Smart Fish
Secure fisheries *Secure futures*

REPORT/RAPPORT : SF/2012/8

Programme for the implementation of a Regional Fisheries Strategy for the Eastern and Southern Africa and Indian Ocean Region

Programme pour la mise en oeuvre d'une stratégie de pêche pour la région Afrique orientale-australe et Océan Indien

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VALUE CHAIN ANALYSIS OF THE ARTISANAL FISHERIES - MAURITIUS

June 2012

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Implementation of a Regional Fisheries Strategy
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Value Chain Assessment of the Artisanal Fisheries - Mauritius

SF/2012/8

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LIST OF ABBREVIATIONS & ACRONYMS

AFRC	Albion Fisheries Research Centre
BDS	Business Development Services
CA	Competent Authority
COP	Code of Practice
COP	Cost of Production
COS	Cost of Sales
CPBL	Catch Per Boat Landing
CPFD	Catch Per Fisherman Day
CSP	Consumer Sale Price
DBM	Development Bank of Mauritius
EEZ	Exclusive Economic Zone
EFAM	Electronic Fish Auction Market
ESA – IO	East-Southern Africa - Indian Ocean
EU	European Union
FD	Fisheries Department
FAD	Fish Aggregating Device
FGD	Focus Group Discussion
FIT	Fishermen Investment Trust
FITEC	Fishermen Investment Trust Extension Centre
FLS	Fish Landing Station
FPO	Fisheries Protection Officer
HACCP	Hazard Analysis and Critical Control Points
HP	Horse Power
IFAD	International Fund for Agricultural Development
IFRS	Implementation of Fisheries Regional Strategies
IOC	Indian Ocean Commission
L/T	Long Term
LFC	Local Fisher Community
M/T	Medium term
MC	Marketing Cost
MdP	Maison des Pêcheurs
MM	Marketing Margin
MOFR	Ministry of Fisheries and Rodrigues
MP	Marketing Profit
MSY	Maximum Sustainable Yield
PM	Profit Margin
PSP	Producer Sale Price
RRA	Rural Rapid Appraisal
S/T	Short Term
SMEDA	Small Medium Enterprises Development Authority
STE	Short Term Expertise
T	Metric Tonne
TC	Total Cost
VCA	Value Chain Analysis
WSP	Wholesale Price

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PREFACE

Value Chain Assessment: Artisanal Fisheries of Mauritius & Rodrigues

Within the broader framework of the IOC SmartFish programme (Implementation of a Regional Fisheries Strategy for ESA-IO programme), component Result 4, Regional Trade Development, this report has been prepared to assist the Ministry of Fisheries & Rodrigues in Mauritius to better understand the situation in the artisanal fishery from an economic and value perspective. This will allow for objective planning for potential interventions to assist in the move towards a more market driven and sustainable fishery that will enhance and contribute to the growing demand for fish in the country in the long-term, whilst maintaining the socio-economic value of the fishery in the country.

This report looks closely at the different types of fishing methods within the artisanal sub-sector, such as the hand-line (motorized and non-motorized) fishery, the basket trap fishery, the large net fishery as well as the on-foot fishery. It provides a detailed analysis of performance in terms of typical business models for each unit and makes assessments of performance with respect to catch potential, capacity /over-capacity vs. stocks and estimated MSY. Ultimately the impact on the local fishing communities, as well as the broader issue of increasing demand in the country, is addressed and how to re-model and empower the artisanal fishery to better serve the economy, as well as the local population. Recommendations for short-term interventions are made to inform the many stakeholders of what works and what doesn't work so well and a view to the future for everyone's benefit.

Regionally, small island artisanal fisheries, as well as regional coastal artisanal fisheries are all dealing with issues of over-capacity and depleted stocks in coastal lagoons, as well as deciding how to ensure future productivity of the sector where local fishers derive a significant part of their livelihoods from fishing. This report will contribute to the regional knowledge in this regard and inform other initiatives to be planned regionally under the SmartFish programme.

This report is the first step and a similar exercise is to be implemented for the island of Rodrigues. Although some similarities are expected, there are very different aspects to each of these fisheries to be understood.

LAYMAN'S SUMMARY

The study has carried out an economic appraisal of the production and marketing systems in the artisanal fisheries in Mauritius. The results have shed some light on the profitability of the different enterprises involved in the supply chain and on the distribution of value added or profit between fishing and marketing. The major problems identified in the fisheries are namely; open access which is tantamount to overfishing; obsoleteness of fisheries infrastructure; over-investments in fishing operations; and, absence of a food safety and quality standard for the fresh fish on the local markets. Appropriate measures have been recommended to drive the artisanal fisheries on the path socio-economic and ecological sustainability.

RÉSUMÉ DES NON-INITIÉS

Une étude d'analyse économique est entreprise dans les filières de la pêche et de la commercialisation dans le secteur de la pêche artisanale à Maurice. L'étude a apporté un éclairage sur la rentabilité des différentes entreprises dans la filière et sur le partage de la valeur ajoutée entre les composantes de la pêche et celles de la commercialisation. Les problèmes identifiés dans le sous-secteur sont entre autres, le libre accès ce qui comporte un risque potentiel de surpêche, surinvestissements dans les outils de production, mauvais état des infrastructures de la pêche côtière et l'absence des normes sanitaires et de qualité des produits de pêche sur les marchés locaux. Des actions nécessaires ont été recommandées pour que la pêche artisanale soit socio-économiquement et écologiquement soutenable.

EXECUTIVE SUMMARY

This study was commissioned by the Ministry of Fisheries and Rodrigues of Mauritius and executed by the Implementation of Regional Fisheries Strategies for the ESA-OI under the aegis of the Indian Ocean Commission funded by the European Union. Its principal objective is to carry out a value chain analysis of the artisanal fisheries sub-sector in Mauritius to assess the economic performance of its production functions and marketing channels. Based on the findings, recommendations are made to enhance overall efficiencies in the artisanal fisheries while taking into account the social and ecological implications.

Actually the artisanal fisheries are the main suppliers of fresh fish to the local markets with an annual production of 830 metric tonnes. As of 2010 there were 1,620 registered fishers, 1,605 fishing boats and 400 active fishmongers in the sub-sector. The targeted fish stocks have attained their MSY. The CPFD is at 6.4 kg over the past 3 years. The MOFR provides a plethora of incentives to divert fishing efforts from the lagoon to off-lagoon deep-sea FAD and demersal fisheries in order to relieve fishing pressure in the lagoon.

There are 60 Fish Landing Stations (FLS) around Mauritius that serve as operational base to the coastal fishing fleet. They are mandated for unloading of fish, data collection and primary sale of fish. In the early 70's they were conceived to provide basic facilities for cleaning, sorting and marketing of fish. Actually most of them have outlived their purposes and are out of use. The decline of the Local Fishing Community (LFS) has had a negative impact on the development and management of the coastal fisheries and the organisation of the LFC. Efforts are being made by the Ministry to rehabilitate the FLS network around the island in consultation with the LFC.

A major concern for the artisanal fisheries is the absence of a food safety and quality standard along the supply chain, from capture to consumption. Preservation of fish on board is rudimentary or non-existent. Flake Ice is not available around the island particularly at the FLS. Traditional boats are not equipped with fish holds and ice is simply not used.

For the value chain assessment (VCA), the artisanal fisheries were classified into 5 typical fishing units or enterprises using fishing gears and operational strategies as key determinants:

- Hand line fishery
- Basket and Trap fishery
- Large Net fishing fishery
- Non-motorized hand line fishery
- On-foot hand line and harpoon fishery

Costs and revenues were collected by secondary and primary surveys on each of the selected fishing enterprises in different regions of the country to prepare a standardized Income and Expenditure statement (IES). Economic efficiencies / profitability of these fishing units were determined by calculating the Cost of Production (COP) and Profit Margin (PM). The break-even quantity of the fishing enterprise was determined by assuming a minimum salary of Rs 10,000 as opportunity cost for fishing labour. The results of the VCA are summarized in the table below:

Table 1: Profitability of fishing enterprises – Rs /Kg

Items	Unit	H L	B T	H L/ B T	L N	N/M HL	On/FT
Annual Catch @ f/ boat	Kg	4139	3780	3980	24635	2041	737
Sales at PSP	Rs/kg	190.70	120.21	155.46	128.30	126.92	131.20
Cost of Production	Rs/kg	155.77	80.90	117.89	110.92	68.81	32.01
Surplus Income (1)	Rs/kg	34.93	39.31	37.57	17.32	56.98	97.80
Profit Margin to Sales	%	18 %	33 %	24 %	14%	45 %	75.%
Cost of Fuel	Rs/kg	36.50	40.00	38.25	11.56	-	-
Cost of fishing labour	Rs/kg	85.25	39.25	62.25	86.84	87.09	97.80
B/E– Qty (TR-TC)	**Kg**	**3 379**	**2 546**	**2963**	**21 300**	**2070**	**1095**

(1) Surplus Income of the fishing enterprise

The above table provides simple economic indicators that can be helpful in the management and monitoring of the fisheries. By extrapolating the break-even catch level to the existing fishing capacities, it is concluded that there is a serious problem of overcapitalization in the artisanal fisheries.

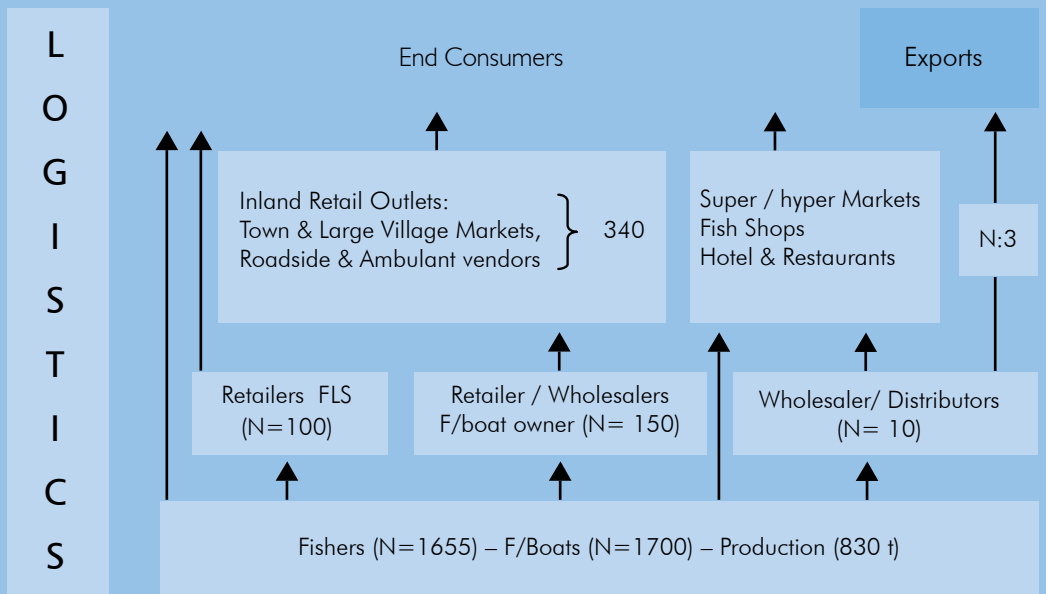
Table 2: Estimates of Surplus fishing capacities at current MSY level

Items	HL	BT	BT/HL	LN	O/f–HL/H	TOTAL
Annual Catch Percentage Mean Catch @ f/ boat (kg)	227 12% **4 139**	267 11% **3780**	28 36% **3960**	222 6% **24635**	87 35% **737**	831 100%
Optimal No. f/boats (N) **Optimal On-foot fishers (N)**	**54** **-**	**150** **-**	**7** **-**	**27** **-**	**-** **118**	**238**
Active fishing boats Active on-foot fishers	678	761	139	27	- 134	1605
Surplus fishing boats (N) **Surplus On-foot fishers (N)**	**624** **-**	**611** **-**	**132** **-**	**0** **-**	**-** **16**	**1367**

At the current MSY, the artisanal fisheries can sustain 238 fishing boats and 832 fishers including 118 on-foot fishers. There is a surplus of 1367 boats and 788 registered fishers including 16 on-foot fishers. The situation is more alarming in reality because the coastal fisheries, with the exception of the LN fishery are open access.

On the marketing side, a preliminary survey was carried out to have an in-depth understanding on the market structures and marketing channels of the artisanal fisheries. To address the VCA in the marketing channels, Marketing Margin (MM), Marketing Cost (MC) and Marketing Profit (MP) were determined. The fresh fish market is supply driven and the market price has high volatile. In fact there are nearly 400 active fishmongers chasing 830 metric tonnes of fresh fish annually. An increasing number of fishmongers are owners of fishing boats as a part of a business strategy to secure a regular supply of fish. Some others would act as indigenous bankers to fishing enterprises to gain priority of their catch. Also an increasingly large number of fishing enterprises in the coastal areas have diversified into roadside fish retailing as a household business.

Figure 1: Flow chart of the market channels of fresh fish in Mauritius



The following fish marketing channels were surveyed:

- Roadside fish vendor (supplied by hand line fishing enterprise)
- Roadside fish vendor (supplied by a Basket Trap fishing enterprise)
- Supermarket fish stall (supplied by hand line fishing enterprises)
- Institutional fish Market (supplied by a wholesaler)
- Non-motorized fishing enterprise selling directly to end consumers
- On-foot fisher selling directly to end consumers

Table 3: Distribution of value-added between Fishing and Marketing segments

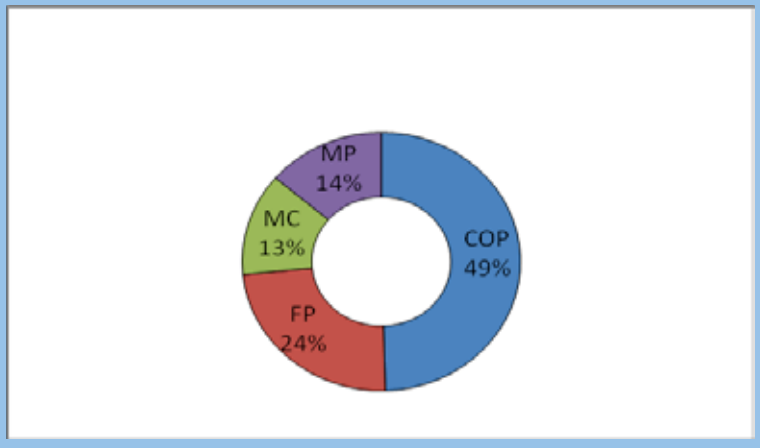
Items (Rs / kg)	CSP	COP	MC	COS	T P	F P	M P
HL / Road side Retailer	243.50	155.77	20.10	175.87	67.63	34.93	32.70
BT /Road side Retailer	161.00	86.52	22.75	109.27	51.73	39.31	12.42
HL / Supermarket Retailer	341.00	155.77	83.77	239.54	101.46	34.93	66.53
LN / Inst. Market Retailer	163.21	86.52	12.79	99.31	63.90	41.68	22.22
O&S Boat – HL / Direct Sales	243.50	129.76	20.10	149.86	93.64	60.93	32.71
On-Foot / Direct sales	151.70	32.01	10.00	42.01	109.69	99.06	10.63
Mean (Rs / kg)	**217.32**	**107.73**	**28.25**	**135.98**	**81.34**	**51.81**	**29.54**
Mean (%)	**-**	**50 %**	**13 %**	**63 %**	**37 %**	**24%**	**13%**

CSP: Consumer Sale Price; COP : Cost of Production; MC: Marketing Cost; TP: Total Profit;

COS: Cost of Sales ; FP : Fishing Profit and MP : Marketing Profit

It is concluded that the distribution value added between the fishing and market blocks is equitable and realistic. The stakeholders in the value chain are dynamic, efficient and adaptive to uncertainties and high risks relevant to the artisanal fisheries. Distribution of profit margin between production and marketing is realistic.

Figure 2: Mean value-added per Kg



Marketing Cost is negligible of the short distribution network and low capital investment in logistics. It represents 13% of the CSP. However marketing cost for dedicated fish stall in supermarkets is higher (25% of the CSP) and obviously it is rewarded by a higher profit margin (20%). The implementation for food safety and quality standard has to be viewed as market opportunities instead of cost constraints. There should be no resistance on the part of marketing channels to comply with a food safety and quality standard. Actually the development of micro and small processing and value added enterprises is on stand still mainly due to shortage of supply of fresh fish and absence of food safety and quality norms. However the market prospects are good. The cultural heritage of the artisanal fisheries can be promoted as an attraction for the tourism industry. A new concept of fish terminal is proposed to tap additional revenue for fisher community from the growing number of foreign visitors in the country.

The study has concluded and recommended the following:

- There is a potential risk of overfishing in the artisanal fisheries because the active fishing capacities exceed in manifold the sustainable level. There is an urgent need to undertake a risk assessment on fish stocks harvested in the lagoon and off-lagoon.

- The coastal ecosystem is under more intense pressure from an increasingly large number of (non-registered) professional, amateur and sport fishers. To do away with the prevailing open access environment, it is recommended to conduct a survey on the activities of the amateur and sport fisheries leading to the implementation of an appropriate regulatory framework to manage and monitor these fisheries at par with the artisanal fisheries.

- The present fisheries statistical model including sampling and data collection strategies has outlived its purpose and it is high time to replace it. The new system must be capable of integrating the activities of amateur and sport fisheries.

- An appropriate bio-economic model for the artisanal fisheries has to be developed to serve as a management tool kit.

- An Economic Unit headed by a fisheries economist has to be set within the AFRC. It will be responsible for all socio-economic issues related the fisheries sector, in particular the artisanal fisheries.

- The FLS network has to be rehabilitated at the earliest with the involvement of the local fisher communities. LFCs have to be empowered with local governance, leadership and co-management skills to bring about a shift from an external enforcement approach to shared goals and responsibilities in fisheries management. It is indicated that IFAD-MARS is committed to fund a study on a comprehensive management plan for the lagoon and off-lagoon fisheries within the framework of the upcoming Fisheries Master Plan.

- There should be no compromise regarding safety and quality of fresh fish placed on the local markets. The guideline for a detailed action plan for the enforcement of the COP – Handling and Preservation of fresh fish is enumerated as follows:

    - Launch an awareness campaign at the national level using audio-visual means and FGD to sensitize consumers and producers of the critical need for food safety and quality of fresh fish on the local markets and particularly the use of ice-flakes for fish preservation.

    - Conduct an audit on the existing fisheries infrastructure from the perspective of the implementation of the COP – "Handling and Preservation of Fresh Fish" as minimum food safety and quality in the artisanal fisheries.

    - Enforcement of the COP – Handling and Preservation of fresh fish by the MOFR as a national food safety and quality standard for the marketing of fresh fish.

- Development of a human resources plan at public and private sector levels to ensure the smooth implementation of the safety and quality standard.

- Implement a pilot project on COP – Handling and Preservation of Fresh Fish based on voluntary compliance at Tamarin or Trou d'eau Douce where an ice-plants exists, to showcase its importance.

- To develop a new concept of a Fish Terminal at strategic locations to serve equally as a tourist attraction, as a strategy to maximise revenue of the artisanal fisheries. The cultural heritage of the fisher communities, the everyday activities at the fishing wharf and seafood market will be main theme of this concept. The project will create positive interactions / synergies between artisanal fisheries and the tourism sector. It is proposed to prepare a pre-feasibility study and business plan for the development of a pilot project to be located at "Maison des Pêcheurs" complex, Fishermen Village of Mahebourg Waterfront.

- The prospects for the development of micro and small scale processing and value addition activities will grow progressively with an increase in the supply of fresh fish. FITEC will have to adopt a pro-active and one-stop-shop approach to assist promoters through project facilitation, training in technical and entrepreneurial skills and mentoring.

- To strengthen management and extension capacities of AFRC, by creating an Economic Observatory headed by a fisheries economist. It will be responsible for all socio-economic issues related to the fisheries sector inter alias, cost-benefit analysis of policy-decisions, socio-economic surveys and technical supports to FITEC.

