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## IS MARINE FISH FARMING A WAY FOR ECONOMIC DEVELOPMENT IN THE FRENCH OVERSEAS TERRITORIES ?

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### ABSTRACT

Following the introduction of the red drum *Sciaenops ocellatus* in the early 80\_s in the Caribbean island La Martinique, farming techniques were set up and a small scale farming sector developed. The introduction of that fish species in Indian Ocean islands, la Réunion and Mayotte, allowed to start fish farming with various scales, from small size to semi-industrial scale. Through an analysis of the available information related to natural and socio-economic conditions, technical and economical results, domestic and export markets, organization of the sector, the possible development of fish farming in these three French overseas territories is questioned. A SWOT analysis is proposed and allows to precise the situation, strategies and needs of economic information for further development in the three zones. One critical issue concerns the marketing of red drum to both local and international markets. The role played by such an aquaculture industry is questioned in relation to different stakes: local development, food security, environmental concerns, context of international trade. The limits in present knowledge and experiences are pointed and recommendations proposed for future studies.

**Keywords:** red-drum, fish farming, overseas territories, development

### INTRODUCTION

This paper focuses marine fish farming in the three islands and French overseas territories: La Martinique (Caribbeans), Mayotte and La Réunion (Indian Ocean). Following the introduction of the red drum *Sciaenops ocellatus* in the early 80\_s in La Martinique, farming techniques were set up and a small scale farming sector developed. The introduction of that species in la Réunion and Mayotte, allowed to start fish farming with various scales, from small size to semi-industrial scale. In a first phase, the development has been focusing mainly the technical aspects, as it was driven by biologists from IFREMER<sup>1</sup> in la Martinique, and extension centres in the two other islands. Then some studies about economic questions with various objectives and methodologies were performed independently in the three zones. In 2004 a programme was defined in common by the partners in the three zones. Gathering research and development bodies, professional stakeholders and local public administration, it allowed to facilitate information exchanges and common definition of research needs for future development.

As for the socio-economic aspects, a research programme (2005-07), funded by the French Ministry of Overseas Territories and performed by IFREMER and INA PG<sup>2</sup>, was set up. It concerned two axis:

- what is the state of economic knowledge for marine fish farming sector in the three territories, and the needs for further economic studies ? This is the subject for the present communication.
- what are the opportunities for exporting red drum to the European market ? which results are presented in a communication by Girard and Mariojouis in the present conference,

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<sup>1</sup> IFREMER : French Institute for the Exploitation of the Sea

<sup>2</sup> INA PG merged in 2007 with 2 other Graduate Schools to become AgroParisTech

This part of the work, published in a report (Mariojouis & Fischer 2007b), aimed at gathering the available economic data about fish farming sector (production cost) and economic environment (general data, supply chain, markets), through a synthesis of the 22 reports and studies published between 1996 and 2006. This work allowed to identify the missing data for managing the development of fish farming sector and elaborate a strategy. It was completed by a more in-depth study in Martinique where a small inquiry in farms allowed to collect fresh information for an estimation of production cost.

Beyond the results of that programme, in the present paper we propose a SWOT analysis regarding to the situation of each island the possible strategies for development and needs for economic studies. Finally we take the opportunity of this work to draw a few elements about the question of aquaculture development as a tool for local development, in the case of remote islands.

## **BRIEF PRESENTATION OF THE ZONES AND PRESENT DEVELOPMENT**

La Martinique Island, located in the Caribbeans, has a double coast, with sheltered bays on eastern side “under the wind”, and is periodically hit by tropical storms which can be a threat for marine activities. The red drum was introduced in Martinique in the 80’s by Ifremer which set up the farming techniques for reproduction and on-growing in coastal floating cages. Today the marine fish farming sector includes one private hatchery and 10 small scale farms, producing 60 T for local market with mainly direct sales from farmer to consumer. The development has been supported by public subsidies for investments and running costs (fry and feed).

