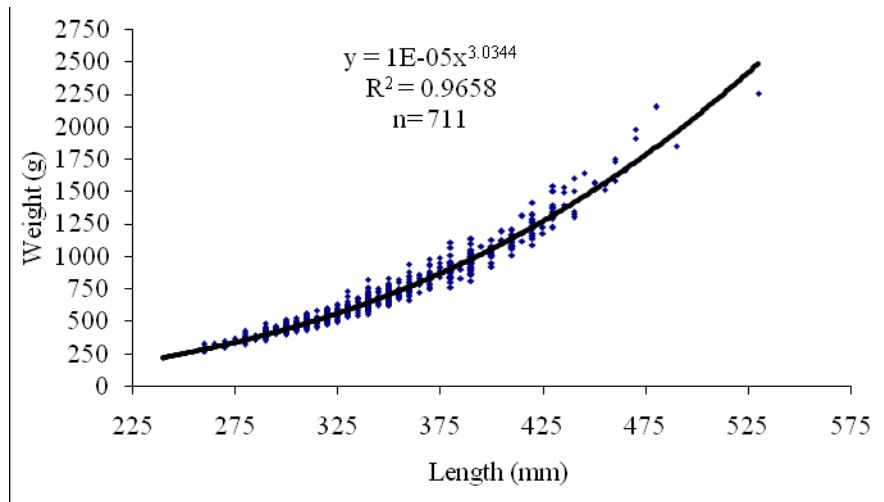


Figure 1.8: Length-weight relationship for *L. mahsena* from St. Brandon

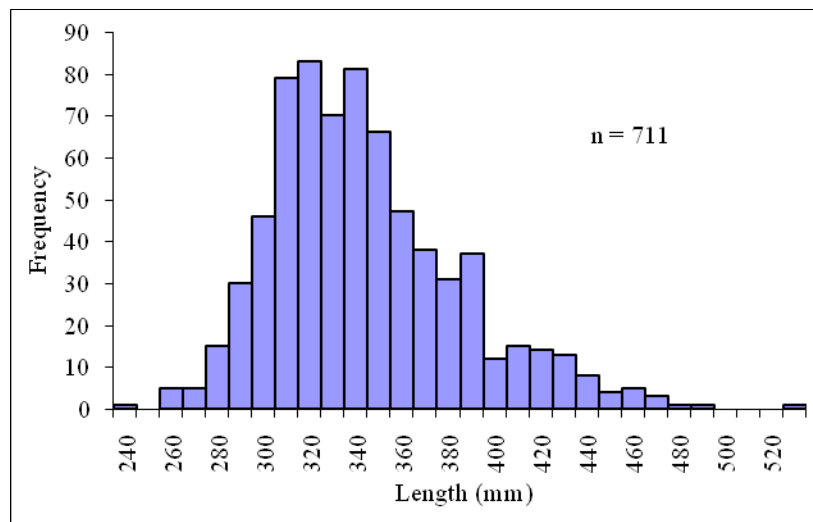


Figure 1.9: Length frequency distribution of *L. mahsena* from St. Brandon

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

The study on the stock assessment and fishery management of the St. Brandon plateau and associated banks fisheries was pursued under the Technical Cooperation Programme between the Government of Mauritius and FAO. As part of an activity under the programme, an acoustic survey on the slopes of St Brandon and Nazareth Bank was carried out using

the FV Ste Rita from 19 October to 2 November 2006. The aims of the survey were to determine the presence and relative abundance of the demersal fishery resources in the shelf-break and upper continental slope area, to collect data relating to environmental conditions; otoliths, gut contents and gonads of the target species were also collected for other related studies. Research officers from the Albion Fisheries Research Centre and the Fisheries Resource Survey (South Africa) participated in the survey.

The survey highlighted the presence of deepwater snappers, namely; *Polysteganus baissaci*, *Etelis coruscans* and several species of *Pristipomoides* and the grouper, *Epinephelus morrhua*, throughout the area. The highest densities of fish were found in the region north of St Brandon and east of Nazareth Bank. More fishing grounds were found east of Nazareth Bank; a preliminary survey indicated substantial fish stocks at depths ranging from 200 to 300m. The potential yield of the deep water snappers in the surveyed area was estimated at around 1 000 tonnes.