- A pilot project to empower local fisher communities in local governance, leadership participatory management leading shared commitment and responsibility in policy formulation and voluntary compliance; and co-management of local fisheries infrastructure such as FLS.

Many international and regional organisations as well as inter-governmental Co-operations are active in the artisanal fisheries sub-sector. A new Fisheries Master Plan is in the process of approval by the Cabinet. A concerted approach will be necessary to allocate adequate technical and financial resources for the implementation of the above recommendations.

RÉSUMÉ EXECUTIF

La présente étude a été commandée par le Ministère de la Pêche et de Rodrigues (MOFR) de Maurice et effectuée par le Programme pour la Mise en oeuvre d'une Stratégie Régionale de la pêche pour la région Afrique Orientale et Australe - Océan Indien (AOA-OI) sous l'égide de la Commission de l'Océan Indien (COI) avec le financement de l'Union européenne (UE). L'objectif principal consistait à entreprendre une étude de la chaîne de valeur du sous-secteur de la pêche artisanale à Maurice dans le but d'évaluer la performance économique de ses fonctions de production et de ses canaux de commercialisation. Sur la base des conclusions, des recommandations sont formulées afin de renforcer l'efficacité globale de la pêche artisanale tout en tenant compte des implications sociales et écologiques.

La pêche artisanale constitue en fait la principale source d'approvisionnement des marchés locaux en poisson frais, avec une production annuelle de 830 tonnes métriques. En 2010, on comptait 1 620 pêcheurs enregistrés, 1 605 bateaux de pêche et 400 mareyeurs actifs dans le sous-secteur. Les stocks de poissons ciblés ont atteint leur rendement maximal durable (RMD). Les captures par pêcheur par jour se sont élevées à 6,4 kg au cours des trois dernières années. Le MOFR fournit une pléthore de mesures incitatives pour détourner l'effort de pêche vers l'extérieur du lagon, sur les pêcheries en eaux profondes, démersales ou sur DCP, afin de diminuer la pression de pêche dans le lagon.

Il existe autour de Maurice 60 stations de débarquement du poisson (SDP) qui servent de base d'opérations à la flotte de pêche côtière. Elles sont habilitées à décharger le poisson, recueillir les données et effectuer la première vente du poisson. Au début des années 70, ils étaient conçus de sorte à offrir les installations élémentaires pour le nettoyage, le tri et la commercialisation du poisson. En fait, la plupart d'entre elles ont fait leur temps et sont hors d'usage. Le déclin des communautés de pêche locales (CPL) a eu un impact négatif sur le développement et la gestion des pêches côtières et l'organisation des SDP. Le Ministère entreprend actuellement des efforts afin de réhabiliter le réseau de sites de débarquement autour de l'île en consultation avec les CPL.

Une source majeure de préoccupation pour la pêche artisanale s'avère être l'absence de normes de qualité et de sécurité alimentaire le long de la chaîne d'approvisionnement, de la capture à la consommation. Les mesures de préservation du poisson à bord des bateaux sont rudimentaires ou non existantes. La glace en flocons n'est pas disponible autour de l'île, en particulier aux débarcadères. Les bateaux traditionnels ne sont pas munis de cales à poisson et la glace n'est simplement pas utilisée.

Aux fins de l'analyse de la chaîne de valeur (ACV), la pêche artisanale a été classée en cinq types d'unités ou d'entreprises de pêche, en utilisant les engins de pêche et les stratégies opérationnelles comme déterminants clés :

- pêche à la ligne (HL) ;
- pêche au panier et au casier (BT) ;
- pêche au grand filet (LN) ;
- pêche à la ligne non motorisée (NM HL) ;
- pêche à la ligne à pied et pêche au harpon (On/FT).

Des données sur les coûts et les revenus ont été recueillies grâce à des enquêtes secondaires et primaires auprès de chacune des entreprises de pêche sélectionnées dans différentes régions du pays afin de préparer un état standardisé des revenus et des dépenses (IES). L'efficience et la profitabilité de ces unités de pêche ont été déterminées en calculant le coût de production (CP) et la marge de profit (MP). La quantité requise pour la rentabilité de l'unité de pêche a été déterminée en supposant qu'il y ait un salaire minimal de Rs 10 000 comme coût d'opportunité pour la main d'œuvre de pêche. Le tableau suivant présente un résumé des conclusions de l'ACV :

Tableau 1: Rentabilité des entreprises de pêche - Rs/kg

Eléments	Unité	HL	BT	HL / BT	LN	N/M HL	On / FT
Prise annuelle par bateau	Kg	4139	3780	3960	24635	2041	737
Ventes aux PSP	Rs/kg	190.70	120.21	155.46	128.30	126.92	131.20
Coûts de production	Rs/kg	155.77	80.90	117.89	110.92	68.81	32.01
Revenus en excédent ([1])	Rs/kg	34.93	39.31	37.57	17.32	56.98	97.80
Marge de profit par rapport aux ventes	%	18 %	33 %	24 %	14%	45 %	75.%
Coût du carburant	Rs/kg	36.50	40.00	38.25	11.56	-	-
Coût de la main d'œuvre de pêche	Rs/kg	85.25	39.25	62.25	86.84	87.09	97.80
B/E– Qté (TR-TC)	**Kg**	**3 379**	**2 546**	**2963**	**21 300**	**2070**	**1095**

([1]) Revenus en excédent de l'entreprise de pêche

Le tableau ci-dessus fournit des indicateurs économiques simples qui peuvent être utiles dans la gestion et la surveillance des pêches. En extrapolant le niveau des prises nécessaires pour atteindre le seuil de rentabilité des capacités de pêche existantes (B/E – Qté), l'on conclut qu'il existe un sérieux problème de surcapitalisation dans le sous-secteur de la pêche artisanale.

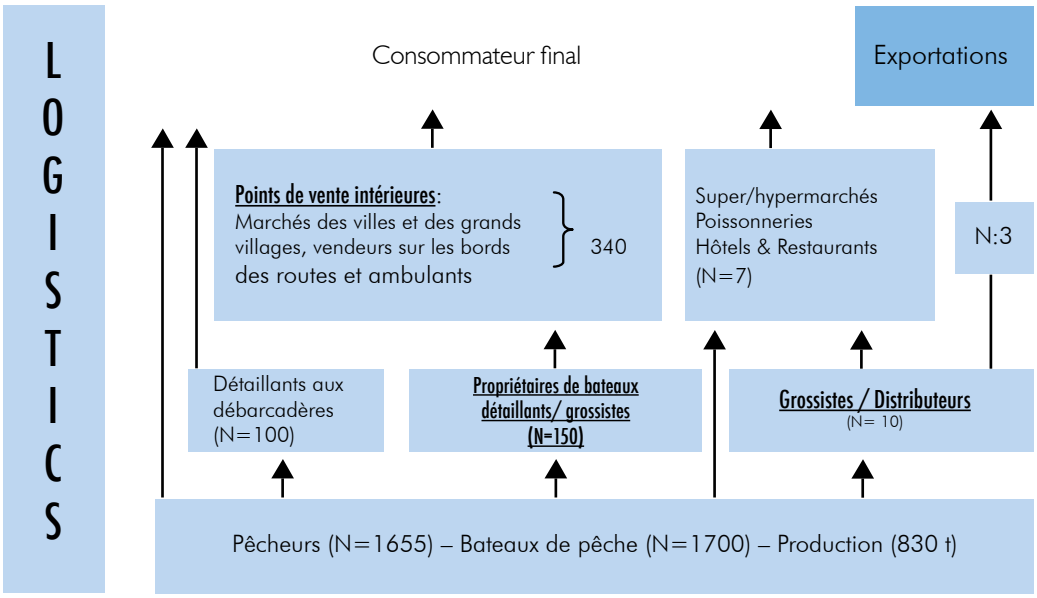
Tableau 2 : Estimations des capacités de pêche excédentaires au niveau actuel de RMD (rendement maximal durable)

Eléments	HL	BT	BT / HL	LN	O/F - HL / H	TOTAL
Prise annuelle	227	267	28	222	87	**831**
Pourcentage	12%	11%	36%	6%	35%	100%
Prise moyenne par bateau (kg)	4139	3780	3960	24635	737	
Nombre de bateaux de pêche optimal (N)	**54**	**150**	**7**	**27**	**-**	**238**
Nombre de pêcheurs à pied optimal (N)	**-**	**-**	-	-	**118**	-
Bateaux de pêche actifs	678	761	139	27	-	1605
Pêcheurs à pied actifs					134	
Nombre de bateaux de pêche en surplus (N)	**624**	**611**	**132**	**0**	**-**	**1367**
Nombre de pêcheurs à pied en surplus (N)	**-**	**-**	**-**	**-**	**16**	

Au RMD actuel, la pêche artisanale peut supporter 238 bateaux de pêche et 832 pêcheurs, y compris 118 pêcheurs à pied. Il y a un surplus de 1 367 bateaux et 788 pêcheurs enregistrés, y compris 16 pêcheurs à pied. La situation est en réalité plus alarmante parce que les pêcheries côtières, à l'exception de la pêche au grand filet, sont en accès ouvert.

En ce qui concerne la commercialisation, une étude préliminaire a été menée en vue de mieux comprendre les structures du marché et les canaux de commercialisation de la pêche artisanale. Afin d'aborder les canaux de commercialisation dans cette analyse de chaine de valeur, la marge de commercialisation (MM), le coût de commercialisation (MC) et le profit de commercialisation (MP) ont été déterminés. Le marché du poisson frais est déterminé par l'offre et le prix du marché est très volatile. En fait, il existe environ 400 mareyeurs actifs brassant 830 tonnes de poissons frais annuellement. Un nombre croissant de mareyeurs sont des propriétaires de bateaux de pêche, ce qui fait partie d'une stratégie commerciale permettant de s'approvisionner en poisson sur une base régulière. D'autres agiraient comme des banquiers locaux auprès des entreprises de pêche afin d'être les premiers à accéder aux prises. Par ailleurs, un nombre de plus en plus élevé d'entreprises de pêche des zones côtières ont diversifié leurs activités pour faire de la vente au détail sur le bord de la route en tant qu'entreprises familiales.

Figure 1: Organigramme des canaux du marché du poisson frais à Maurice



Les canaux suivants de commercialisation du poisson ont fait l'objet d'une étude :

- Vendeur de poisson sur les bords des routes (approvisionné par une entreprise de pêche à la ligne) ;
- Vendeur de poisson sur les bords des routes (approvisionné par une entreprise de pêche au panier/casier) ;
- Étal de poisson de supermarché (approvisionné par des entreprises de pêche à la ligne) ;
- Marché au poisson institutionnel (approvisionné par un grossiste) ;
- Entreprise de pêche non-motorisée vendant directement aux consommateurs finaux ;
- Pêcheur à pied vendant directement aux consommateurs finaux.

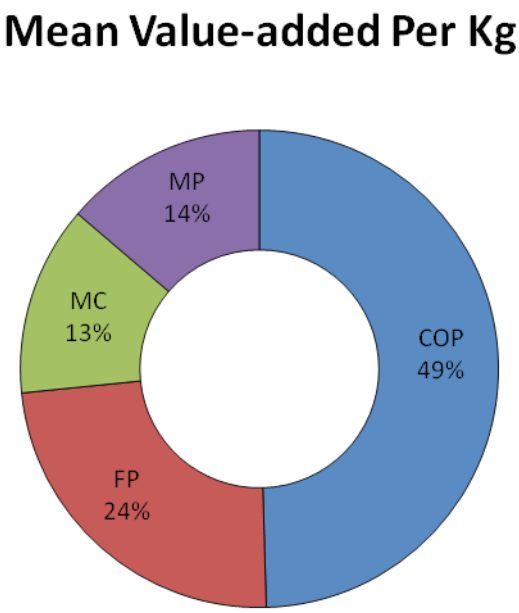
Tableau 3: Distribution de la valeur ajoutée entre les segments de la pêche et de la commercialisation

Eléments (Rs / Kg)	CSP	COP	MC	COS	T P	F P	M P
HL / Détaillant sur les bords des routes	243.50	155.77	20.10	175.87	67.63	34.93	32.70
BT / Détaillant sur les bords des routes	161.00	86.52	22.75	109.27	51.73	39.31	12.42
HL / Détaillant au supermarché	341.00	155.77	83.77	239.54	101.46	34.93	66.53
LN / Détaillant au marché institutionnel	163.21	86.52	12.79	99.31	63.90	41.68	22.22
O&S Bateau – HL /Ventes directes	243.50	129.76	20.10	149.86	93.64	60.93	32.71
À pied/Ventes directes	151.70	32.01	10.00	42.01	109.69	99.06	10.63
Moyenne (Rs / kg)	**217.32**	**107.73**	**28.25**	**135.98**	**81.34**	**51.81**	**29.54**
Moyenne (%)	**-**	**50%**	**13%**	**63%**	**37%**	**24%**	**13%**

CSP: Prix de vente au consommateur ; COP : Coût de production; MC: Coût de commercialisation ; TP: Profit total ; COS : Coût des ventes ; FP : Profit des pêches ; MP : Profit de commercialisation

L'on conclut que la distribution de la valeur ajoutée entre la pêche et la commercialisation est équitable et réaliste. Les parties prenantes de la chaîne de valeur sont dynamiques, efficaces et s'adaptent aux incertitudes et aux risques élevés afférents à la pêche artisanale. La distribution de la marge de profit entre la production et la commercialisation est réaliste.

Figure 2 : Valeur ajoutée moyenne/kg



Les coûts de commercialisation sont négligeables pour le court réseau de distribution et le faible investissement en capital dans la logistique. Il représente 13 % du CSP. Toutefois, les coûts de commercialisation pour les étals de poisson dédiés dans les supermarchés sont plus élevés (25 % du CSP) et, manifestement, une marge de profit supérieure (20 %) en découle.

La mise en œuvre de normes de sécurité alimentaire et de qualité doit être perçue comme des opportunités de marché plutôt que comme des contraintes coûteuses. Les canaux de commercialisation ne devraient nullement s'opposer au respect des normes de sécurité alimentaire et de qualité. En fait, le développement de micro et petites entreprises de transformation et d'ajout de valeur est au point mort, particulièrement en raison d'une pénurie d'approvisionnement en poisson frais et de l'absence de normes de sécurité alimentaire et de qualité. Cependant, les perspectives de marché sont satisfaisantes. Il est possible de promouvoir l'héritage culturel de la pêche artisanale comme une attraction pour l'industrie du tourisme. Il est proposé de créer un nouveau concept de terminal de poisson pour engendrer des revenus additionnels en faveur de la communauté des pêcheurs auprès du nombre croissant de visiteurs étrangers dans le pays.

Les conclusions et les recommandations de l'étude sont les suivantes :

- Il existe un risque potentiel de surpêche dans la pêche artisanale parce que les capacités actives de pêche dépassent très largement le niveau durable. Il est extrêmement urgent de mener une évaluation des risques en ce qui concerne les stocks de poisson ciblés à l'intérieur et hors du lagon.
- L'écosystème côtier subit de plus en plus de pression d'un nombre grandissant de pêcheurs professionnels, amateurs et sportifs (non enregistrés). Afin de se débarrasser de cet environnement d'accès ouvert, il est recommandé de mener une étude sur les activités de la pêche amateur et sportive, qui aboutira à la mise en œuvre d'un cadre réglementaire approprié pour gérer et surveiller ces pêcheries comme c'est le cas dans la pêche artisanale.
- Le présent modèle statistique en matière de pêche, notamment l'échantillonnage et la collecte de données, est devenu obsolète et il est grand temps de le remplacer. Le nouveau système doit être en mesure d'intégrer les activités de la pêche amateur et sportive.

- Il est nécessaire d'élaborer un modèle bioéconomique approprié pour la pêche artisanale, qui servirait de boîte à outils de gestion.
- Il est nécessaire de mettre en place une unité économique dirigée par un économiste des pêches au sein de l'AFRC. L'unité sera chargée de toutes les questions socio-économiques relatives au secteur de la pêche, en particulier la pêche artisanale.
- Il est nécessaire de réhabiliter au plus tôt le réseau de stations de débarquement du poisson avec la collaboration des communautés de pêcheurs locales (LFC). Les compétences des LFC devront être renforcées en matière de gouvernance locale, de leadership et de co-gestion, afin de passer d'une approche externe de la gestion des pêches à une approche où les buts et les responsabilités sont partagés. Il est indiqué que le FIDA-MARS (Fonds International de Développement Agricole) s'est engagé à financer une étude sur un plan de gestion exhaustif de la pêche à l'intérieur et hors du lagon dans le cadre du prochain Plan directeur sur la pêche.
- Aucun compromis ne devrait être autorisé en ce qui concerne la sécurité et la qualité du poisson frais mis sur le marché local. Les lignes directrices d'un plan d'action détaillé pour l'application du COP – Manutention et préservation du poisson frais, se déclinent comme suit :

    - lancer une campagne nationale de sensibilisation à l'aide de moyens audiovisuels et de FGD (groupes de discussion dirigée) afin que les consommateurs et les producteurs prennent conscience de l'urgente nécessité d'assurer la sécurité alimentaire et la qualité du poisson frais sur les marchés locaux, en particulier l'utilisation de glace en flocons pour la préservation du poisson ;
    - entreprendre un audit de l'infrastructure existante pour la pêche dans l'optique d'une mise en œuvre du COP – Manutention et préservation du poisson frais – comme un minimum de sécurité alimentaire et de qualité dans la pêche artisanale.
    - formuler un plan d'action détaillé comprenant un budget et un calendrier spécifiques en consultation avec tous les intervenants de la chaîne d'approvisionnement, y compris les prestataires de services indirects dans le but de créer un environnement propice à la mise en œuvre de normes de sécurité et de qualité ;
    - appliquer le COP – Manutention et préservation du poisson frais – grâce aux efforts du MOFR, en tant que normes nationales de sécurité alimentaire et de qualité pour la commercialisation du poisson frais ;
    - développer un plan de ressources humaines aux niveaux des secteurs public et privé afin d'assurer la mise en œuvre harmonieuse des normes de sécurité et de qualité ;
    - mettre en œuvre un projet pilote sur le COP - Manutention et préservation du poisson frais – sur la base du respect volontaire à Tamarin ou à Trou d'eau Douce, où existent des glacières, afin d'illustrer son importance.

- Il est nécessaire d'élaborer un nouveau concept de Terminal du poisson dans des sites stratégiques qui agirait également comme attraction touristique, en tant que stratégie visant à maximiser les revenus de la pêche artisanale. L'héritage culturel des communautés de pêcheurs, les activités quotidiennes au quai de pêche et le marché des produits de la mer constitueront le thème primordial de ce concept. Le projet créera des interactions/synergies positives entre les pêcheries artisanales et le secteur du tourisme. Il est proposé de préparer une étude de préfaisabilité et un business plan en vue de développer un projet pilote qui sera installé à la «Maison des Pêcheurs », sur le front de mer du village de pêcheurs de Mahébourg.
- Les perspectives de développement d'activités de transformation et d'ajout de valeur à l'échelle de micro et petites entreprises croîtront graduellement avec l'augmentation de l'approvisionnement en poisson frais. FITEC devra adopter une approche proactive et de guichet unique afin d'aider les promoteurs grâce à la facilitation du projet, la formation en compétences techniques et d'entreprenariat et l'encadrement.
- Il est nécessaire de renforcer les capacités de gestion et de vulgarisation de l'AFRC (Centre de recherche d'Albion en matière de pêche) en créant un Observatoire économique dirigé par un spécialiste de l'économie des pêches. Cet Observatoire sera chargé de toutes les questions socioéconomiques relatives au secteur de la pêche, entre autres, de l'analyse des coûts-avantages des décisions politiques, des études socioéconomiques et de l'appui technique au FITEC (*Fisheries Training and Extension Centre* - Centre de

formation et de vulgarisation en matière de pêche).