Mayotte Island, located in the Indian Ocean, is part of the Comorian Archipelago. A wide lagoon provides sheltered sites for aquaculture development. The red drum was introduced in 1998 for tests and showed a very good growth in floating cages on-growing . Today, the marine fish farming sector includes one nursery (larvae provided by La Reunion hatchery) and a hatchery under construction, run by the extension centre AQUAMAY, three very-small scale farms (3 T in 2005) supported by AQUAMAY, and one semi-industrial farm Mayotte Aquaculture (Cannes Aquaculture Group), with a production of 160 T. The aquaculture sector benefits from public subsidies for investments and running costs (fry and feed).

La Réunion is a volcanic island of the Indian Ocean, with rough coast frequently hit by typhoons. The St Paul Bay has been found to be the most sheltered from main winds, but nevertheless an off-shore technology, with relatively high investments costs, is needed for the floating cages. The red drum was introduced in 1999 by ARDA, extension centre in aquaculture (freshwater and marine). The marine fish farming sector includes today a hatchery-nursery run by ARDA, one average-scale farm Aquamarine de Bourbon (50 T), and there is a project of cooperative farm by fishermen.

## **THE SOCIO-ECONOMIC ENVIRONMENT**

The socio-economic environment can be briefly characterized through selected indicators (Table 1). The three islands are densely populated and the population is strongly growing in La Réunion and Mayotte. The unemployment rates are high, and show the need for creating economic activity.

Tourism is very developed in La Martinique and La Réunion versus at early stage in Mayotte, which beautiful natural environment offers great opportunity. While La Martinique and La Reunion show a GDP per capita that compares with the one in France mainland, Mayotte has a less developed economy, despite a more favoured situation than the other islands of Comorian archipelago (average GDP 431 €/capita) belonging to the groups of LIFDC. A lower life standard in Mayotte compared to La Réunion and La Martinique is also visible in the level of minimum wages, half in Mayotte compared with the other islands or France mainland.

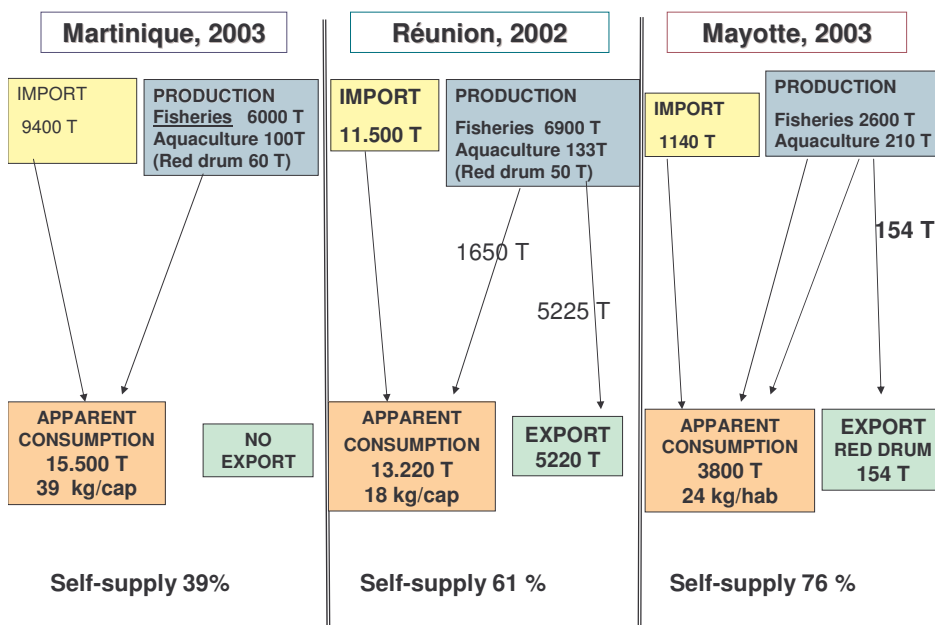
	La Martinique	La Réunion	Mayotte	France mainland
Population	400 000	775 000	176 000	
Population Growth rate / year	0,75 %	1,61 %	3,6 %	0,58 %
Population density (hab/km2)	350	310	470	110
Touristic population	640 000	410 000	39 000	
GDP (€ / capita)	16 500	13 900	4 000*	26 000
Unemployment rate	23 %	32 %	25 %	9 %
Minimum wages (€/hour) – incl. social contributions	8,03	8,03	3,83	8,03