1.4 The semi-industrial chilled fish fishery

Sixteen semi-industrial vessels operated on the Saya de Malha, Albatross, Soudan and Nazareth banks undertaking 123 trips. The average duration of a trip was 12 days. They landed 251.4 tonnes of chilled fish. Table 1.13 shows the particulars of the vessels and 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 chilled fish fishery

Vessel	LOA (m)	GRT (t)	Fish hold (t)	Crew	No of fishermen	Joined in
La Derive*	17.0	58.4	9.0	12	nil	1995
Eliza*	18.8	36.7	7.0	12	nil	1995
King Fish I	17.0	14.5	5.5	2	10	1996
King Fish II	21.0	14.5	10.0	4	11	1998
Coryphaena	12.0	8.5	2.5	2	4	1999
King Fish IV	15.0	24.0	6.0	2	4	2002
Roshan	14.0	14.0	7.0	1	5	2002
Dai Fah I	17.0	14.0	14.0	2	4	2002
Quo Vadis I	12.0	26.9	4.0	2	4	2003
King Fish V	15.1	14.8	5.8	2	8	2004
Sea Quest	20.0	59.0	20.0	8	7	2004
St. Mathilde	14.1	45.2	9.0	2	4	2004
King Fish VI	13.1	11.0	3.5	2	3	2005
Ouma	14.0	17.5	9.0	2	6	2005
l'Espoir	50.1	299.4	155.6	33	54	2005
Sainte Rita	34.0	222.0	100.0	7	9	2006

*
Carrier boats

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

Fishing area	Lethrinids	Snappers	Groupers	Tuna and others	Total
Albatross	109 509	4 116	7 445	2 030	123 100
Saya de Malha	15 510	60 158	2 016	721	78 405
Nazareth	35 066	8 440	5 755	53	49 314
Soudan	387	180	57	-	624
Total	160 472	72 894	15 273	2 804	251 443

The catch, fishing days, effort (fisherman 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 of chilled fish

Fishing area	Catch (kg)	Fishing days	Fisherman days	CPFD (kg)
Albatross	123 100	403	2 538	48.5
Soudan	624	3	28	22.3
Saya de Malha	78 405	168	1 104	71.0
Nazareth	49 314	124	812	60.7
Total	251 443	698	4 482	

Fig. 1.10 shows the trend in catch of the chilled fish fishery from the Nazareth bank, Saya de Malha bank, Albatross bank, Soudan bank and the St Brandon waters.