- Il est nécessaire de mettre en place un projet pilote en vue de renforcer les capacités des communautés de pêcheurs locales en gouvernance locale, en leadership et gestion participative, de sorte qu'elles se partagent l'engagement et la responsabilité dans la formulation des décisions et le respect volontaire des normes ; et en co-gestion des infrastructures de pêche locales telle que les stations de débarquement.

De nombreuses organisations internationales et régionales ainsi que des initiatives de coopération intergouvernementales sont actives dans le sous-secteur de la pêche artisanale. Un nouveau Plan directeur sur la pêche est en voie d'approbation par le Conseil des ministres. Il est nécessaire d'adopter une approche concertée en vue d'allouer des ressources techniques et financières suffisantes pour mettre en œuvre les recommandations susmentionnées.

1.0 Introduction

The Government of Mauritius accords high priority to the sustainable development of the artisanal fisheries sub-sector because of its crucial role in providing employment opportunities and protein diets to some 4,000 households in the marginal coastal regions of the country and thus contributing significantly to poverty alleviation, food security and gender emancipation.

Artisanal fisheries are the main suppliers of fresh fish to the domestic markets in Mauritius. A small quantity of high grade reef fish, mainly chilled snappers is also exported to Réunion Island. Currently the total catch is estimated at 830 tonnes, which is close to the MSY of the targeted fish stocks. As of 2010 there were 2,303 registered fishers apart from an increasingly large number of non-registered active amateurs and sport fishers operating in the lagoon and off-lagoon. There were 2,525 registered fishing boats but according to a recent survey of the AFRC, only 70% of these registered fishers and fishing boats are active. The marketing functions are performed by some 400 licensed fishmongers at wholesale and retail levels.

This study is conducted under the "Implementation of Fisheries Regional Strategies for the ESA-OI" under the aegis of the IOC and funded by the EU. The overall objective of the Programme is to enhance socio-economic and environmental development and deeper regional integration in the ESA-OI through sustainable exploitation of fisheries resources. This assignment falls specifically under the Module of Result 4 related to the implementation of strategic improvement to production and supply of fish. The aim of this VCA[1] is to gain a deeper understanding of the value chain with particular emphasis on the production functions, market structures and marketing channels of the artisanal fisheries sub-sector, so as to assess its economic efficiencies. The study will also examine the underlying prospects and weaknesses to come up with an action plan to enhance sustainable development of the artisanal fisheries in a highly dynamic and competitive global environment.

1.1 Work Plan and Implementation

- To examine the market structures and marketing systems of fish production of the artisanal fisheries sub-sector;
- To determine the marketing cost and marketing margin of the fishmongers in the distribution and market structures;
- To collect critical data on production costs (fishing operations), marketing cost (logistic cost) and product prices in different market channels (PSP, WSP and CSP);
- To examine the value chain of fresh fish and fish products aiming to determine the value addition to marketed fish at different levels of market channels;
- To investigate the key factors for improvement of preservation, quality, value addition, processing and marketing of fish production of the artisanal fisheries.

[1] *The terms of reference of the study is given in Appendix 1*

1.2 Methodology

This is the first VCA[2] in the artisanal fisheries of Mauritius. It was not possible to conduct a classical stratified survey of the sub-sector. A preliminary survey was carried out to determine cost and revenue data which were readily available and those that had to be collected or derived to perform the study. A systemic approach was adopted to gather quantitative and qualitative data through primary and secondary surveys without compromising the consistency of the study. RRA and FGD were primarily conducted to have a deeper understanding of structural and functional features of the supply chain that included:

- Fishers' status with regard to ownership of fishing assets;
- Types of gears used;
- Commercial grades and market prices of fresh;
- Fishmonger status and marketing channels;
- Vertical integration and diversification in supply chain;
- Technological and environmental factors – fishing gears, fishing areas…
- Hard and soft fisheries infrastructure: FLS, MdP, Institutional fish markets...
- Fisheries regulations; management and monitoring measures;
- Seasonal/ regional/variation of catch and market prices;
- Location of main production and market centres;
- Safety and quality of fresh fish on local markets.
- Processing and Value addition activities.

1.2.1 Primary and Secondary Sources

Data were collected both from primary and secondary sources. Fisheries Statistics, PSP and CSP time series of the MOFR were actualized through field works. Discussions were held with FIT, FITEC and MFFC. Focus group discussions were organised with fishers and fishmongers at landing centres in the North, East and West. Literature research was focused on these study reports:

- Annual Fisheries Statistics and Fish Price data from 2009 and 2010 (unpublished) of the MOFR;
- Study on Fish Handling, Preservation and Marketing in Mauritius & Rodrigues– Final Report, Volume 1 and 2, Appavoo & Associates, 2007;
- Fish Handling, processing and Marketing in Mauritius, FAO, 2005;
- Enquête socio-économique sur la pêche artisanale à Maurice, sous l'égide du Projet Thonier régional Phase II de la COI/EU, S. Sweenarain, 1995.

Following the preliminary surveys, two questionnaires[3] were prepared to collect inputs and cost data from fishing units[4] and marketing enterprises. One–to–one interviews were also arranged with selected stakeholders to cross-check data / information so as to ascertain their accuracy. PSP and CSP data of the FD are limited to the FLS. Complementary price data were gathered from institutional fish markets in main towns and villages; fish peddlers and hawkers; dedicated fish shops and fish stalls in super/hyper markets.

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2 *The theory of Value Chain Analysis was developed by Micheal Porter in 1980. It is applied to determine the efficiencies of each and every component of a business enterprise so as to improve its over comparative advantages and competitiveness on the markets.*

3 *Given in Appendices 2 and 3*

4 *A fishing Unit or enterprise is considered as an economic unit and is defined in terms of ownership of fishing assets and control of fishing operations and marketing of harvested fish. This concept leads to a better understanding of the economic role of fishing labour / crew in the artisanal fisheries.*

1.3 Analysis

The analytical works aim at determining the economic efficiencies and income generating capacity/profitability of enterprises involved in the supply chain of the artisanal fisheries. A standardized business model[5] was used to prepare Income and Expenditure Statements for the various types of fishing activities. Economic efficiency is measured in terms of profitability, cost of production (COP), break-even (B/E) revenue and other relevant financial ratios. The B/E Revenue was assumed on the basis of a minimum monthly salary of Rs 10,000 as an opportunity cost of labour. A specific case study was prepared for each one of the typical fishing enterprises:

- Hand Line fishery
- Basket Trap Fishery
- Large Net Fishery
- Non-motorized hand line (lagoon) fishery
- On-foot Line & Harpoon (lagoon) fishery

In the VCA of the marketing channels, two important variables were measured namely marketing cost and marketing margin. While marketing margin represents the difference between consumer and producer price, marketing cost consists of material and non-material costs involved in performing marketing functions by the fishmongers. These functions include transportation, grading, storage, processing, financing and other direct services. The main players in the marketing channels are wholesalers/distributors and different types of retailers.

Vertical integration or linkage between production and market structures and diversification are common in the artisanal fisheries whereby:

- An increasing number of fishing units are involved in retail marketing either by direct sale or through a household road side fish stall. Fishers do not require a fishmonger license to sell their catch to end consumers.

- About 25% of licensed fishmongers are owners of up to 3 fishing boats (Appavoo & Associates, 2007). It is part of their business strategy to secure regular and adequate supply of fish. They normally manage the fishing operations by contracting fishing crew/labour.

5 *The fishing Business Model used for the Value Chain Assessment is given in Appendix 4*

2.0 Overview of the Artisanal Fisheries Sub-sector

2.1 Fisheries Policies

With an EEZ of 1.9 million km^2, the Government of Mauritius envisions the land based oceanic industries as a strategy for extracting more value from the ocean to spearhead sustainable economic growth. Development of the seafood hub[6], the marine fisheries and aquaculture forms part of the aforesaid strategy. Actually the fisheries sector has a contribution of about 1% of the GDP and provides some 20,000 direct and indirect jobs.

Government through its "People First" philosophy is laying special emphasis on the development of the artisanal fisheries sub-sector and on the welfare of coastal fisher communities through various institutions and programmes. It is recognized that the social welfare programme in favour of professional fishers in Mauritius is unique and highly generous. However, this approach may be appropriate for socio-economic and ecological sustainability of the coastal fisheries.

The Fisheries and Marine Resources Act 2007 provides a policy framework of the Government with regards to the development of the artisanal fisheries sub-sector that focuses on access to investment capital through the Empowerment Fund, SMEDA, SME Partnership Fund and extension services to empower traditional fishers to participate actively in the development of FAD and deep-sea demersal fisheries. An ambitious Fisheries Master Plan is in the process of approval by the Cabinet.

FITEC was set up to provide tailor-cut training courses in fishing technology and fish handling and preservation to enhance overall capabilities of registered fishers and licensed fishmongers. The extension services dispensed by FITEC have to be further oriented towards effective BDS including facilitation and mentoring of new entrants in the extended artisanal fisheries. It will have a key role to play in promoting micro and small scale processing and value addition activities in the artisanal fisheries.

FIT was set up in 2006 to act as an investment arm of the Government in fisheries sector and mandated by its parent Ministry to invest in fishing, processing, logistics and marketing activities. Registered fishers are shareholders of the FIT and are represented on the Board of Directors. It will have to take the lead in promoting investment in promoting viable commercial projects such as integrated fish terminals, ice plants and logistics services in the artisanal fisheries.
Government has promoted "Syndicat des Pêcheurs" to encourage local fisher communities (LFC) to participate in policy formulation and in joint management of the fisheries ecosystems and infrastructure. This organisation has to be equipped with local governance, leadership and participatory management skills through capacity building programmes. Emphasis has to be laid on the social implications of voluntary compliance to fisheries regulations, sustainable management and conservation of marine resources.

2.2 Supporting Institutions

The Fisheries Division (FD) is under the organisational structure of the MOFR and is responsible for the overall management and development of marine resources in the EEZ of Mauritius including fisheries, aquaculture and the seafood hub. It is organized into various services to cater for Research & Development, Management and Protection

6 *Seafood hub is defined as an efficient and attractive environment for the supply of value added processes and services related to the sourcing and market of sea food products.*

of marine resources and so on. AFRC and FITEC are also under the aegis of FD. An audit is underway at AFRC to align its organisational and functional structures to the challenges and opportunities ahead of the Mauritian seafood sector. MFFC regroups over 600 registered fishers including 16 LN fisher cooperative societies in Mauritius. It was established in the 1970s to emancipate and empower the fisher communities. Actually the MFFC is vetted by the MOFR and MOC for the operationalization of 3 integrated fish landing centres commonly known as "Maisons des Pêcheurs" (MdP) at Cap Malheureux, Tamarin and Mahebourg. The MdP at Cap Malheureux is inactive while the other ones at Tamarin and Mahebourg are underutilized. MFFC is an important player in the distribution and marketing of fresh fish. They have an ice-plant of 500 kg per day capacity at Tamarin, which can be included in a pilot project for preservation of fresh fish in the region.

These MdP are located at strategic points of the coastal fisheries and major tourist hubs on the island. It is proposed to prepare a pre-feasibility for the conversion of the MdP at Fishermen Village of Mahebourg Waterfront into an integrated Fish Terminal cum dedicated commercial complex as a pilot project to create positive synergies with the tourism industry.

The Competent Authority (CA) is the apex organisation with regard to health and sanitary standards for fish and fish products. It is responsible for compliance with HACCP and EU health and sanitary standard in the seafood export industry. It also provides a one-stop-shop for export formalities to the seafood hub in Port Louis. Actually there is no food safety and quality standard applicable to the artisanal fisheries. These world class standards might be an ideal for the artisanal fisheries in the long-run. However, the journey must start with the creation of an adequate environment for the enforcement of the COP for handling and preservation of fresh fish and CPCF established by FITEC.

2.3 On-going Programmes in the Artisanal Fisheries

There are several on-going national, regional and international technical assistance programmes in the artisanal fisheries and coastal marine ecosystems. These programmes include amongst others:

- The electronic fish auction market (EFAM) project at Fort William was sponsored financially by the Greek Government and implemented by the MOFR. The project is nearing completion this year and its operationalization will be entrusted to the Private Sector. The assistance of SmartFish is sought to provide STE for the preparation of a feasibility study in view of preparing an international bidding exercise to allocate a service provider contract. The project is due to become operational next year.

- IFAD-MARS initiative to conduct a Value Chain Analysis in the FAD fisheries. It is indicated that the bidding process is underway. This institution is also committed to provide technical assistance in the preparation of a comprehensive management plan for the lagoon and off-lagoon fisheries within the framework of the new Fisheries Master Plan.

- Mauritius is an active participant of SWIOFP and ACP-FISH II, which are delivering technical and scientific assistances in fish stock assessment and management in the artisanal fisheries. There is an urgent need to undertake a risk assessment study on fish stock commonly exploited by the artisanal fisheries. The technical assistance may be extended to create a bio-economic model to serve as an effective tool for management and monitoring.

FD also benefits from the technical assistance from bilateral cooperation with Japan, Norway and Australia in the fisheries sector.

2.4 Coastal Fisheries Infrastructure

There are 60 FLS around Mauritius that serve as operational bases to coastal fishing activities. Statutorily they are mandated for unloading fish and for fisheries data collection. They consist of small concrete structures with basic utilities such as water, electricity (at some places) that serve for discharging, cleaning, grading and primary sale of fish. They are managed by FD and maintained by the Local Authorities. These FLS have outlived their purposes and most of them

have become obsolete for the following reasons:

- They are not accessible during low tides (dredging works required);
- They are far from the Fisheries Post and traditional landing sites;
- They are in an unhygienic condition;
- There is no attached washroom and toilet;
- Absence of active participation of the local fisher communities.

The MOFR has started modernizing some of these FLS. The new ones e.g. the one at Albion, is more fisher-friendly. It provides for lockers to stack fishing gears and outboard engines. Local fisher communities and fishmongers are the main users of the FLS and therefore they have to be consulted on any rehabilitation works / development of new facilities. They should be empowered to participate in the management of the fisheries infrastructure together with the FD and the local authorities.

2.5 Fish Resources in the Lagoon and Off-lagoon

To date about 60% of fish harvested by the artisanal fisheries is still from the lagoon. Fish stocks in the lagoon and off-lagoon are exploited to their MSY levels (Boyer & Soondron, 2009). A series of restrictions such as; a close season of six months for the net fisheries, a ban on imports of small hooks and a crackdown on illegal fishing, are implemented by the FD to help the fish stocks to recover. An impact assessment of fish gears used by the artisanal fisheries on the marine ecosystem and non-targeted fish species has to be carried out so as to improve management and conservation policies.

A plethora of incentives have been introduced by the MOFR to divert fishing efforts from the coastal fishing zones to deep-sea FAD and demersal fisheries. However, the mobility of traditional fishers is usually very slow due their aversion to new technologies and reluctance to change. Consumers' preference for traditional reef and demersal fish is also responsible to some extent for the slow development of the FAD fishery in Mauritius. It was assumed that consumers would readily accept tuna and tuna-like species. It is necessary to embark on a nation-wide awareness campaign to sensitize consumers and the population at large on the need to modify their fish consumption habit in favour of large pelagic fish. By so doing they will contribute significantly to the conservation of fish stocks in the lagoon and in promoting private investments in the FAD fishery. There is unlimited scope for processing and value added activities of raw tuna for the local and export markets. Similar development models can be adapted from the experience of countries like Hawaii, Bangladesh, Uganda and so.

The actual coastal fisheries management and conservation measures cannot yield the expected results because of the prevailing open-access environment, which is tantamount to the high risk of overexploitation of the fish stocks. The number of non-registered active, amateur and sport fishers active in coastal fisheries significantly exceeds the number of registered fishers[7]. To attain socio-economic and ecological sustainability in the artisanal fisheries, development strategies must focus on selection of fishing gears[8], quality, value addition and efficient marketing, as ultimate means to maximise economic rent of the fish resources and revenue of the stakeholders.

7 *According to a Survey conducted by the Ministry of Fisheries and Cooperatives in 2003, there were over 25500 of amateur fishers operating regularly in the coastal fisheries. It is likely that this figure has increased significantly.*

8 *Selectivity of fishing gears promotes eco-friendly technologies so as to reduce negative impacts of fishing activities on the marine ecosystem. They are instrumental to avoid untargeted fish species and undersized fish with low commercial value.*

2.6 Supply of Fresh Fish

In 2010, local supply of fresh fish was estimated at 1,780 tonnes, which consisted of 830 tonnes from artisanal fisheries, 650 tonnes from sport fisheries and 300 tonnes from amateur fisheries. The catch of the artisanal fisheries from the lagoon and off-lagoon was estimated at 515 tonnes and 315 tonnes respectively.
The production of sport and amateur fisheries is as important as the artisanal fisheries and yet, they are not covered adequately by the fisheries statistics. It is necessary to extend fish sampling, data collection and monitoring procedures to these fisheries.

2.7 Fisher Community

Currently there are 1,770 active registered fishers. The maintenance of a fishers Registry is purposely for administration of social welfare policies such as closed season allowance, bad weather allowance, sick leave allowance, scholarship to children of fisher community, insurance for fishermen lost at sea and so on.

Table 4: Summary of allowances paid to registered fishers – 2005 /9

Year / Rs	Bad Weather Allowance	Close Season Allowance	Sick Leave Allowance	Scholarship Allowance	Total
2005	41 597 895	2 763 010	11 480	922 500	45 294 885
2006	35 890 800	2 882 125	9 870	290 250	39 073 045
2007	47 380 770	2 565 825	10 710	258 000	50 215 305
2008	56 737 336	3 121 216	8 540	2 250	59 869 342
2009	53 601 880	3 421 950	4 800	1 473 000	58 501 630

Source: MOFR

In 2009 the Ministry of Social Security, National Solidarity and Senior Citizens Welfare and Reform Institutions has paid a mean sum of Rs 26 175 in the form of various allowances per registered fisher. The mean age group of fishers is 45 – 50[9] years. The number of registered fishers is declining because of retirement age and this trend will continue

2.8 Fishing Equipment

The fishing assets comprise 2,525 registered wooden and fibre-glass boats in the range of 6 to 7 metres long. About 85 % of the fleet are motorized while the others are still using oars and sails. It is indicated that only 1,655 boats are active but it is not clear whether the remaining are temporarily inactive or removed permanently. Most of the motorized ones use 15 HP outboard engines. These traditional boats are not fitted with a fish hold and are not designed to carry mobile ice boxes. The actual cost of a 7 metres long RFP boat is approximately Rs 200,000 – Rs 250,000 and that of a 15 HP outboard engine is Rs 100,000. Therefore the initial capital investment required for a fishing unit is estimated at approximately Rs 350,000.

The fishers and fishing boats data-base in their actual format cannot be used to segregate fishing units / enterprises (fishers who owners of their fishing boats) and fishers who are hired as fishing labour or crew. All the same it is not

9 Survey on artisanal fishermen in Mauritius - Appavoo & Associated 2007

possible to identify fishmongers who are also owners of fishing boats. The above information are kept and maintained in hard copy at regional Fisheries Posts. It is necessary to create an interactive data-base to deal with fishers, boats and fishmonger inputs at the national level for management and monitoring purposes.

2.9 Fishing Gears

The main types of gear used in the artisanal fisheries are described briefly below:

Hand line fishing is fishing with a single fishing line held in the hands with one or more baited hooks or lures that contributes to 20% of the total catch. It is a selective gear and targets high value bottom fishes in the lagoon and off-lagoon. The targeted fish species are Vieille Rouge (Red Snapper) and Capitaine (Emperor).

Basket Traps are made of galvanized steels mesh and are passive and close-end gear used to trap reef fishes. It is the most common fishing gear of the artisanal fisheries and is sometimes used alternately with hand lining. The main harvested species is Licorne (82%).

Large Net Fishery consists of using a net of 500 m long to encircle reef fish in the lagoon. One Net fishing operation comprises a minimum of 3 fishing boats and 15 fishers (about 5 fishers per boat). The net fishery harvests 22% of the total catch, which comprises Cordonnier (30%), Licorne (37%) and Capitaine (22%). The net fishery is regulated in terms of prescribed size of mesh and length of net, renewal of worn out nets and a close season of 5 months from October to February annually. During close season registered net fishers are entitled to an allowance of Rs 210 per day in spite of the fact of the existence of a buyback scheme to encourage net fishers to give up this fishery.

Since 1996 the Government has introduced a buy-back scheme for nets for the reduction of nets operating in the lagoon. Presently there are 15 large nets in activity.

On-foot, Line and Harpoon Fishery is practiced on foot during low tides and in shallow waters in the lagoon. It targets mainly octopus and small reef fish. 31% of fishers in this fishery contribute to only 15% of the production. MOFR has introduced a ban on imports of small hooks to avoid the fishing of juvenile fish in the lagoon.

Table 5: Total catch by fishers, by fishing gears and fishing boats (2010)

Items	HL	BT	BT/HL	LN	O/F-HL/H	TOTAL
Registered Fishers (N)	283	279	862	146	733	2303
Percentage	12%	11%	36%	6%	35%	100%
Active Fishers	**212**	**195**	**638**	**106**	**620**	**1770**
F/Boats (N)	1124	1149	225	27	-	2525
Percentage	44%	46%	9%	1%	-	100%
Active fishing boats	**728**	**761**	**149**	**17**	-	**1655**
Catch (t)	227	267	28	222	87	831
Percentage	27%	32%	3%	28%	10%	100%

Source: Annual Report 2010 - MOFR

With the exception of the net fishery, which is pseudo regulated, there is no restriction whatsoever on the use of HL or BT. HL is a more selective and more environmentally friendly gear as compared to BT and LN. During the close season, net fishers may opt for HL and/or BT fishing.

2.10 Preservation of Fish on Board

There is a serious concern about safety and quality of fish landed by the artisanal fisheries. Post capture handling and preservation procedures are non-existent. Consumers suspect the freshness and quality of fish preserved on ice. The main reasons advanced by the fishers for not using ice are:

- Catch is kept only for a few hours on board and is sold immediately at FLS;
- Fishing boats are not equipped with an ice box or ice;
- Ice in cubes or flakes is not available at the FLS;
- Consumers have an aversion for fish preserved in ice;
- Additional operating cost.

Safety and quality of fresh fish is mandatory to avoid health hazards and poor quality of raw fish on the local markets. An intensive awareness campaign through audio-visual means to sensitize producers, consumers and logistics services providers about food safety and quality of fresh fish is required. All stakeholders will have to work together to implement the COP – Handling and Preservation of fresh fish along the supply chain.

3.0 VCA of Fishing Enterprises

As stated in section 1.2 above, this study represents an attempt to assess the economic efficiencies and distribution of the value-added, of the various types of fishing units within the artisanal fisheries sub-sector. The analysis normally is carried using accounting records. In the absence of the relevant accounting records and procedures, the consultant had to gather cost and revenue data so as to prepare Income and Expenditure Statements in the form of case studies for each type of fishing unit.

Key factors/assumptions applicable to all the fishing units are as follows:

- **Capital Investment** - Actual cost of a 6 - 7 m fishing boat whether wooden or fibreglass is at Rs 200,000 and is depreciated at the rate 5% per annum (an average life time of 20 years). Actual Cost of a 15 HP outboard engine ia at Rs 100,000 and is depreciated at the rate 20 % per annum (an average life time of 5 years).

- **Informal sector** - No formal accounting procedures are followed by artisanal fishers.

- **Seasonal variation** - Fishing activities are more intensive and productive in the summer (6 months), than in the winter (6 months) due to bad weather. It is assumed that a fishing boat makes 2 fishing trips/week during winter and 5 fishing trips per week during summer. On the basis of 52 weeks per year, the total number of fishing trips per year is at 182 e.g. 52 fishing /days in winter and 130 fishing/days in summer.

- **Classification of Commercial grade of fish** - as established by the MOFR was used as it regroups all fish species into 6 groups according to their respective commercial importance. These commercial grades reflect the market realities in Mauritius and were used in this study.

- **Latest PSP and CSP time series data of the MOFR** - used and actualized by primary surveys; e.g. catch composition by gear and PSP at FLS. Table 6 on the following page shows PSP Data for the fishing units for species groups.

- **Cash business** - Payment received from fishmongers and provided to fishing crew is customarily on a weekly basis. The transactions are mostly on a cash basis.

- A conservative approach is adopted so as to avoid under estimates of cost and/or over-estimates of revenue.

- **License** - A fisher does not require a fishmonger license to sell his catch directly to end consumers.

- **Auto-consumption** - Fish taken home by fishers commonly called "curry" is not included in the simulations.

- There is no **Value Added Tax** (VAT) on fresh fish.

- **Environmental / ecological cost** - (damages caused by a specific gear to the marine ecosystem) is included in the VCA.

- The revenue estimates are before any **interest paid on loans and income tax.**

Table 6: Catch Composition and PSP at FLS

Commercial Group		HL	%	BT	%	LN	%	PSP RS/KG
Lobster		0	0	38	1	0	0	700
Shrimps & Crabs		0	0	11	0.3	0	0	350
Vieille Rouge & others	Grade 1	1573	38	18	0.5	0	0	250
Capitaine & Others	Grade 2	1573	38	151	4	5420	22	180
Octopus & Others	Grade 3	83	2	38	1	492	2	130
Cordonnier & Others	Grade 4	455	11	189	5	7391	30	120
Mullet & Others	Grade 5	0	0	8	0.2	493	2	110
Licorne & Others	Grade 6	207	5	3100	82	9115	37	100
Miscellaneous fish	Grade 7	248	6	227	6	1724	7	80
Mean Catch	Kg	4139	-	3780	-	24635	-	

3.1 Case Study I – Hand Line Fishing Unit / Enterprise

Key variables & assumptions

(i) The owner of the fishing unit is an active fisher and employs 2 co-fishers (Total = 3);

(ii) The fishing ground is mainly off-lagoon;

(iii) Annual mean CPFD = 7.3 kg x 3 fishers; Total Catch per fishing day: 21.9 kg.

3.1.1 Income and Expenditure Statement

The following table shows a normal year of activity for a hand line fishing unit.

Table 7: Income and Expense for Hand Line Fishing Unit

Items (a normal year of activity)	Rs	Rs	Rs
Sales – 4139 kg @ Rs 190.70			789 307
Less Fixed Costs			
Depreciation: F/Boat 5 % p.a; O/board Engine 20% p.a	30 000		
Repair and Maintenance: F/Boat & Engine – 10 % p.a	30 000		
Sundry fixed costs (Rs 1 000 / month)	12 000	72 000	
Less Variable Costs (excluding Labour costs)			
Fuel and Lubes (Rs 800 @ fishing day)	151 200		
Repair & Replacement – fishing gears (Rs 1 000 p.m.)	12 000		
Baits (Rs 200 @ fishing day)	37 800		
Sundries (Rs 100 @ fishing day)	18 900	219900	291 900
			497 407
Less Labour Cost			
3 fishers incl. boat owner-fisher (4139 @ Rs 85.25)			352 850
Surplus income after provision for depreciation			Rs 144 557

3.1.2 Economic Analysis

- The fishing enterprise's mean income per month is Rs 21,848 which includes Rs 9,801 to fishers and Rs 12,047 to profit or surplus income for fishing enterprise);
- Fisher (crew) mean income : Rs 9,801 / month;
- Cost of Production : Rs 155.77 per kg;
- Profit Margin: Rs 34.93 per kilo;
- Profit Margin on sales: 18 %;
- Break-even quantity (TR = TC) = 3379 kg e.g. CPFD = 6.0 kg.

3.2 Case Study II – Basket Trap Fishing Unit

3.2.1 Key variables and assumptions

(i) The boat owner is an active fisher and has no co-fisher. The fishing unit operates 10 basket traps per fishing day.
(ii) CPFD = 20 kg; Total annual catch: 3780 kg;
(iii) Fishing ground: Lagoon & Off Lagoon.

3.2.2 Income and Expenditure Statement

The following table demonstrates a normal year of activity for the Basket Trap fishing unit.

Table 8: Income and Expenses for Basket Trap Fishing Unit

Items (a normal year of activity)	Rs	Rs	Rs
Sales – 3780 kg @ Rs120.21			454 394
Less Fixed Costs			
Depreciation: F/Boat 5 % p.a; O/board Engine 20% p.a	30 000		
Repair and Maintenance: F/Boat & Engine – 10 % p.a	30 000		
Sundry fixed costs (Rs 1 000 p.m)	12 000	72 0000	
Less Variable Costs (excluding Labour costs)			
Fuel and Lubes (Rs 800 @ fishing day)	151 200		
Repair & Replacement – fishing gears (30 BT @ Rs 1500)	45 000		
Baits (Rs 100 @ fishing day)	18 900		
Sundries (Rs 100 @ fishing day)	18 900	234 000	306 000
Surplus of income after provision for depreciation			**148 394**

3.2.3 Economic Analysis

- Fisher mean income per month: Rs 12 366
- COP: Rs 80.95 per kg
- Profit Margin: Rs 39.31 per kilo
- Profit Margin to Sales: 32.7 %
- Break-Even Quantity = 2 546 kg (67.35 % fishing capacity)

3.3 Case Study III – Large Net Fishing Cooperative / Enterprise

3.3.1 Key variables & assumptions

(i) One fishing enterprise comprises 3 fishing boats and 15 fishers (e.g. each fishing boat has 5 fishers). The fishing unit operates a seine net of 500 m long;

(ii) The fishery is regulated in terms of size of mesh and length of net, a six month close season from October to March every year;

(iii) Fishing ground: Lagoon;

(iv) Catch per fishing days is 259.3 kg, (84.44Kg /boat) No. fishing days: 95;

(v) Fishing crew remuneration: One additional share for boat owner after deduction of trip costs.

3.3.2 Income and Expenditure Statement

The following table shows a normal year of activity for a large Net fishing enterprise

Table 9: Income and Expense for Large Net Fishing Enterprise

Items (a normal year of activity)	Rs	Rs	Rs
Sales – 24 635 kg @ Rs 128.30			3 160 690
Less Fixed Costs			
Depreciation: 3x (F/Boat 5 % p.a; O/board Engine 20% p.a)	90 000		
Repair and Maintenance: 3x(F/Boat & Engine –10 % p.a)	90 000		
Sundry fixed costs 3 x (Rs 1 000 p.m)	36 000	216 000	
Less Variable Costs (excluding Labour costs)			
Fuel and Lubes (Rs 1000 @ fishing day)	285 000		
Repair & Replacement – fishing gears (10 Nets @ Rs 4500)	45 000		
Sundries (Rs 500 @ fishing day)	47 500	377 500	593 500
			2 567 190
Less Labour Cost			
15 Fishers: (5/6 of net revenue after deduction of trip costs)			2 139 325
Surplus of Income after provision for depreciation			427 865

3.3.3 Economic Analysis

- Boat Owner Income = Rs 47 540 / month (for six months)
- Fisher mean Income = Rs 23 770 / month (for six months)
- COP: Rs 110.92 per kg
- Profit Margin: Rs 17.38 per kilo
- Profit Margin to Sale: 13.6 %
- Break-Even Quantity (TR = TC) = 21 300 kg (at 86 % of actual capacity)

3.4 Case Study IV – Non-Motorized Boat Hand Line Unit

3.4.1 Key variables and assumptions

(i) Owner of the fishing Unit is an active fisher and employs 1 co-fisher;

(ii) The fishing ground is mainly lagoon;

(iii) Annual mean CPFD = 5.4 kg x 2 fishers; Total Catch per fishing day: 10.8 kg.

3.4.2 Income and Expenditure Statement

Table 10 shows a normal year of activity for a non-motorised boat hand line unit

Table 10: Income and Expense for Non-motorised Boat Hand Line unit

Items (a normal year of activity)	Rs	Rs	Rs
Sales – 2041 @ Rs 126.92			259 065
Less Fixed Costs			
Depreciation: F/Boat 5 % per annun	10 000		
Repair and Maintenance: F/Boat – 10%	20 000		
Sundry fixed costs (Rs 500 / month)	6 000	36 000	
Less Variable Costs (excluding Labour costs)			
Repair & Replacement – fishing gears (Rs 600 / month)	7 200		
Baits (Rs 100 @ fishing day)	18 900		
Sundries (Rs 100 @ fishing day)	18 900	45 000	81 000
			178 065
Cost of Labour – Rs 1021 Kg @ 60.21			61 474
Surplus of income after provision for depreciation			116 291

3.4.3 Economic Analysis

- Mean annual income of fishing enterprise: Rs 116 292 or Rs 9 691 per month
- Fisher mean income per month: Rs 5 123

- COP: Rs 69.81/ Kg
- Profit margin to Sale: Rs 57.11 / kg
- Profit Margin to sale: 45%
- Break-Even Qty: 2070 kg (almost as a current production level)

3.5 Case Study V - On-foot Hand Line & Harpoon Fishing

3.5.1 Key variables and assumptions

(i) On-foot fisher using hand line and harpoon operating in the lagoon

(ii) Annual mean CPFD = 3.9 kg (Break even CPFD = 6.1 kg)

3.5.2 Statement of Income and Expenditure

Table 11 shows a normal year of activity for an on-foot fisher

Table 11: Income and Expense for an On Foot Fisher

Items (a normal year of activity)	**Rs**	**Rs**	**Rs**
Sales – 737 kg @ Rs 131.20			96 694
Less Fixed Costs			
Depreciation: F/Boat & Engine	Nil		
Repair and Maintenance: F/Boat & Engine	Nil		
Sundry fixed costs (Rs 500 / month)	6 000	6 000	
Less Variable Costs (excluding Labour costs)			
Fuel and Lubes	Nil		
Repair & Replacement – fishing gears (Rs 400 /month)	4 365		
Baits (Rs 30 @ fishing day)	7560		
Sundries (Rs 30 @ fishing day)	5 670	17 595	23 595
Surplus income after depreciation			73 099

3.5.3 Economic Analysis

- Mean annual income of fisher is at Rs 73 099 or Rs 6 092 per month
- COP: Rs 32.01/ Kg
- Profit margin to Sale: Rs 99.19 /kg
- Profit Margin to sale: 75.60 %
- Break-Even Quantity: 557 kg
- Break-even Quantity on the basis of Rs 12 000 / month basic salary: 1 095 kg

3.6 Summary of Economic Indicators of Artisanal Fisheries

Here below in Table 12 is a summary of the economic indicators from the previous analsys of the different fishing units.

Table 12: Summary of Economic indicators by Fishery

Items **Case Studies**	**Unit**	**HL** **I**	**BT** **II**	**HL/BT** **(50/50)**	**LN** **III**	**N/M** **IV**	**On/FT** **V**
Mean fishing days per year	N	189	189	189	95*	189	189
No. of Fishers incl. owner	Unit	3-4	1-2	2-3	(3x5) 15	1	-
Catch per Fisherman day	Kg	7.3	20	10.4	259.3	5.4	3.9
Catch per Boat Landing	Kg	21.9	20	21	86.44	10.8	6.1
Mean annual Catch @ f/ boat	Kg	4 139	3 780	3 960	24 635	2 041	737
Break-even– Quantity (TR-TC)	**Kg**	**3 379**	**2 546**	**2 963**	**21 300**	**2 070**	**1 095**
Difference	+/-	+ 760	+1 234	+ 997	+ 3335	- 29	-358
As a percentage of B/E Quantity		22%	48%	34%	16%	-1%	-31%
Mean (PSP)	Rs	190.70	120.21	155.46	128.30	126.92	131.20
Annual Sales Estimates	**Rs**	**789307**	**454394**	**615622**	**3 160 690**	**259 065**	**96 694**
Sales / Fishing Boat (LN)	Rs	-	-	-	1 053 563	-	-
Annual Income - Fishing Enterprise	Rs	262176	148 596	205 386	285 240	116 291	73099
Annual Mean Income - Fisher	Rs	117612	148596	133 104	142 620	61 474	-

N/M: Non-Motorized canoe: On/FT : On foot Fishers

3.7 Profitability of Fishing Enterprise – Rs /Kg

The following table summarise the profitability of the fishing enterprises by fishing unit:

Table 13: Summary of Profitability by type of Fishery

Items	Unit	HL	BT	HL/BT	LN	N/M HL	On/FT
Sales at PSP	Rs/kg	190.70	120.21	155.46	128.30	126.92	131.20
Cost of Production	Rs/kg	155.77	80.90	117.89	110.92	68.81	32.01
Profit	Rs/kg	34.93	39.31	37.57	17.32	56.98	97.80
Profit Margin to Sales	%	18 %	33 %	24 %	14%	45 %	75.%
Cost of Fuel	Rs /kg	36.50	40.00	38.25	11.56	-	-
Cost of fishing labour	Rs/kg	85.25	39.25	62.25	86.84	87.09	97.80

3.8 Cash Flow Management

Income derived from fishing activities fluctuates significantly during the peak summer and the lean winter seasons due to climatic conditions (preventing access) and availability of fish stocks. Also, fish business is carried out mainly on a cash basis and on a day to day basis usually outside the banking sector. Therefore, it is imperative for a fishing enterprise to manage its cash flow on an annual basis to cope efficiently with intra-annual fluctuation of income. The ability to do this unusual in artisanal fisheries. It requires an efficient cash flow management ability that can be acquired through basic business skills and a positive attitude towards saving.

3.9 Bio-Economic Approach of the Artisanal Fisheries

The break-even quantity calculated of each type of fishing units was extrapolated to estimate the existing production capacities of the fishing assets. The following table demonstrates this.

Table 14: Estimates of existing fishing capacities

Items	NOTE	HL	BT	HL/BT	LN	ON-FOOT	TOTAL
Estimates of fish harvested							
(i) Motorized Crafts	(a)	**569**	**647**	**114**	**27**	**-**	**1357**
Mean annual catch (Kg)	(d)	**4139**	**3780**	**3960**	**8212**		**4034**
Total (tonnes)	(a x d)	**2355**	**2446**	**451**	**222**	**-**	**5474**
(iii) Non-Motorized crafts	(b)	**109**	**114**	**25**	**-**	**-**	**248**
Mean annual catch (kg)	(e)	**2041**	**1890**	**1966**	**-**		**1768**
Total (tonnes)	(b x e)	**222**	**215**	**49**			**486**
(iii) On-foot fishers	(c)					**134**	**134**
Mean annual catch (kg)	(f)	**-**	**-**	**-**	**-**	**737**	**1153(1)**
Total (tonnes)	(c x f)	**-**	**-**	**-**	**-**	**99**	**155**
Total Estimates (metric tonnes)	**(t)**	**2577**	**2661**	**500**	**222**	**99**	**6115**

Note The FAD fishery comprising 50 fishing boats and about 150 fishers has been excluded from the above simulation since it is not relevant to lagoon and off-lagoon fish stocks. (1) Break Even Quantity for On-foot fishers*

According to the above estimates, the existing fleet of 1605 boats will have to harvest 6115 tonnes of fish annually to be economically viable. It implies that there is an excessive fishing capacity, which can potentially overexploit fish stocks in the lagoon and off-lagoon areas.

Based on the manning capacity of each type of fishing units and on the statistics of active on-foot fishers, Table 15 provides estimates of active manpower in the artisanal fisheries.

Table 15: Estimates of active fishing crew and on-foot fishers

Items	NOTE	HL	BT	HL/BT	LN	ON-FOOT	TOTAL
Estimates of active fishers							
(i) Motorized Crafts	(a)	**569**	**647**	**114**	**27**	**-**	**1357**
No. of fishers per fishing boat	(e)	**3**	**1**	**2**	**5**	**-**	**2**
Total	(a x e)	**1707**	**647**	**228**	**135**	**-**	**2717**
(ii) Non- Motorized Crafts	(b)	**109**	**114**	**25**	**-**	**-**	**248**
No. of fishers per fishing boat	(f)	**2**	**2**	**2**	**-**	**-**	**2**
Total	(b x f)	**218**	**228**	**50**	**-**	**-**	**496**
(iii) No. of On-foot fishers	(c)	**-**	**-**	**-**	**-**	**134**	**134**
Grand Total of Active fishers	(N)	**1925**	**875**	**278**	**135**	**134**	**3347**

The number of active fishers employed by the fleet of active boats is estimated at 3347, which nearly double the number of registered active fishers of 1620. This estimate excludes amateur and sport fishers. Table 16 shows the optimal number of fishing boats and fishers needed to operate at the current MSY level.