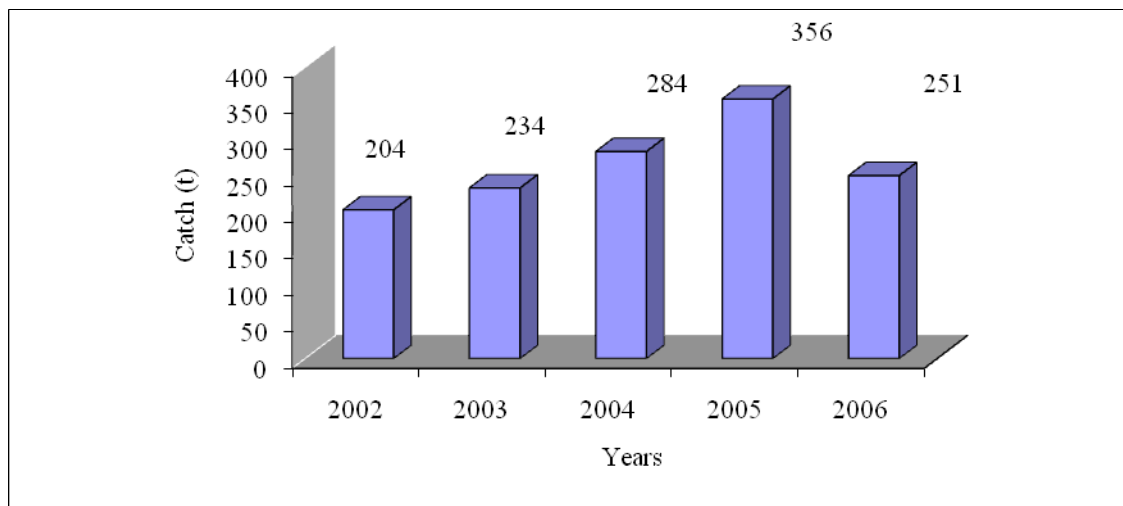


Figure 1.10: Trend in catches from the semi-industrial chilled fish fishery

Sampling of chilled fish was carried out upon arrival of chilled fish vessels and details of the number of fish sampled by species and by banks are presented in table 1.16.

Table 1.16: Details of fish sampled from the different banks

Species	Banks	Number sampled	Length range(mm)	Weight range (g)
<i>Lethrinus mahsena</i>	Albatross	870	230 - 640	250 – 3 100
<i>Lethrinus mahsena</i>	Nazareth	19	320 - 520	550 – 1 980
<i>Lethrinus mahsena</i>	Saya de Malha	181	290 - 550	400 – 2 800
<i>Lethrinus nebulosus</i>	Albatross	49	430 - 600	990 – 2 080
<i>Lethrinus rubrioperculatus</i>	Saya de Malha	5	315 - 360	460 – 600
<i>Etelis coruscans</i>	Nazareth	52	390 - 910	600 – 6 700
<i>Epinephelus morrhua</i>	Nazareth	37	570 - 810	3 300 – 10 650

<i>Polysteganus baissaci</i>	Nazareth	146	290 - 710	450 – 6 250
<i>Polysteganus baissaci</i>	Saya de Malha	49	270 - 590	400 – 3 950
<i>Pristipomoides filamentosus</i>	Saya de Malha	219	360 - 940	500 – 6 850
<i>Pristipomoides argyrogrammicus</i>	Nazareth	15	420 - 840	1 200 – 6 500
TOTAL		1 642		

1.5 Ecotoxicology

1.5.1 Mongoose bioassay

Sixteen fish samples comprising whole fish, slices and fillets were tested for the presence of ciguatoxin. Two specimens of “carangue” identified as *Carangoides fulvoguttatus* from the Nazareth Bank were found to be slightly and moderately toxic respectively whereas the remaining fourteen samples were not toxic. The particulars are given in table 1.17.

Table 1.17: Particulars of toxic fish specimens

Common name	Scientific name	Length (cm)	Weight (g)	Origin	Results
Carangue	<i>Carangoides fulvoguttatus</i>	47.0	1 700	Nazareth	Not toxic
Croissant	<i>Variola louti</i>	69.0	3 250	Bank	Not toxic
Vieille	<i>Plectropomus sp</i>	headless	5 150	Bank	Not toxic
Croissant	<i>Variola louti</i>	79.9	4 670	Bank	Not toxic
Bourgeois	<i>Lutjanus sebae</i>	65.4	5 000	Bank	Not toxic
Carangue	<i>Carangoides fulvoguttatus</i>	44.3	1 500	Nazareth	Not toxic
Carangue	<i>Carangoides fulvoguttatus</i>	40.0	1 100	Nazareth	Slightly toxic
Croissant	<i>Variola louti</i>	79.0	4 500	Nazareth	Not toxic
Vieille babonne	<i>Plectropomous sp</i>	headless	3 350	Nazareth	Not toxic
Carangue	<i>Carangoides fulvoguttatus</i>	57.3	2 900	Nazareth	Not toxic
Vieille babonne	<i>Plectropomous sp</i>	headless	3 350	Nazareth	Not toxic
Carangue	<i>Carangoides fulvoguttatus</i>	50.2	2 000	Nazareth	Moderately toxic
Vieille	<i>Plectropomous sp</i>	fillet		Nazareth	Not toxic
Vieille	<i>Plectropomous sp</i>	slices		Bank	Not toxic

Vieille	<i>Plectropomous</i> sp	fillet		Bank	Not toxic
Vieille	<i>Plectropomous</i> sp	fillet		Bank	Not toxic

1.5.2 Mouse Bioassay

Six fish samples were tested for the presence of ciguatoxin using the mouse bioassay. Six sets of three mice each of weight ranging between 20 and 22g were used. Two samples of *Lutjanus bohar*, vara vara, were found to be toxic. Details are shown in the table 1.18.