Table 16: Estimates of surplus fishing capacities at current MSY level

Items	HL	BT	BT/HL	LN	ON-FOOT	TOTAL
Annual Catch / Current MSY	227	267	28	222	87	**831**
Percentage	12%	11%	36%	6%	35%	100%
Mean Catch @ f/boat (kg)	**4139**	**3780**	**3960**	**24635**	**737**	**-**
Optimal No. f/boats (N)	**54**	**150**	**7**	**27**	**-**	**238**
Optimal On-foot fishers (N)	**-**	**-**	**-**	**-**	**118**	**118**
Actual Active fishing boats	678	761	139	27	**-**	1605
Actual active on-foot fishers					134	
Surplus fishing boats (N)	**624**	**611**	**132**	**0**	**-**	**1367**
Surplus On-foot fishers (N)	-	**-**	**-**	**-**	**16**	

At current MSY level, the artisanal fisheries can afford to sustain 238 fishing boats and 832 active fishers including 118 on-foot fishers. Therefore existing surplus capacities are estimated at 1367 active fishing boats and 938 registered active fishers. The allowances and subsidies given to the fishers have become a real obstacle for reduction of fishing efforts and voluntary exit and thus contributing to continued depletion of the fish stocks in the lagoon and off-lagoon. In keeping with the findings of the VCA on the production functions, it is necessary to undertake the following measures:

- To carry out a risk assessment on fish stocks harvested in the lagoon and off-lagoon by the artisanal fisheries,
- To undertake an environmental impact assessment of artisanal fishing gears used on the marine ecosystems so as to encourage selective and environment friendly fishing methods.
- To implement a survey on the existing fleet of fishing efforts in terms of boats and all active fishers including non-registered professional, amateur and sport fishers in view to replace the current fisheries statistical system and sampling methods.
- To perform an audit of the existing fishing boats, FLS and logistics to evaluate their adequacy in the perspective of the implementation of COP – Handling and Preservation of Fresh Fish in the fishing operations.
- To create an Economic Observatory headed by a fisheries economist within the organisational framework of the AFRC.
- To develop an appropriate bio-economic model that can be used as an effective management tool.
- To create an interactive data-base for active fisher, fishing boats, fishmongers and eventually amateur and sport fishers.
- To an economic analysis on the artisanal fisheries on an annual basis and to publish the results the annual report of the Fisheries Division.

4.0 Fresh Fish Trade in Mauritius

The domestic markets of fresh fish are supply-driven and the suppliers are price makers. The market is highly flexible and adapts itself constantly to supply. The main players in the marketing channels are the fishmongers commonly called "Banyan". The primary sale takes place at the FLS. In brief, there are about 400 fishmongers chasing 830 tonnes of fresh fish annually for the consumption of the local population and foreign visitors. The per capita-consumption of fish and fish products in Mauritius is at 20 kg while the contribution of the artisanal fisheries is less than 1 kg. There is no VAT of fish and fish products.

The primary concern of fishmongers is to secure regular and adequate supply of fish to satisfy their clientele. While an increasing large number of fishing entrepreneurs are also involved in marketing functions, fishmongers have responded by investing significantly in fishing assets. Others act as indigenous bankers to fishing enterprises as a means of procuring fish at competitive prices.

The marketing strategy of a fishing enterprise is correlated to targeted commercial species and the level of catch that fluctuates intra-annually and from year to year. Generally a LN fishing unit harvests relatively large quantity of fish in a single fishing trip and requires a more significant distribution and marketing network. HL fishing enterprises target high value demersal fish such as Vieille Rouge, Sacrechien and Capitaine, which are sold directly to end consumers and restaurants at a premium price. The use of mobile phones is becoming a marketing strategy for HL fishing units as they start marketing their catch at sea, before returning to shore.

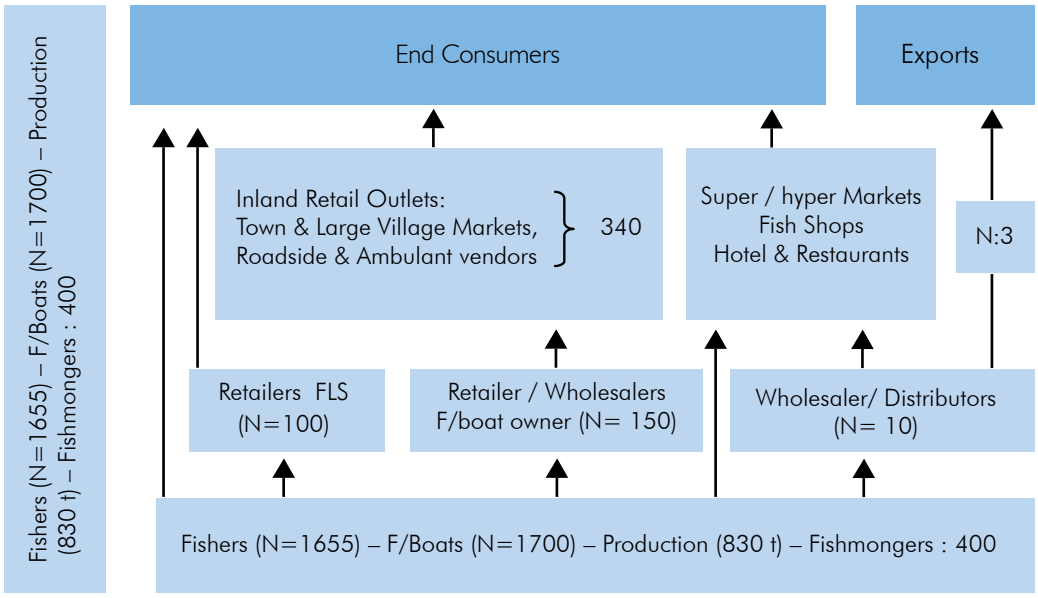
LN and BT fishing enterprises prefer to deal with wholesalers, so as to sell their fish – fast and slow moving commercial species - in one deal. There are specialized "niche" markets for certain commercial species such as Lobster, Vieille Rouge, and Squids as well as for traditional delicacies such as Licorne and Cateau.

Marketing and distribution networks connect FLS to the consumption centres. The main production centres are at Cap Malheureux, Trou d'Eau Douce, Mahebourg and Tamarin, while fish market outlets (institutional fish markets, roadside and ambulant fish vendors and dedicated fish stalls in super/hyper markets) are spread over the urban and rural areas of the country. The distribution network is generally short because the fish is not preserved on ice.

In keeping with the above, it can be summarized that market structures and marketing channels in the artisanal fisheries are dynamic and adaptive. The main strategy is to sell the unloaded fish as soon as possible to avoid spoilage. A single fishmonger may act as wholesaler and retailer so as to adjust with the supply and his sale capacity. The VCA will also examine vertically and horizontally integrated enterprises.

The flow chart given below highlights the existing marketing channels in the artisanal fisheries.

Figure 3: Flow chart of the market channels of fresh fish in Mauritius



4.1 Fishmongers

Out of 961 licensed fishmongers in Mauritius; only about 400 are active in the artisanal fisheries, either on part time or full time basis. All licensed fishmongers have to attend a compulsory one week course on "COP - Handling and Preservation of fresh fish" imparted by FITEC as a prerequisite for renewal of their license. Generally part-time fishmongers are seasonal and work as construction workers, drivers, gardeners or agricultural labourers.

4.1.1 Fishmongers – Wholesalers

Wholesale requires a relatively large quantity of supply that can be supplied by a LN fishing enterprise or several BT and/or HL fishing enterprises. The followings features are common to wholesale fishmongers:

- To tie up with a net fishing unit (a Net fishermen Co-op Society);
- To invest directly in fishing equipment and contract fishing crews to operate them;
- To act as an indigenous banker to fishing units;
- To operate in an extended fisher family system.

LN and BT fishing units are more inclined to tie-up with wholesalers. A few wholesalers have established a strong goodwill over time and hold a dominant position at their acquainted FLS. Wholesale market margin is approximately Rs 10 to 20 per kilo depending on the commercial species and quantities supplied at a given time.

A few distributors in the fisheries sector have diversified into fresh fish marketing to target a higher income group of consumers through dedicated fish stalls in super/hypermarkets, restaurants and the hotel industry. They have invested in modern fishing boats fitted with insulated fish holds, logistical components, such ice machines, refrigerated trucks and cool rooms to comply with international health and sanitary norms for fresh fish and to align with the HACCP system. One of such integrated enterprise is exporting selective high value chilled fish to Réunion Island.

4.1.2 Fishmonger – Retailers

Fresh fish retail outlets comprise institutional fish markets in urban and rural areas, traditional fish peddlers and hawkers, modern fish stalls in super/hyper markets and dedicated fish shops. Road side and ambulant fish vendors have built up a strong clientele in their locality.

With increasing operating costs for fishing (higher fuel prices, labour costs and declining catches), some fishing enterprises are now involved in the direct sale of their catch in order to improve margins for themselves.

4.2 Marketing and Distribution Logistics

Motorcycles and pick-up vans are the most common means of transport used by fishmongers. Fish is usually stacked in jute baskets, plastic crates and fibreglass boxes. The time factor is crucial in the marketing of fresh fish that is not preserved with ice. It may take between 4 and 24 hours before the fish reach the end consumers from the time of harvest. Roadside and ambulant fish vendors trade in small quantities varying from 25kg to 50kg per day to avoid spoilage. It is a common practice to keep unsold fish in domestic freezers overnight or longer and sold in "fresh form" the following day! This is a real health hazard to be prevented. Quality conscious consumers prefer to buy fish at the FLS or directly from fishers.

4.2.1 Preservation of fresh fish

As stated earlier, the means for preservation of fresh fishes in the marketing network are either rudimentary or inexistent. Institutional fish markets in towns and villages are in deplorable hygienic conditions. This is a real health hazard to consumers and an eyesore for local and foreign visitors. Arguments advanced by fishmongers for not using ice are:

- Fresh fish is sold quickly after reception;
- Vehicles are not appropriate for carrying insulated containers and ice flakes;
- Ice flakes are not available on the market;
- Ice flake is expensive and will increase operating cost;
- Consumers do not buy fresh fish kept on ice.

The same arguments were made by the fishers concerning post-harvest handling and preservation of fish. Commercial supply of ice flakes is limited on the island and not available at the FLS. Due to a lack of adequate infrastructure and equipment the implementation of COP – "Handling and Preservation of Fresh Fish" relies mainly on voluntary compliance.

A cultural change in preservation of fresh fish has started by some fish vendors who are using simple means to improve safety and quality standards. They are using simple / practical means such as ice boxes, home-made ice, fly-nets, aluminium, sheet-embedded working tables, and so on. In some cases broken-down freezers are used as insulated containers. However the consumers' perception that iced fish is not fresh has to be dissipated through a nationwide awareness campaign.

Food safety and quality is mandatory for a health population. There is an urgent need for a comprehensive and concerted action plan with a specified timeframe to enforce the COP – "Handling and Preservation of Fresh Fish" as a minimal food safety and quality standard along the supply chain of the artisanal fisheries.

4.2.2 Processing and value-addition activities

Freshness is a mark of high quality and value-added that is rewarded by a price premium. In dedicated fish shops and fish stalls in supermarkets consumers pay a higher price for fresh fish for its hygienic display, quality and associated value-added services, such as gutting, cleaning, filleting, slicing and packaging. With the emergence of modern lifestyles in Mauritius, demand for high quality ready-to-cook raw fish and fish products will increase significantly. Micro and small scale processing and value-added activities do not exist mainly because of a scarcity and irregularity of the supply of fresh fish. With the development of the FAD fishery and extended demersal fishery, deficient supply of raw fish may

be overcome in the short and medium terms. Eventually minor processing and value-added activities can potentially improve job creation and income earning capacities in the artisanal fisheries.

4.3 Pricing Mechanism

There is no price control on fresh fish in Mauritius and prices are determined by market forces and are not subject to VAT. The market is predominantly supply driven and prices are volatileas a result. Price varies according to:

- Consumers preference and taste;
- Seasonal fluctuations in demand and supply;
- Effective demand of corporate buyers – restaurants , caterers and hotels;
- Marketing channels.

Table 17 on the following page shows the mean Producer Sale Price (PSP) and Consumer Sale Price (CSP) at FLS by commercial groups for the year 2010. This table is extracted from a previous report and is labelled table 5. It is Table 17 in this report.

REGION	Lobster			Crabs & Shrimps			Grade 1			Grade 2			Grade 3			Grade 4			Grade 5			Grade 6			Misc. Others		
	PSP	CSP	MM	PSP	CSP	MM	PSP	CSP	MM	PSP	CSP	MM	PSP	CSP	MM	PSP	CSP	MM	PSP	CSP	MM	PSP	CSP	MM	PSP	CSP	MM
NORTH	900	1300	400	450	550	100	241	375	134	179	259	80	145	180	35	122	156	34	110	150	40	123	167	44	77	112	35
EAST 1	600	700	100	300	400	100	205	253	48	187	230	43	135	170	35	125	155	30	125	155	30	114	142	28	60	81	21
EAST 2	550	700	150	275	325	50	238	293	55	180	220	40	125	155	30	106	135	29	120	150	30	115	137	22	77	87	10
WEST 1	700	800	100	300	400	100	235	280	45	167	209	42	145	180	35	145	174	29	115	140	25	120	147	27	62	75	13
WEST 2	700	800	100	275	350	75	209	281	72	207	279	72	150	180	30	148	167	19	160	185	25	137	167	30	61	78	17
MEAN	690	860	170	320	405	85	226	296	71	184	239	55	140	173	33	129	157	28	126	156	30	122	152	30.	67	87	19
%	25			26.6			31			30			24			22			24			25			28		

Notes: PSP: Producer Selling Price / Primary Sale Price

CSP: Consumer Selling Price

WSP: Wholesale Price

MM: Marketing Margin

a) Market Margin varies between 20 to 30 % depending on the commercial species. The overall average is 25 %

b) Primary surveys reveal that Wholesaler operate at Market margin of approximately 10 %

c) Marketing Cost for the fishmongers at FLS is minimal or negligible

This explains the motivation of fishers to diversify to fish retailing

The above data do differentiate between WSP and RSP at the FLS

5.0 VCA of Marketing Channels

To address the VCA, the Marketing Margin (MM), Marketing Cost (MC) and Marketing Profit (MP) of the various market channels were determined. A simple marketing business model was designed to calculate the above economic indicators with particular emphasis on the vertically integrated activities (fishing and marketing).

5.1 Case Study VI – Integrated Coastal Retailer of Hand Line Harvested Fish

An increasing number of roadside fish stalls operate in coastal areas around residential and commercial centres. They are often connected to fishing enterprises within the household or extended family. Fish retailing business requires a minimal capital investment and administrative formalities that makes it accessible to the fisher communities.

5.1.1 Key determinants & assumptions

(i)	Capital investment consists of 2 x 150 litre freezers, 2 x 60 litre ice boxes, a fish stall / working table and sundry tools such as weighing scale, chop board and knives;
(ii)	Annual fish supply: 4139 kg;
(iii)	Purchase price: PSP at FLS is taken as Transfer price from fishing Unit to Retail unit;
(iv)	Customers: mainly restaurants and regular clients;
(v)	Value-added services: Personalized services like gutting, cleaning, slicing, filleting and home delivery within the locality are inclusive in CSP.

5.1.2 Statement of Income and Expenditure

The following table summarize the results of this analysis.

Table 18: Income /Expense Summary for Integrated Retailer for Hand-line Harvested Fish

Items	Vieille	Capitaine	Octopus	Cordo	Licorne	Misc.	TOTAL	MEAN
	Grade 1	Grade 2	Grade 3	Grade 4	Grade 6	Grade		Rs/kg
% of total catch	38%	38%	2%	11%	5%	6%	**100%**	
Quantity supplied	1572,82	1572,82	82,78	455,29	206,95	248,34	**4139**	
Retailer CSP	350	200	160	160	130	120		
Total Sales	550487	314564	13244	72846	26904	29801	**1 007 846**	243.50
PSP	250	180	130	120	110	100		
Total Purchases (A)	393205	283108	10761	54635	22765	24834	**789307**	**190.70**
MARKET.COST								
Transport	14364	14364	756	4158	1890	2268	**37800**	9.13
Electricity	5472	5472	288	1584	720	864	**14400**	3.48
Rent	0	0	0	0	0	0	**0**	0.00
Water	1140	1140	60	330	150	180	**3000**	0.72
Telecoms.	2280	2280	120	660	300	360	**6000**	1.45
Sundries	4560	4560	240	1320	600	720	**12000**	2.90
Overheads*	3800	3800	200	1100	500	600	**10000**	2.42
Total MC (B)	31616	31616	1664	9152	4160	4992	**83200**	**20.10**
COST OF SALES	424 821	314 724	12425	63787	26925	29826	**872507**	**211.00**

Profit Margin	125 666	-160	819	9 060	-21	-25	**135339**	**32.70**
Margin / Sales (%)	**22.83%**	**-0.05%**	**6.19%**	**12.44%**	**-0.08%**	**-0.08%**	**13.43%**	

5.1.3 Economic Analysis

- The Net Income of the fish retailer after depreciation is Rs 135339 per year, which is equal to an average of Rs 11278 per month
- MM is at Rs 53.10 / kg
- MC is at Rs 20.10/kg
- MP is at Rs 33.00/ Kg
- Profit Margin to Sales (all groups of fish included as above) is equal to 13.43%

5.2 Case Study VII – Integrated Coastal Retailer of Basket Trap Harvested Fish

This case study is connected to a BT fishing enterprise within a fisher household.

5.2.1 Statement of Income and Expenditure

The following table summarises the results of the analysis.

Table 19: Income / Expense Summary for Coastal Retailer of Basket Trap harvest fish

Items	Lobster	Vieille	Capitaine	Octopus	Cordonn	Licorne	Misc.	TOTAL	MEAN
	Crabs …	Grade 1	Grade 2	Grade 3	Grade 4	Grade 6	Grade		Kg
%	0.013	0.005	0.040	0.010	0.050	0.822	0.060	1.000	
Qty supplied	49	18	151	38	189	3108	227	3780	
Retailer CSP	884	400	200	180	170	150	100		161.00
Total Sales	43316	7200	30200	6840	32130	466200	22700	608586	
PSP	621	300	250	130	130	100	80		
Purchases (A)	30429	5400	37750	4940	24570	310800	18160	**432049**	**114.30**
MARKETING COST									
Transport	491	189	1512	378	1890	31072	2268	37800	
Electricity	187	72	576	144	720	11837	864	14400	
Rent	0	0	0	0	0	0	0	0.00	
Water	39	15	120	300	150	2466	180	3000	
Telecoms.	78	30	240	600	300	4992	360	6000	
Sundries	156	60	480	1200	600	9864	720	12000	
Overheads*	130	50	400	1000	500	8220	600	10000	
Total MC (B)	1082	416	3328	3622	4160	68451	4992	**86051**	**22.76**
COST OF SALES	31510.60	5816.00	4107800	8562.00	28730.00	379251.00	23152.00	**518100**	**137.06**
Profit Margin	11805.40	1384.00	-10878.	-1722	3400	86949	-4520	**90486**	**23.94**
Margin/Sales	**27%**	**19%**	**-36%**	**-25%**	**11%**	**19%**	**-1.99%**	15%	

5.2.2 Economic Analysis

- The Net income of the fish retailer after depreciation is at Rs 90486 per year which is equal to and average of Rs 7541 per month.
- MM is at Rs 45.70/ kg
- MC is at Rs 22.76 /kg
- MP is at Rs 23.94/ Kg
- The Profit Margin to Sales is at 15%

5.3. Case Study VIII – Wholesaler of Large Net & Basket Trap Harvested Fish

The wholesale price is about 10% below the PSP at FLS. A wholesaler takes possession of the fish at the FLS and either sells it on the spot to retailers and/or distributes it to inland institutional markets.

5.3.1 Key determinants & assumptions

(i)	Capital Employed - One 3 tonner-refrigerated truck that serve as transport and storage convenience at an actual cost of Rs 400,000. And 20 plastic crates @ Rs 250 each.
(ii)	Mean annual qty traded – 62 435 kg on the basis of a regular supply from 1 LN fishing enterprise and 10 BT fishing Units. It has a dominant position at a specific FLS.
(iii)	No. of retail outlets - 6 at the tune of 1000 kg / month.
(iv)	Production Centres – East and Retailing outlets – mainly inner towns and villages.

5.3.2 Statement of Income & Expenditure

The following table summarises the results of the analysis.

Table 20: Income /Expense for Wholesaler of Large Net and Basket Trap Harvested Fish

Items	Lobster	Vieille	Capitaine	Octopus	Cordonn	Licorne	Misc.	TOTAL	MEAN
	Crabs …	Grade 1	Grade 2	Grade 3	Grade 4	Grade 6	Grade		Kg
%	0,007	0,002	0,111	0,014	0,155	0,644	0,063	1	
Qty supplied	490	180	6950	872	9734	40215	3994	**62435**	
RSP	600	300	180	130	120	120	70		
Total Sales	294000	54000	1251000	113360	1168080	4825800	279580	7985820	**127.91**
WSP at FLS	**500**	**200**	**160**	**120**	**110**	**100**	**60**		
Tot/Purchases	245000	36000	1112000	104640	1070740	4021500	239640	6829520	**109.39**
MARKETING COST									
Fuel & Lubes	1228	451	17420	2185	24399	100803	1001	156500	-
Electricity	94	34	1335	167	1871	7729	768	12000	-
Rent	0	0	0	0	0	0	0	0	-
Water	23	9	333	42	468	1932	192	3000	-
Telecoms.	70	25	1001	126	1403	5796	576	9000	-
Labour Cost	765	281	10853	1362	15201	62800	6237	97500	-
R&M	510	187	7235	908	10134	41867	4158	65000	-
Depreciation	376	138	5343	670	7483	30917	3071	48000	-
Contingencies	304	112	4319	542	6049	24991	2482	38800	-

Total MC (B)	3 370	1 237	47 839	6 002	67 008	276 835	18 485	429 800	6.88
COS	248370	37237	1159839	110642	1137748	4298335	258125	7259320	116.27
Profit Margin	45630	16763	91161	2718	30332	527465	21455	726500	11.64
Profit /Sales %	15.52	31.04	7.29	2.40	2.60	10.93	7.67	9.10	-

COS: Cost of sales

5.3.3 Economic Analysis

- Annual Net income of the wholesaler = Rs 726,500 before interest and tax
- MM = Rs 18.52 /kg
- MC = Rs 6.88 /kg
- MP = Rs 12.81/ Kg
- The Profit Margin to Sales = 9.105 %

5.4. Case Study IX – Municipal Fish Retail Outlet

This case study is related to a Municipal fish market supplied by the wholesaler presented in Case study VIII. The mean monthly procurement of fish is 1000 kg.

5.4.1 Statement of Income and Expenditure

The following table summarises the results of the analysis.

Table 21: Income /Expense for Municipal Fish Market supplied by Wholesaler

Items	Vieille	Capitaine	Octopus	Cordo	Licorne	Misc.	TOTAL	MEAN
	Grade 1	Grade 2	Grade 3	Grade 4	Grade 6	Grade		Rs/kg
%	0,03	0,11	0,01	0,16	0,64	0,06	1,00	-
Quantity supplied	129	1336	168	1871	7729	768	**12 000**	-
CSP	**400**	**200**	**160**	**160**	**160**	**100**		-
Total Sales	51600	267200	26880	299360	1236640	76800	1958480	**163.21**
RSP	**300**	**180**	**130**	**120**	**120**	**70**		
Total Purchases	**38700**	**240480**	**21840**	**224520**	**927480**	**53760**	**1506780**	**125.57**
Marketing Cost								
Rent, Rate & levies	37	1447	182	2027	8373	832	13000	-
Electricity	17	668	84	935	3865	384	6000	-
Water	9	334	42	468	1932	192	3000	-
Labour [1]	281	10853	1362	15201	62801	6237	97500	-
Telecoms	35	1336	168	1871	7729	768	12000	-
Overheads[2]	23	891	112	1247	5153	512	8000	-
Contingencies	40	1553	195	2175	8985	892	13950	-
Total M/ Cost	**442**	**17081**	**2143**	**23924**	**98839**	**9816**	**153450**	**12,79**
Cost of sales	**39142**	**257561**	**23983**	**248444**	**1026319**	**63576**	**1660230**	**138.36**
Marketing Profit	**12458**	**9639**	**2897**	**50916**	**210321**	**13224**	**298250**	**24.85**
Margin to Sale	**11,64**	**3,61**	**15,12**	**21,89**	**10,13**	**15,65**	**15.23**	

Notes:
(1) 1 helper is employed at the rate of Rs 7500 /month on basis of 13 months/year.
(2) Overheads include depreciation of a freezer and sundry tools.

5.4.2 Economic Analysis

- Annual Net income of the fish stall = Rs 298 250
- MM = Rs 37.64 / kg
- MC = Rs 12.79 /kg
- MP = Rs 24.85/Kg
- Profit Margin to Sales = 15.23 %

5.5. Case Study X – Fish Stall in a Hypermarket

An increasing number of customers buy fresh fish from dedicated fish stalls in supermarkets for its freshness, quality and ready-to-cook services such as gutting, cleaning, slicing and filleting. This case study examines its marketing margin and profit. The mean sale capacity is estimated at 1500 kg /month.

5.5.1 Statement of Income and Expenditure

The following table summarises the results of the analysis.

Table 22: Income /Expense for Fish Stall in Hypermarket

Items	Vieille	Capitaine	Octopus	Carang	Cordon	TOTAL	MEAN
	Grade 1	Grade 2	Grade 3	Grade 4	Grade 6		Rs/kg
%	0.250	0.500	0.100	0.100	0.050	1	
Quantity supplied	3750	7500	1500	1500	750	15,000	
Retail Sale Price	500	300	250	280	250		
Total Sales	1,875,000	2,250,000	375,000	420,000	187,500	5,107,500	**341**
WSP	350	180	140	120	140		
Total Purchases	1,312,500	1,350,000	210,000	180,000	105,000	3,157,500	**211**
Marketing Cost							
Rent, Rate & levies	90,000	18,0000	36,000	36,000	18,000	360,000	-
Salesman (1)	32,500	65,000	13,000	13,000	6,500	130,000	-
Driver / Helper	39,000	78,000	15,600	15,600	7,800	156,000	-
Telecoms	3,000	6,000	1,200	1,200	600	12,000	-
Rpr & Maintenance	60,000	120,000	24,000	24,000	12,000	240,000	-
Refri truck	56,250	112,500	22,500	22,500	11,250	225,000	-
Ice flakes Rs 3@Kg	9,000	18,000	5,000	5,000	2,500	36,000	-
Depreciation (2)	10,000	20,000	18,500	18,500	2,000	40,000	-
Contingencies (3)	14,471.25	28,942.5	11,470	11,470	573.5	57,885	-
Total M Cost	314,221	628,443	126,170	126,170	62,844	1,256,885	**83.79**
Total Cost	1,626,721	1,978,443	336,170	306,170	167,844	4,414,385	**294**
Marketing Profit	248,279	271,558	38,830	113,830	19,656	693,115	**46.21**
Margin to Sale %	11.64	3.61	15.12	21.89	10.13	13.57	-

Notes to accounts:
(1) Salary of a salesman at Rs 10,000 / month for 13 months
(2) Depreciation of refrigerated truck at 10% per annum
(3) 5% of total marketing cost

5.5.2 Economic Analysis

- Annual Net income of the fish stall in Hypermarket= Rs 693,115 before tax
- MM = Rs 130.00/kg
- MC = Rs 83.79 /kg
- MP = Rs 46.21/ Kg
- The Profit Margin to Sales = 13.57 %

6.0 Distribution of Value Added Between Fishing and Marketing Functions

Distribution of value-added and profit between fishing and marketing enterprises is examined through the following simulations. The main criterion used is the Net Income derived by the stakeholder in the different types and /or segments the production and marketing functions.

6.1 HL Integrated (Fishing and Marketing) Activities

The economic performance in terms of Net Income or profit a household diversified fish business is estimated in the table below:

Table 23: Analysis of Net income for a Household diversified fish Business

Items	Rs / Kg	% to CSP
CSP (roadside fish stall)	243.50	-
Fishing - Less Cost Production	(155.77)	64%
Retailing – Less Marketing Cost	(20.10)	8%
Total profit (Fishing and Marketing)	**67.63**	**28%**
Profit from fishing operations	34.93	**14.3%**
Profit from marketing operation	32.70	**13.7%**
Marketing Margin (MM = MC+ MP)		**21.7%**

6.1.1 Economic analysis

- Total Profit = Rs 67.63 / kg (Fishing - Rs 34.93 / Kg + Marketing - Rs 32.70 / Kg)
- Annual Income before tax = Rs 279 921 or Rs 23 327 / month
- Total Profit / Net Income to CSP = 28%

6.2 BT Integrated (Fishing and Marketing) Activities

This case-study is also related to a household integrated fish business. The following table summarises the analysis

Table 24: BT Integrated Business

Items	Rs / Kg	% to CSP
CSP (roadside fish stall)	161.00	-
Fishing - Less Cost Production	(86.52)	54%
Retailing – Less Marketing Cost	(22.75)	14%
Total profit (Fishing and Marketing)	**51.73**	**32%**
Profit from fishing operations	39.31	24%
Profit from marketing operation	12.42	8%
Marketing Margin (MM = MC+ MP)		22%

6.2.1 Economic Analysis

- Total Profit = Rs 51.73/Kg (Fishing = Rs 39.31/kg & Marketing = Rs 12.42/kg)
- Annual Net Income before tax = Rs 195 539 or Rs 16 295 /month
- Net Income / Profit to CSP = 32% (Fishing = 24% and Marketing = 8 %)

6.3 HL and Supermarket Fish Stall Integrated Activities

This case-study is related to a HL and Supermarket integrated fish business. The following table summarises the analysis.

Table 25: HL & Supermarket Fish Stall integrated business

Items	Rs / Kg	% to CSP
CSP (roadside fish stall)	341.00	-
Fishing - Less Cost Production	(155.77)	46%
Retailing – Less Marketing Cost	(83.79)	25%
Total profit (Fishing and Marketing)	**101.44**	**29%**
Profit from fishing operations	34.93	10%
Profit from marketing operation	66.51	19%
Marketing Margin (MM = MC+ MP)		44%

6.3.1 Economic Analysis

- Total profit = Rs 101.44 / Kg (Fishing = Rs 34.93/ Kg & Marketing = Rs 66.51/Kg)
- Annual Income / Profit before interest & tax = Rs 1 521 600
- Total Profit to CSP = 29 % (Fishing 10% and Marketing 19%)

6.4 LN Fishing and Institutional Fish Market Integrated Activities

This case-study is related to an integrated LN Fishing and Institutional Fish Market. The following table summarises the analysis.

Table 26: LN fishing and institutional fish market integrated activities

Items	Rs / Kg		% to CSP
CSP (Institutional fish market)	163.21		-
Fishing - Less Cost Production	(86.52)		**53%**
Retailing – Less Marketing Cost	(12.79)		**8%**
Total profit (Fishing and Marketing)	**63.90**		**39%**
Profit from fishing operations	41.68		**26%**
Profit from marketing operation	22.22		**13%**
Marketing Margin (MM = MC+ MP)			**21%**

6.4.1 Economic analysis

- Total Profit = Rs 63.90/ Kg (Fishing = Rs 41.68/Kg & Marketing = Rs 22.22/Kg)
- Total annual Income before tax = Rs 766 800
- Total Profit to CSP = 39 % (Fishing = 26% and Marketing = 13%)

6.5 Integrated Fishing and Marketing Activities – Non-Motorized HL Boats

This case-study is related to an integrated Non-motorized HL boats and marketing business. The following table summarises the analysis.

Table 27: Non-Motorized HL boats and fish marketing business

Items	Rs / Kg	% to CSP
CSP (Institutional fish market)	243.50	-
Fishing - Less Cost Production	(129.76)	**53%**
Retailing – Less Marketing Cost	(20.10)	**8%**
Total profit (Fishing and Marketing)	**93.64**	**39%**
Profit from fishing operations	60.93	**25%**
Profit from marketing operation	32.71	**14%**
Marketing Margin (MM = MC+ MP)		**22%**

6.5.1 Economic analysis

- Total profit = Rs 93.64 / Kg (Fishing Rs 60.93/K & Marketing Rs 32.71/Kg)
- Annual Net Income = Rs 191 119 or. Rs 15927 per month
- Total Profit to CSP = 39 % (Fishing = 25 % & Marketing 14 %)

6.6 On-foot Fishers - Integrated Fishing and Marketing Activities

This case-study is related to On-foot integrated fishing and marketing business. The following table summarises the analysis.

Table 28: On-foot fishers - Integrated fishing and marketing business

Items	Rs / Kg	% to CSP
CSP (Institutional fish market)	151.70	-
Fishing - Less Cost Production	(32.01)	**21%**
Retailing – Less Marketing Cost	(10.00)	**7%**
Total profit (Fishing and Marketing)	**109.69**	**72%**
Profit from fishing operations	99.06	**65%**
Profit from marketing operation	10.63	**7%**
Marketing Margin (MM = MC+ MP)		**14%**

6.6.1 Economic Analysis

- Net Income = Rs 109.69/Kg (Fishing = Rs 99.69/kg & Marketing = Rs 10.63/Kg)
- Total annual Income before tax = Rs 80842 e.g. Rs 6737 / month
- Total Profit to CSP = 72 % (65 % from fishing and 7 % from marketing)
- Critical size of operation = Break-Even Quantity at 1153 kg to yield an annual income of Rs 126403 e.g. Rs 10534 per month

6.7 Summary of Case Study Results

The following table summarises the findings of the above case studies

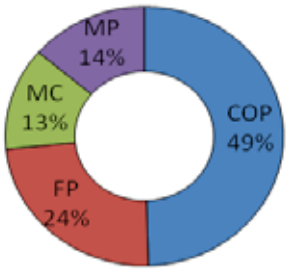
Table 29: Summary of Profit Margin of integrated (fishing & marketing) activities

ITEMS (Rs / kg)	CSP	COP	MC	COS	T P	F P	M P
HL / Road side Retailer	243.50	155.77	20.10	175.87	67.63	34.93	32.70
BT /Road side Retailer	161.00	86.52	22.75	109.27	51.73	39.31	12.42
HL / Supermarket Retailer	341.00	155.77	83.77	239.54	101.46	34.93	66.53
LN / Inst. Market Retailer	163.21	86.52	12.79	99.31	63.90	41.68	22.22
O&S Boat – HL / Direct Sales	243.50	129.76	20.10	149.86	93.64	60.93	32.71
On-Foot / Direct sales	151.70	32.01	10.00	42.01	109.69	99.06	10.63
Mean (Rs / kg)	**217.32**	**107.73**	**28.25**	**135.98**	**81.34**	**51.81**	**29.54**
Mean (%)	-	**50 %**	**13 %**	**63 %**	**37 %**	**24%**	**13%**

CSP : Consumer Sale Price; COP : Cost of Production; MC: Marketing Cost; TP: Total profit;
COS : Cost of Sales ; FP : Fishing Profit and MP : Marketing Profit
TP = MP + FP
CSP – COS = MP; COS = COP + MC
PSP = COP + FP

It can be concluded that the distribution of value added between Fishing functions and marketing channels is equitable and realistic. The current mean PSP and CSP are at Rs 191 and Rs 217 per Kg respectively. The pie chart below illustrates the mean distribution of value added per kg of fish harvested by the artisanal fisheries.

Figure 4: Mean value added per Kg



As stated above, the consumer sale price of fresh fish has increased at an average 15 % per year over the past 3 years. The shortage of supply is compensated by higher prices through consistently strong demand.

7.0 Results and Discussions

The artisanal fisheries sub-sector has to be economically viable to sustain its own socio-economic and ecological development. It cannot afford to be an economic liability or a negative saving to the national economy. Therefore it is essential for the artisanal fisheries to be shaped up so as to meet the opportunities and challenges in a highly competitive global environment. Under the prevailing environment, the artisanal fisheries sub-sector is economically deficient, which will impoverish the fisher communities giving rise to social tension. The following sections review the short comings and weaknesses that have to be addressed in a concerted manner.

7.1 Management and Monitoring Measures

7.1.1 Open access fisheries / No entry-barriers

The artisanal fisheries operate in a relative open access environment. Various allowances provided by the Government to registered fishers have become a barrier to voluntary exit. It is important to undertake a cost-benefit analysis on the various allowances and to find alternative measures to relieve the sub-sector from the surplus fishing efforts / over-capacity.

This open access situation is also relevant for an increasing large number of (non-registered) active, amateur and sport fishers exploiting the same fish stocks in the lagoon and off-lagoon. It is admitted by the population at large that fish stocks are declining due to over-fishing and that degradation of the coastal marine ecosystem is apparent. This momentum can be seized positively to introduce an effective regulatory framework to manage and monitor the coastal fisheries in a holistic manner.

7.1.2 Over-investment in the artisanal fisheries

There is serious problem of overcapitalization in the fisheries in terms of fishing assets and active manpower. At the current MSY of 830 tonnes per annum, the sub-sector can sustain a fleet of 238 fishing boats and 832 registered fishers to achieve its bio-economic equilibrium.
A list of registered fishers, fishing boats and licensed fishmongers are maintained separately at regional Fisheries Posts

and are not compiled into an interactive database that can provide useful management information, such as:

- Registered fishers / Owners of fishing boats
- Registered fishers / Fishmongers
- Fishmongers / Owners of fishing boats

It was indicated that in 2010 the number of registered fishing boats and fishers has declined by nearly 30%. It is obvious that some registered fishers quit because they have reached the retirement age while others are taking an alternate job for their livelihood. They are held virtually on the fisheries roll just for the sake of the allowances provided by Government. Apparently the number of registered fishing boats has declined but there is no indication whether they have been laid up temporarily or removed permanently.

A comprehensive survey has to be conducted on the actual fishing efforts namely fishing boats, registered and non-registered professional fishers; amateur and sport fishers to update the existing data-base.

7.1.3 Underestimated fisheries statistics

Deficient data collection, sampling methods, a laxity in the enforcement of relevant regulations and a systematic avoidance on the part of the fishing units, all contribute to underestimated fisheries statistics in Mauritius.

According to existing fisheries regulations, FLS are the only authorized place for unloading of fish by the artisanal fisheries. However a large number of fishing boats and on-foot fishers avoids systematically the FLS for unloading their catch. The main causes are attributed to:

- Close down or inactivity of a large number of the FLS
- Aversion of the fishing units to disclose their real catch
- Tense relationships between fisheries officers and fisher communities
- Impossible to moor at the FLS during low tides – poor design and facilities

Reliable statistics are mandatory for the efficient management and monitoring process as well as cost effective policing for enforcement. Voluntary compliance is the only sustainable solution that can be achieved through a participatory management framework.

The CPFD, which is at 6.4kg for the past 3 years, is not a reliable indicator for biological sustainability of the targeted fish stocks. It is most urgent and highly recommended that a risk assessment be undertaken on the targeted fish stocks in the lagoon and off-lagoon. The fisheries statistical systems, sampling methods and data collection strategies will have to be reviewed in light of the new configuration of the coastal fisheries.

7.2 FLS and LFC as the Focal Point

FLS is the operational base of the coastal fisheries and the development of the fisheries has suffered greatly from their marginalization. Actually FLS are managed by the FD and maintained by the local authorities while the main users - fishers and fishmongers - are not directly involved in their management.