Table: 1.18 Results of tests by mouse bioassay

Genus/Species	Mouse bioassay	
	Test 1	Test 2
<i>Lutjanus bohar</i>	Toxic	Toxic
<i>Carangoides fulvoguttatus</i>	Non toxic	Not toxic
<i>Lutjanus bohar</i>	Toxic	Toxic
<i>Plectropomus</i> spp	Non toxic	Not toxic
<i>Carangoides fulvoguttatus</i>	Non toxic	Not toxic
<i>Plectropomus</i> spp	Non toxic	Not toxic

1.5.3 Harmful marine microalgae

The study of potentially harmful marine microalgae, especially those which are involved in toxin production in fish, was continued at the four established sites; Albion, Blue Bay, Le Morne and Trou aux Biches. The sites were sampled for the presence and density of harmful marine microalgae and were monitored on a quarterly basis.

The dinoflagellates of *Coolia* species was not reported in 2005 but was observed in samples collected at Blue Bay and Le Morne. Species of *Gambierdiscus toxicus* was observed only at Albion. *Prorocentrum lima* was recorded in higher numbers at Blue Bay and *Ostreopsis* at Albion. Species of *Amphidinium* and *Synophysis* and diatoms were present at all the sites. The total number of dinoflagellates recorded from the four sampling sites is shown in table 1.19.

Table 1.19: Total number of dinoflagellates recorded (cell count)

Species	Blue Bay	Trou aux Biches	Albion	Le Morne
<i>Gambierdiscus</i> sp.	nil	nil	2	nil
<i>Ostreopsis</i> sp.	23	7	63	8
<i>Prorocentrum lima</i>	44	4	12	21
<i>Prorocentrum concavum</i>	5	2	6	2
<i>Prorocentrum</i> sp.	6	5	2	8
<i>Amphidinium</i> sp.	3	nil	nil	2
<i>Synophysis</i> sp.	2	3	nil	3
<i>Coolia</i> sp.	nil	1	nil	4

1.6 Identification of fish specimens

During the year, officers of the Fisheries Protection Service, National Coast Guard and Ministry of Health brought fish specimens for identification purposes. Fish specimens which were brought on sixteen occasions were identified, where possible and reports submitted accordingly.

1.7 Exploitation of sea cucumber

The commercial exploitation of sea cucumbers which started in late 2005 was continued throughout 2006. Six operators were authorised to collect and export processed sea cucumbers. Another company was permitted to exploit sea cucumber in St Brandon.

The catch was sampled and the specimens were of weight ranging from 80 to 550g. The gonads were analysed to determine maturity stages and spawning seasons. Gonads analysed in October and December for the *Actinopyga echinites* and *Actinopyga mauritiana* were of maturity stage I and II.

The main sea cucumber species collected were the *Actinopyga echinites* (brownfish), *Actinopyga mauritiana* (surf red fish), *Bohadschia marmorata* (brown sandfish), *Stichopus chloronatus* (green fish), *Stichopus variegatus* (curry fish), *Holothuria scabra* (sandfish), *Holothuria nobilis* (black teatfish) and the *Holothuria* spp.

A total of 414.5 tonnes (wet weight) of sea cucumbers were collected and 80 tonnes in the processed form were exported to Far East countries.

To ensure the sustainable exploitation of sea cucumbers and conservation of the marine ecosystem, it was decided to undertake a survey to estimate the stock of sea cucumbers in the lagoon. Sixteen sites in the lagoon around Mauritius were thus selected for the survey to be undertaken in January 2007.