Direct involvement of the LFC in up-grading or delocalisation, as well as in co-management of FLS is crucial to deliver value for money. LFC has to be empowered through capacity building programmes in local governance, leadership and participatory management. A pilot project can be initiated at a selected site(s) to experiment the advantages of this new approach in collaboration with of NGOs and the MFFC. The concept can be improved by lessons learned and replicated progressively across the island. The LFC's commitment will be a milestone in the implementation of voluntary compliance to fisheries regulations and other cross-sectional issues such as safety and quality standards, renewal of manpower, technological innovations and so on.

7.3 Handling and Preservation of Fresh Fish

There cannot be any compromise on health safety and quality of fish placed on the local markets. A myriad of regulations exist at the national and local levels to control the safety and quality of fresh fish. However, the array of institutions involved, concerns about overlapping jurisdictions and official mandates at different levels, have all contributed to making enforcement difficult.

The COP for Handling and Preservation of Fresh Fish provides a basic safety and quality standard for the local markets that can be upgraded progressively to achieve world class standards over time. The existing misconception regarding the use of ice-flakes for preservation of fresh fish has to be removed by an intensive awareness campaign.

Consumers have to be sensitized on the fundamentals of food safety and quality applicable to fresh fish while suppliers have to be convinced that safety and quality standards are not cost constraints but marketing opportunities.
In practice, fish quality improvement implies upgrading along the supply chain, from fishers through to end consumers. It requires additional capital investment and working capital all along the supply chains, i.e. insulated containers (ice boxes) have to be present on the boats, at the FLS, during transportation to markets and in the retail markets a suitable presentation of iced fish has to be made.
A commonly used strategy to deal with the upgrading of safety and quality standard in the artisanal fisheries in a sustainable way is elaborated as follows:

- Work with local container manufacturers to design new types (rigid / flexible) of plastic coolers adapted to the fishing boats and fishmongers;
- Introduce appropriate sizes of coolers to boat owners and fishmongers at FLS along with training on fish safety and quality preservation ;
- Bring in financial institutions like the DBM, Empowerment Fund and commercial banks to provide assets and working capital financing;
- Provide financial literacy and entrepreneurial skill training as an embedded business development service to new borrowers along the supply chain;
- Promote private investment in logistics such as ice plants and refrigerated vehicles to establish cost-effective and reliable deliveries of ice flakes to the FLS.

This approach has to be characterized by sustainability and innovation. Sustainability, in the sense of how will goods and services be paid for commercially; and, innovation comes into play in terms of technology, finance, role of fishmongers, and governance/partnerships.
The MdP at Tamarin has an ice plant of 500kg of ice / flake per day and 2 refrigerated trucks which are actually underutilized. These facilities can be incorporated in a pilot project for the implementation of the safety and quality of fresh fish on the west coast through collaboration between MFFC and FD. Likewise a techno-economic audit is proposed to assess the cost of rehabilitation of the MdP at Cap Malheureux.

7.4 Processing and Value Added Activities

The slow development of processing and value-addition activities in the artisanal fisheries is attributable to:

- Scarcity and irregularity of supply
- Poor safety and quality standard of fresh fish

The new Fisheries Master Plan lays emphasis on the development of extended artisanal FAD and deep-sea demersal fisheries so as to boost domestic supply of fresh fish. Also, a food safety and quality standard for fish is imminent.

Assuming that the above constraints are removed, a large number of micro and smallscale processing and value-added enterprises can be promoted in the following areas:

- **Value addition with vacuum packed options**
  - Filet / loin
  - Cube flesh
  - Slices
  - Whole fish scaled, gutted and packed

- **Semi-processed**
  - Fish balls, fish burgers, samosas and so on
  - Fish sausages
  - Fish paste

- **Ready-to-cook**
  - Marinated fish
  - Fish pickles
  - Smoked fish
  - Cooked fish (traditional recipes)

FITEC has a major role to play in promoting micro and small-scale processing activities in the artisanal fisheries in the following ways:

- Establishment of a COP for processing and preserving of fresh fish and fish products;
- Capacity building in product development / marketing;
- Business Development Services & facilitation (one stop-shop) services;
- Mentoring and follow up start ups;
- Training and access to finance.

7.5 New Concept of Fish Terminal

The artisanal fisheries sub-sector forms part of the cultural heritage of the country. Like in other developed countries, this can be showcased as a theme to local and foreign visitors. A modern concept of a Fish Terminal / Market is proposed to promote excellence in seafood safety and quality that will be integrated to fish landing, processing, retail outlets and seafood courts in the same complex. This project has tremendous potentials of creating positive synergies between the artisanal fisheries and the tourism industry. This proposal aims at transforming an existing and partly utilized MdP into a world class tourist attraction.

The SIC has 3 integrated FLS commonly known as “Maisons des Pêcheurs” located at strategic points of the artisanal fisheries and major tourist hubs of the country. Their management is vetted to MFFC though the MOFR and MOC. Presently the MdP at Cap Malheureux is inactive while the ones at Tamarin and Mahebourg waterfront are partly utilized. They are equipped with basic facilities for fish handling, preservation, distribution and marketing. It is proposed to promote this new concept of a Fish Terminal at the MdP of Mahebourg Waterfront.

MFFC is an example of fisher community-based income generating NGO in the artisanal fisheries. It has been at the service of the fisher communities since the 1970s and has 625 active registered fishers at its members. It is already in the fresh fish distribution and marketing business. It has shown interest in the proposed new Fish Terminal concept at Mahebourg Fishermen Village (waterfront) and is prepared to commission a pre-feasibility study and business plan through an STE. Eventually capital investment could be raised from the Decentralized Cooperation Development Fund of the EU and the SME Partnership Fund.

8.0 Recommendations

		Time frame		
	Short/Medium/Long Term	**S/T**	**M/T**	**L/T**
	Months	**1-6**	**7-18**	**19-36**
IMPROVEMENT IN FISH STOCKS MANAGEMENT [10]				
	1. Risk assessment of fish stocks harvested in the lagoon and off-lagoon.	X		
	2. Impact assessment of the fishing gears used by the artisanal fisheries on the marine ecosystem.	X		
	3. Regulatory framework to manage active (non-registered, amateur and sport fishers in the lagoon and off-lagoon.	X		
	4. To carry out a survey on the (non-registered) active, amateur and sport fishers operating in the lagoon and off-lagoon.	X		
	5. Assessment of existing sampling methods and statistical system in the artisanal fisheries.	X		
IMPROVEMENT OF SAFETY AND QUALITY OF FRESH FISH[11]				
	6. An audit of all FLS to evaluate their effectiveness to serve as operational bases to LFC in the prospective of enhancement of local participatory management and the implementation of safety and quality standard for fresh fish.	X		
	7. To prepare a detailed action plan, with budgetary and regulatory provisions and time frame to serve as a blue print for the implementation of the COP – "Handling and Preservation of fresh Fish" as a food safety and quality standard.	X		
	8. To launch a pilot project on the voluntarily Compliance to the COP – Handling and Preservation of Fresh Fish in a selected FLS or MdP to serve as a model in the crusade for the improvement of safety and quality of fresh fish on the island.	X		
FISH MARKET INTEGRATED TO TOURISM INDUSTRY				
	9. Preparation of a Pre-feasibility study and business plan for the development of a new concept of integrated Fish Terminal at "Maison des Pêcheurs" of MFFC at Mahebourg Waterfront as pilot project that can be replicated to other strategic sites.	X		

[10] *It is indicated by the FD that there is a commitment on the IFAD to fund the STE for the implementation a comprehensive coastal fisheries management programme. These actions will be undertaken planning process would start within the framework of the new Fisher Master Plan.*

[11] *The COP – Handling and preservation of fresh fish was implemented the IFAD and the continued supports of this international organisation for the enhancement of the value chain of the coastal fisheries are assured.*

BIO-ECONOMIC APPROACH TO MANAGEMENT[12]				
	10. Development and use of an appropriate bio-economic model / software as a management tool.	X		
	11. Creation of an Economic Observatory headed by a fisheries economist at FD to deal with all socio-economic issues related to fisheries sector including artisanal fisheries.	X		
LOCAL GOVERNANCE IN FISHERIES MANAGEMENT				
	12. A pilot-project for empower LFC in local governance and participatory management of decision making at local level and shared responsibility in management of FLS.	X		
IMPROVED COMMUNICATION				
	13. Publication of a reader-friendly newsletter to disseminate fisheries, socio-economic, technological, safety and quality, entrepreneurship, innovations and marketing information to fisher communities and the citizens at large.		X	

[12] *An audit has been carried on the organisational and functional structure of the AFRC the IFRS-ESA (IOC/EU) recently and the mission has recommended appointment of an Economist at the MOFR which can be a first step towards the creation of an Economic Unit / Observatory*

APPENDIX

Appendix 1: Terms of Reference

Objectives of TOR	Works done and incorporated in the study report
1. Convene stakeholders meetings in selected areas to identify the current problems with marketing within this fishery and fully understand the main constraints / opportunities for fishers in handling, processing and marketing of fish nationally and for export.	A primary survey was carried on the fishers, fishmongers and service providers in the artisanal fisheries with the collaboration of the Fisheries Officers. The constraints & opportunities in the production functions and marketing channels are identified.
	FGD were organised with Fishers and Fishmongers at Grand Gaube, Trou d'Eau Douce, Mahebourg and Case Noyale to have a deeper understanding of issues related to handling, processing and marketing structures.
3. Investigate /define the structure of the distribution chain for the sub-sector from catch to markets, using 2 or 3 examples in the country.	An in-depth study was done on the supply chain from catch to market and 10 case studies were been prepared.
4. Investigate prices for fish products throughout the distribution channels and review costs / margins associated with the process to reach markets.	Prices were studied at different levels of the marketing channels namely, primary sale price and whole sale price at FLS as well as retail sale prices at different fish markets.
5. ollect information on domestic / export markets, and compile information on individuals / groups involved in fish trade, products processed, and successes, failures.	Information on major stakeholders in the artisanal fisheries has been compiled.
6. Collect information on processed fish products and assess possibilities for improved processing techniques in securing / sustaining current and future markets nationally / and for export.	A survey has been done and recommendations made to this effect.
7. Assess value-addition opportunities for the artisanal fisheries in Mauritius, with a view to improving the sustainability of the sector for the future.	Processing and value addition opportunities in the artisanal fisheries were assessed and recommendations made accordingly.
8. Outline a simple business model(s) (capital costs / revenue/ operating costs / margins) that represent(s) the key processing activities in the fishery required to sustain and improve trade.	Business models and case studies have been prepared for major, fishing and marketing components in the artisanal fisheries.
9. Review required personal investment in the fishery for market entry, as well as to secure current / future markets national / and for export and assess the requirements for investment in this fishery including access to funds and financing opportunities (e.g. micro-credit) for such personal investment.	Capital investment required in the personal fishing and marketing enterprises as well as the local sources of finance were investigated Extension services provided in the sub-sector were scrutinized.
10. Take the view that existing infrastructure should be used as much as possible to define short term recommendations from the assessment, however identify other infrastructure requirements to support the industry and provide an estimate of capital costs – such as landing sites and other logistical infrastructure (ice, drying facilities, storage, transportation, wholesale markets, etc.) that would improve the performance of the sub-sector.	Major coastal fisheries infrastructure were assessed in view to optimize their use. A new concept of Fish Terminal was proposed to create positive synergies between the artisanal and tourism sector by use of an under-utilized fisheries complex.
11. Assess and analyse situation with regards to community structure in relation to sustainable marketing of quality fisheries products performance.	Ways and means were discussed to empower the local fisher communities in participatory management and local governance.

12. Investigate underlying reasons for non performance of the artisanal fishery to perform in such an unbalanced market.	An economic assessment of the artisanal fisheries was carried out and recommendations made to enhance their efficiencies at all levels.
13. Towards the end of the study period, prepare and present the key findings of the study to stakeholders (fishers, processors, exporters, transporters, investors, public section at a feedback workshop (2 + days envisaged). Where necessary invite participants form regional countries to share their experiences in the artisanal sector.	A draft study report containing the findings and recommendations has been submitted. A workshop at the national level will be organized shortly to present the findings and recommendations to the main private and institutional stakeholders.
14. Produce a final report from the workshop upon receiving stakeholders' comments.	To be done accordingly.

Appendix 2: Commercial Category of Fish Harvested by the Artisanal Fisheries

Category	Mauritian Name	Scientific Name	English Name
	Homard	*Panulirus* sp.	Lobster
	Crabe	*Scylla* sp.	Crab
	Crevette	*Penaeus monodon*	Shrimp
Category I	Vieille Rouge	*Epinephelus fasciatus*	Blacktip grouper
	Geule Pavee	*Rhabdosargus sarba*	Seabream
	Croissant queue jaune	*Variola louti*	Yellow-edged lyretail
	Croissant queue blanc	*Variola albimarginata*	White-edged lyretail
	Vacoas	*Aprion virescens*	Green jobfish
	Sacrechien blanc	*Pristipomoides filamentosus*	Blue spottted jobfish
	Sacrechien rouge	*Etelis cabunculus*	Ruby snapper
Category 2	Capitaine	*Lethrinus nebolus*	Apangled emperor
	Vivaneau	*Pristipomoides zonatus*	Obique blanded grouper
	Mourgate	*Loligos* sp.	Squid
	Vieille la boue	*Epinephelus morrhua*	Obique blanded grouper
	Vieille maman rouge	*Cephalopholis sonerati*	Hind
	Dame berri	*Lethrinus mahesena*	Sky emperor
	Battardet	*Lethrinus harak*	Thumprint emperor
	Barrois	*Lethrinus elongatus*	
	Vieille voleuse	*Epinephelus merra*	Snubnose grouper
Category 3	Caya	*Lethrinus rubrioperculatus*	Spotcheck emperor
	Ourite	*Octopus vulgaris*	Octopus
	Carangue	*Carans* sp.	Coastal trevally
Category 4	Cordonnier	*Sigamus sutor*	Shoenaker spinefoot
	Becure	*Acanthocybium solandri*	Wahoo
	Thon blanc	*Thunnus alalunga*	Dogtooth tuna
	Thon jaune	*Thunnus albacore*	Yellow fin tuna
	Breton	*Gerres oyena*	Longtail silver biddy
	Dorade	*Coryphaena hippurus*	Dolphin fish
	Bardet	*Polynemus plebejus*	Treadfin
	Rouget	*Parupeneus* sp.	Goatfish
	Empereur	*Istiphorus gladius*	Sailfish
	Marlin	*Mokaira mazara*	Blue marlin
Category 5	Mulet voile	*Mugil cephalus*	Flathead mullet
	Boordemar	*Lutjanus sanguinus*	Blacktail snapper
Category 6	Licorne	*Naso unicornis*	Unicornfish
	Cateau bleu	*Scarruc ghoban*	Parrot fish

	Cateau vert	*Scarrus sordichus*	Parrot fish
	Vieille grise	*Ephinephelus merra*	Honey comb grouper
	Mulet sec	*Valanugil seheli*	Blue spot mullet
	Madame tombee	*Cheilinus trilobatus*	Wrasse
	Thazar	*Sphyaena obtusata*	Barracuda
	Bonite	*Euthynnus affinis*	Skipjack tuna
	Lion	*Myripristis chryseres*	Soldier fish
Misc. fish	Aiguille	*Ablennus hians*	Needle fish
	Sap-sap	*Leiognathus fasciatus*	Pony fish
	Lubine	*Elops* sp.	Tenpounder
	Carandine	*Gnathodentex oureolineatus*	Stripped large eye bream
	Chirrurgien	*Acanthurus* sp.	Blue line surgeon fish
	Pavillon	*Chaetodon* sp.	Butterfly fish
	Bourse		Trigger fish
	Requin		Shark

Appendix 3: Fishing Business Model

Items	Variable	Notes / Data sources
SALES		
Mean catch per fishing day	A	Intra-annual mean incl. lean & peak seasons
Mean Price	B	Weighted average mean PSP & fish species
Number of Fishing days per year	C	(Interviews & Secondary Surveys)
TOTAL ANNUAL REVENUE	D	**(a x b x c)**
FIXED COSTS		
Depreciation (fishing boat + Engine)	E	Actual Cost: F/boat , Engines & other Assets
Interest payable on loans / advances	F	If any
Boat & Engine repairs & maintenance	G	(Interviews and Secondary surveys)
Other fixed cost	H	Contingent costs such as Insurance
TOTAL FIXED COSTS	I	**(e + f + g + h)**
VARIABLE COSTS (excl. labour)		
Fishing gear repair / replacement	J	(Interviews & Secondary Surveys)
Fuel and Lubricants	K	-same as above -
Ice	L	-same as above -
Baits	M	-same as above -
Food & Provisions	N	Not applicable
Marketing Costs & others	O	Contingent costs / transport, communications...
TOTAL FISHING TRIPS COST	P	**(j + k + l + m + n + o)**
LABOUR COSTS		
Shared Costs OR	Q	(D – Q) / No of fishers
Crew Salary	Q^{l}	(Agreed price x qty (Kg)
ANNUAL PROFIT	R	**D – (I + P + Q or Q^{l})**

Explanatory Notes

i) Total annual revenue (D) is presented in terms of CPFD (a), mean PSP (b) and number fishing days(c). These variables were determined by the fisheries statistics of the MOFR and complemented / cross checked by primary survey. Regional as wells as seasonal variations of landings and prices were taken into account.

ii) Fixed costs (I) are those costs that are incurred regularly, regardless of the fishing activities, i.e.:

- Depreciation of fishing boat and engines and other assets (e)
- Interest on loans & advances (f)
- Fishing boat & Engine repairs and maintenance (g)
- Other such costs incl. Insurance (h)

iii) Variable costs (Q) are costs that are related, directly or indirectly, to fishing activities, i.e.:

- Fishing gear repair and replacement (j)
- Fish trips costs incl. all direct costs of production and sale:
  - Fuel and lubricant (k)
  - Ice flake (l)
  - Bait (m)
  - Food and provisions (n)
  - Marketing costs and others when appropriate (o)

Unit prices of inputs such as fuel, ice and so on are fairly standard in the country. Fuel consumption was learnt through the survey and was cross-checked by one-to-one interviews

iv) Labour cost (Q or Q^1) was structured in different ways according to the system in use by the fishing unit. The most common arrangements in Mauritius are:
- Share system in which the boat owner and the crew take equal shares of the catch value after deduction trip costs (Q)
- Payment of contracted price per kg for different grades of fish (Q^1)

v) Annual profit of the fishing unit (R) is the gross revenue (d) , less all fixed costs, except depreciation (I), all variable costs (P) and labour costs (Q or Q^1)
A fishing day usually starts at about 6 am to end at 1 pm and thus most lagoon and off-lagoon fishers spend 6 to 8 hours at sea.

vi) Fishing Trips: On an annual basis, a fishing boat undertakes 4 to 5 trips per week during the summer and 2 to 3 trips per week during winter that make 189 fishing days per year. The main cause of interruption of fishing activities is severe climatic conditions during winter and tropical depressions in summer.

The number of crews/fishers on a fishing boat depends on the fishery i.e. a basket and trap fishing boat will normally carry 2 fishers while it varies from 3 to 5 fishers for the hand line fishery. For the large net fishery, one fishing unit comprises 3 to 5 boats with a crew of 3 on each of them. For the purpose of the business model of fishing unit of the Large Net fishery consists of 3 boats and 10 fishers.

The most important value derived from the business model is the net daily income per fishing day and per calendar day that help to appraise the economic viability of the fishing activity.

Appendix 4: Consolidated Data – Reg. Fishers / Fishing Boats / Fishmongers

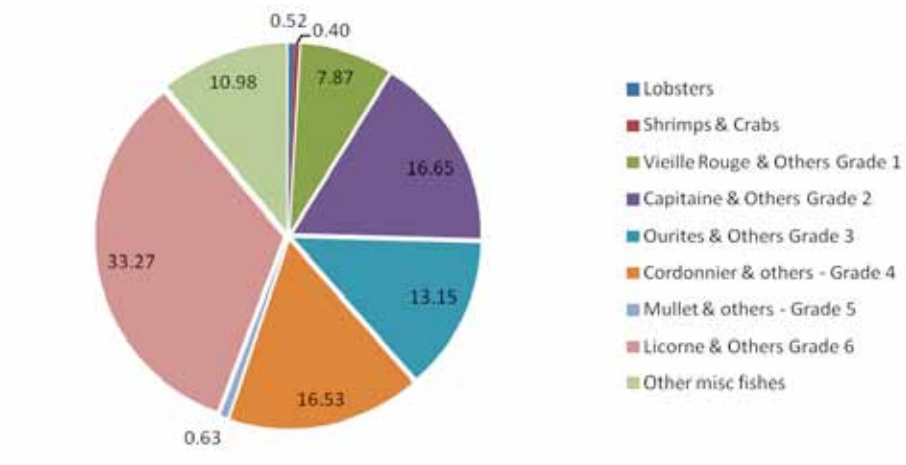
	2009	Reg F'men / gears					Registered	Registered
S/No.	**Fish Post**	**LN**	**BT**	**H L**	**BT/ HL/H**	**Total**	**Fishmongers**	**Fishing Boats**
1	Port Louis	0	1	49	65	115	221	214
2	Tombeau Bay	0	12	59	79	150	72	169
3	Trou aux Biches	4	1	86	101	192	68	217
4	Grand Gaube	28	16	61	190	295	82	287
5	Poudre d'Or	0	12	1	133	146	50	171
6	Poste La Fayette	16	5	0	73	94	34	110
7	Trou d'Eau Douce	18	10	31	63	122	26	131
8	GRSE	0	1	4	91	96	26	153
9	Bambou Virieux	0	15	18	178	211	30	202
10	Mahébourg	30	16	42	249	337	144	376
11	Riambel	6	3	4	77	90	33	31
12	Baie du cap	3	7	20	59	89	30	83
13	Case Noyale	10	2	5	114	131	43	152
14	La Preneuse	18	2	49	77	146	60	140
15	Point aux Sables	16	3	37	33	89	42	89
	Total	**149**	**106**	**466**	**1582**	**2303**	**961***	**2525**

NOTE: Only about 400 are active in the artisanal fisheries.

Appendix 5: Catch Composition of the Artisanal Fisheries - Year 2010

Commercial Species				**%**		**kg**
Lobsters				0.52		4326
Shrimps & Crabs				0.40		3334
Vieille Rouge & Others Grade 1				7.87		65450
Capitaine & Others Grade 2				16.65		138420
Ourites & Others Grade 3				13.15		109320
Cordonnier & others - Grade 4				16.53		137447
Mullet & others - Grade 5				0.63		5211
Licorne & Others Grade 6				33.27		276584
Other misc fishes				10.98		91283
Total				100.00		831375

Figure 5: Catch Composition / Commercial species - 2010



Appendix 6: Questionnaire 2 - Distribution and Marketing Channels

Value Chain Assessment

Artisanal fisheries in Mauritius July / August 2010

Fish Post ☐ Fish Landing Station ☐

1. How do you get your fish supply ? No days / week : ☐ Summer
No days / week : ☐ Winter

2. How many fish suppliers (fishers) do you work with ? ☐
HL / BT

3. What qty (lb) is supplies by each fisher (average) ? ☐ Summer
☐ Winter

Specify

H L	BT	L N

4. Commercial species	Qty /Kg Peak	Low
4.1		
4.2		
4.3		
4.4		
4.5		
Total		

5. Terms of payment for supplies : COD Others / Specify:

6. Do you use ice ? If no why ?

7. Where do you sell your fish :

To consumers		
To Retailers		Specify
Both		

Lowest SP Highest SP Rs / kg

Direct Sale to Consumer	Peak Supply		Low Supply	
Commercial Species	Low	High	Low	High
(Species)				
Sale to Retailers				
(Species)				

Questionnaire 2 - Distribution and Marketing Channels (cont'd)

10 Personal Investment:

10.1 Transportation	M / Cycle	Van	Car	others
Investment Rs.				

10.2 Other eqts	Ice box	Baskets	others
	Freezers	C/ room	
10.3 Total Investments:			

11 How long have been fishmonger :……

12 Is it your only employment ? ……... If not , other activities :……

13.What are the challenges / contraints in marketing……

General remarks and comments:

Appendix 7: Questionnaire 2 – Fishing Enterprise

Artisanal fisheries in Mauritius

Part I : Fishing Equipment Information

Fish Post :…….. Date: ……

Type of F/ Boat	Wooden	Fibreglass
Length	(metre)	…….
Cost of Boat	Rs	…….
Date & Place of Construction		…….
Outboard Engine	HP: ……	
Date & Place of Purchase:……/……...		…….
Cost of Outboard Engine	Rs. …….	
Total Cost and Source of funds :	……/……	

Types of fishing gears used :……..

Date & Place of purchase : …… /……..

Cost of fishing gears : Rs…….

Total Cost and Source of funds …….

No. of crews on board: ……

Remuneration system : Share : Boat Owner …….. / Master Fisher ……. / Crew …...

Alternate system:

Other / General info:

Value Chain Assessment

Artisanal fisheries in Mauritius

Questionnaire 2 : Fishing Unit Owner

Part 2 : Daily Catch information

Fishing Techniques / strategies :	HL	BT	LN	HL/HPN

Fishing Zone : LAG:…….. OFF-LAG ……

Time Out ……. Time In:..... Fishing Time:…….

Expenses :				Rs.
Fuel (incl. Oil)	……	Litres	Cost	……..
Food	…..		Cost	……
Ice	…..	kg	Cost	……
Water	….	Litres	Cost	……
Repair & Maintenance				
Spare-parts / Repairs			Cost	……
Ropes			Cost	……..
Other consumables:			Cost	…….

Income	(targeted species)	Wt/ Kg	Value/ Rs
Fish / Common species	…	.....	
	…	.....	
	…	.....	
	…	.....	
	…	.....	
	…	.....	

Daily Average Income / (Winter) .....

Catch kept for autoconsumption .....

Other source of revenue Amount .....

Value Chain Assessment

Artisanal Fisheries in Mauritius

Questionnaire 2: Fishing Unit Owner (Cont..)

Part 3: Sales & Marketing Strategies

Are you involved in fish processing / distribution / marketing?

How do you determine the sale price of your catch?

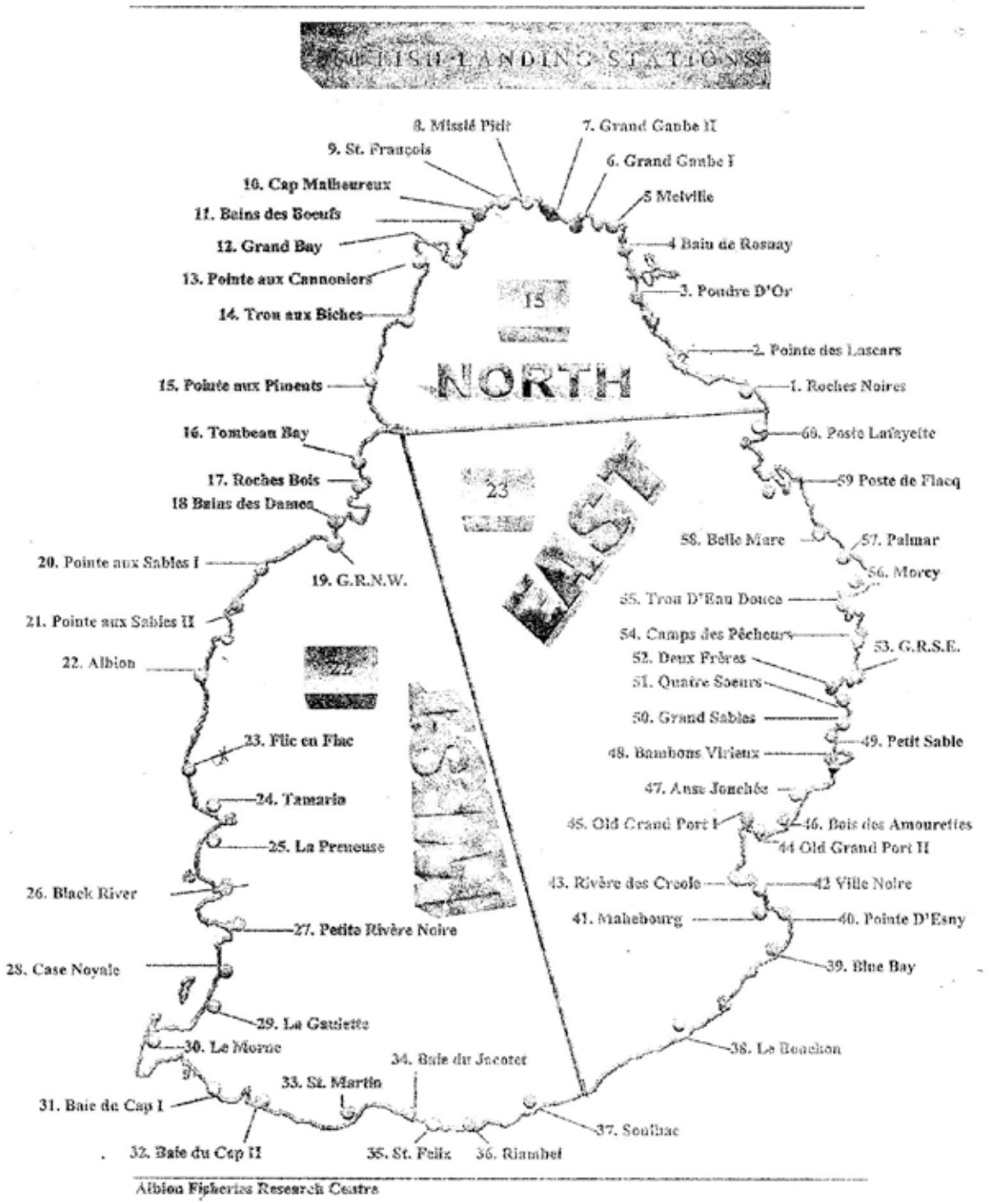
Do you have any commitment or contract with a fish trader or fishmonger?

What are the main problems you encounter in marketing of your catch?

Are you a member of a Fishermen Association / Cooperative Society…?

How can you improve your income in fishing activities?

Appendix 8: Fish Landing Stations (FLS) Around Mauritius



Appendix 9: List of Persons Met

1.	Mr. Anil Manick / Pointe aux Canoniers	HL Fisher / Fishmonger
2.	Mr. Kreshan Beerbul / Grand Bay	HL Fisher / Fishmonger
3.	Mr. Ritesh Gurburry / Cap Malheureux	HL Boat Owner + Fishmonger
4.	Mr. Devanand Vijaynath / Albion	Fisher / Owner of 2 fishing boats
5.	Mr. Domique Romance / Poudre d'Or	BT Fisher + Boat Owner
6.	Mr. La Douceur / Pointe D'Esny	BT + HL Fisher + Boats Owner
7.	Mr. George Fannard / Poste Lafayette	BT Fisher + Boat Owner
8.	Mr. France Basi / Poste de Flacq	Poste de Flacq
9.	Mr. Thomas Baya / Mare La Chaux	Fishmonger / Retailer
10.	Mr. J Claude Victor / Mare La Chaux	Fishmonger
11.	Mr. Sok Appadu / Baie du Cap	Fisheries Enumerator
12.	Mr. Mohabeer / Petit Sable Fisheries	Enumerator
13.	Mr. P Batiste / Poste La Fayette	Fishmonger
14.	Mr. Ramkisson / Le Bouchon	Fisheries Enumerator
15.	Mr. Freddy Mootin / Cap Malheureux	Net Fisher
16.	Mr. Clency Christophe / Grand Gaube	BT Fisher
17.	Mr. Pyaré/ Rivière du Rempart	Fishmonger / Wholesaler & Retailer
18.	Mr. Flério Marie / Grand Gaube	Net Fisher
19.	Jean Pierre / Grand Gaube	Fishmonger / Wholesaler & Retailer
20.	Mr. Gyandeo Panchoo / Cap Malheureux	Net Fisher + Fishmonger
21.	Mr. RambarrunAnand / Poudre d'Or	BT / HL Fisher
22.	Mr. Bachun Anirood / Pereybère	BT / HL Fisher
23.	Mr . Gunee Govinden / Cap Malheureux	BT / HL Fisher
24.	Mr. Begué Eddy / Cap Malheureux	BT / HL Fisher
25.	Mr. Armoogun Goindasamy / Mahebourg	BT / HL Fisher + Boat owner
26	Mr. Armoogum Shivram / Mahebourg	BT / HL Fisher + Boat Owner
27.	Mr. Baichun Vidyanand / GRSE	BT / HL Fisher
28.	Mr. Francoeur Jacque / Poste de Flacq	L N Fisher
29.	Mr. Thome M Louis / Poste de Flacq	L N Fisher
30.	Mr. Ramdeen Jahising / Grand Bay	HL Fisher + Fishmonger
31.	Mr. Chummun Anil / Grand Bay	HL Fisher
32.	Mr. Adeline J Sylvain / T. D. Douce	HL / BT Fisher
33.	J R Dardenne / T. D. Douce	BT / HL + Boat Owner
34.	Mr. P Marie Louise / P. A. Sables	BT / HL Fisher
35.	Mr Jahan Ganeshan / P. A. Sables	HL Fisher
36.	Mr. Thomson J Louis / Roche Bois	HL Fisher
37.	Mr Lindsay J L / Roche Bois	HL Fisher
38.	Mr. Enflé J Pierre / Tamarin	BT / HL Fisher
39.	Mr. Y Mamodally / Triolet	Road side fish Vendor
40.	Mr. Gungabisson Rajkumar / Mahebourg	Fishmonger / Retailer
41.	Mr. Noorani Basarti / New Groves	Fishmonger / Retailer
42.	Mr. Keetaruth / Quatre Bornes	Fishmonger / Retailer
43.	Mr. Ramkisson Mahendranath / Petit Sable	Ambulant Fish Vendor
44.	Mr. Mungur Naidoo / Centre de Flacq	Institutional Fish Market
45.	Mr. Jhurry Kirran / Quatre Bornes	Institutional Fish Market
46.	Mr. Soiobratty Zahoor / Q Bornes	Institutional Fish Market
47.	Mt. Curpen Janaden / Rose-Hill	Instituttional Fish Market
48.	Mr. Hossenee Arshad / Rose-Hill	Institutional Fish Market
49.	Mr. Janashal Fazal / Rose-Hill	Fishmonger
50.	Mrs Francoise / Super U of Grand bay	Saleswoman / Fish stall

Appendix 10: References

- Annual Report 2008, 2009, 2010, Fisheries Division, Mauritius.
- Study on Fish Handling, Preservation and Marketing in Mauritius & Rodrigues, Appavoo & Associates, 2007.
- Fish Handling, Processing and Marketing in Mauritius, FAO Project, 2005.
- A handbook for Value Chain Research prepared for IDRC by Raphael Kapkinsky et al., 2000.
- Enquête socio-économique sur la pêche artisanale de Maurice, Project Thonier Régional II, COI / UE, 1995.
- Value Chain Analysis, M E Porter, Oxford Press Ltd. London, UK, 1980.

List of Publications

SmartFish Programme

1. *Report of the Inception / Focal Point Meeting of the SmartFish Programme – Flic en Flac, Mauritius, 15th-16th June 2011*. REPORT/RAPPORT: SF/2011/01. August/Août 2011. SmartFish Programme. Indian Ocean Commission (55 pages).

2. *Report of the First Steering Committee Meeting of the SmartFish Programme – Flic en Flac, Mauritius, 17th June 2011*. REPORT/RAPPORT: SF/2011/02. August/Août 2011. SmartFish Programme Indian Ocean Commission (51 pages).

3. *Rapport de la réunion de présentation du programme SmartFish aux points focaux – Flic en Flac, Ile Maurice, 15-16 juin 2011*. REPORT/RAPPORT: SF/2011/03. August/Août 2011. SmartFish Programme. Indian Ocean Commission (55 pages).

4. *Eco-Certification for the Tuna Industry, Technical Assistance for Implementation of a Regional Fisheries Strategy for ESA-IO (IRFS)*. REPORT/RAPPORT: SF/2011/04. May 2011. SmartFish Programme. Indian Ocean Commission (40 pages).

5. *Regional Market Assessment (Supply and Demand)*. REPORT/RAPPORT: SF/2012/05. March/Mars 2012. SmartFish Programme. Indian Ocean Commission (264 pages).

6. *Trade Assessment Study*. REPORT/RAPPORT: SF/2012/06. March/Mars 2012. SmartFish Programme. Indian Ocean Commission (120 pages).

7. *Gouvernance des Pêches Maritimes dans l'Ouest de l'Océan Indien*. REPORT/RAPPORT: SF/2012/07. June/Juin 2012. SmartFish Programme. Indian Ocean Commission (101 pages).

8. *Value Chain Assessment of the Artisanal Fisheries – Mauriti*us. REPORT/RAPPORT: SF/2012/08. June/Juin 2012. SmartFish Programme. Indian Ocean Commission (82 pages).

La bonne gouvernance et de la gestion des pêches et de l'aquaculture permettent d'améliorer la contribution du secteur à la sécurité alimentaire, au développement social, à la croissance économique et au commerce régional ; ceci en assurant par ailleurs une protection renforcée des ressources halieutiques et de leurs écosystèmes.

La Commission de l'Océan Indien (COI) ainsi que la COMESA (Common Market for Eastern and Southern Africa), l'EAC (East African Community) et l'IGAD (Inter-Governmental Authority on Development) ont développé des stratégies à cette fin et se sont engagés à promouvoir la pêche et l'aquaculture responsable.

SmartFish supporte la mise en œuvre de ces stratégies régionales en mettant l'accent sur le renforcement des capacités et des interventions connexes visant à :

- mettre en place des mécanismes pour la gestion et le développement durable des pêches ;
- développer un cadre de gouvernance des pêches au niveau régional ;
- renforcer le suivi-contrôle-surveillance pour les pêcheries partagées ;
- développer des stratégies et supporter des initiatives propres à accroître le commerce régional du poisson ;
- contribuer à la sécurité alimentaire en particulier par la réduction des pertes après captures et la diversification de la production.

SmartFish est financé par l'Union Européenne dans le cadre du 10ème Fond Européen de Développement.

SmartFish est mis en œuvre par la COI en partenariat avec la COMESA, l'EAC et l'IGAD et en collaboration avec la SADC. Une collaboration étroite a également été développée avec les organisations régionales de pêche de la région. L'assistance technique est fournie par la FAO et le consortium Agrotec SpA.

By improving the governance and management of our fisheries and aquaculture development, we can also improve food security, social benefits, regional trade and increase economic growth, while also ensuring that we protect our fisheries resources and their ecosystems.

The Indian Ocean Commission (IOC), the Common Market for Eastern and Southern Africa (COMESA), the East African Community (EAC) and the Inter-Governmental Authority on Development (IGAD) have developed strategies to that effect and committed to regional approaches to the promotion of responsible fisheries and aquaculture.

SmartFish is supporting the implementation of these regional fisheries strategies, through capacity building and related interventions aimed specifically at:

- implementing sustainable regional fisheries management and development;
- initiating a governance framework for sustainable regional fisheries;
- developing effective monitoring, control and surveillance for transboundary fisheries resources;
- developing regional trade strategies and implementing regional trade initiatives;
- contributing to food security through the reduction of post harvest losses and diversification.

SmartFish is financed by the European Union under the 10th European Development Fund.

SmartFish is implemented by the IOC in partnership with the COMESA, EAC, and IGAD and in collaboration with SADC. An effective collaboration with all relevant regional fisheries organisations has also been established. Technical support is provided by Food and Agriculture Organization (FAO) and the Agrotec SpA consortium.

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