\*First calculation in 2001

**Table 1 :Data about the socio-economic environment in 2003 , after INSEE & ODEADUM**

**THE AVAILABLE DATA ABOUT AQUATIC PRODUCTS SUPPLY CHAIN**

The analysis of available data issued from several sources presents difficulties, because of missing data or inadequacy between sources. We present the most coherent image that can be given (for year 2002 or 2003), and the calculated apparent consumption. It does not take into account the consumption of tourists population, besides its importance in Martinique and La Reunion. In all zones the market relies for a quite important part on imports, especially in Martinique, with a self-supply ratio as low as 39%.



**Figure 1: Representation of the supply chain organization and markets**

In La Martinique the structure of the fisheries supply chain is still incompletely known. There are important data missing. While the small scale fisheries is the main production sector, their landings are not continuously surveyed and are estimated at 6000 T using a figure issued from the last survey done in 1993. This makes the calculation of apparent consumption questionable. The market outlets for fresh fish still rely in good part on traditional direct sales on the beach, hardly surveyed.

While the structure of the fish supply chain has been described with the available data, no market study focusing the fish market, nor the specific market for red drum, has been performed. It is an important lack in this island where red drum farming has the longest history, and it does not allow the fish farmers to set up a commercial strategy in a highly competing market characterized by an important demand and a high competition with imports at low prices.

In Mayotte the overall structure of fish supply chain is known, but fisheries landings data are somewhat difficult to measure as self-consumption is important, and the official data for export do not include informal export to neighbouring islands. Thus there is uncertainty on apparent consumption. The local fish market was studied in 2001 and 2004, showing that there are two groups of consumers with different preferences and willingness to pay: native people, and people from France mainland. The studies about possible outlets for red-drum brought the following information :

- the fresh open market of Mamoudzou is characterized by low prices and only low grade red drum is sometimes sold there,
- collective restaurants (hospitals, army) in Mayotte have begun to become interesting outlets for red drum,
- a market study for exporting red drum to France has been done in 2002, opening good perspectives for the appreciation of the product. The production of the semi-industrial farm is mainly exported, but development has been slowed down by the interruption of direct airline to Paris.

La Réunion benefits from the best knowledge regarding to the market, as recent studies have been done. The organisation of the supply chain is correctly described, but could be improved by updating statistical data for all flux at the same time. The study of local market showed that the possible market for red drum would not exceed 80 T, corresponding to the capacity of the existing farm. Future development would then rely on the ability to export, which have not been the focus of a dedicated study.

## **THE AVAILABLE DATA ABOUT PRODUCTION COSTS AND MARKETING COSTS**

Table 2 gathers the main available data for production costs in the different regions. It must be underlined that the methodologies used for the studies vary, and make somewhat difficult the comparison of the results. We also give as reference the market prices made available from several sources.

Looking at the data concerning the three zones, one notices that the cost of inputs for red drum farming

- for feed, is the same and at a high level (1 €/kg) as it relies on imports; no factory existing in the zones,
- for fry, is quite different, La Martinique showing the highest fry price; technical improvements in the hatcheries are allowing a decrease and cheaper prices are expected.

On existing small scale farms, two surveys have been performed for Mayotte in 2004 (a), and for La Martinique in 2005 (e), but unfortunately on a very small number of farms which set limits to the interpretation. They showed a very variable FCR explaining the high values reached by the production costs in some cases: 4.7 €/kg in Mayotte (excluding farmer's income), from 5.6 to 9.7 €/kg in Martinique. These results also show large variations in farming efficiency and need for technical improvement.

The simulations for the same type of farm, based on hypothesis for FCR reachable with a better management, give an estimation of a possible production cost. Mayotte shows a much lower production cost (3.04 €/kg, excluding farmer's income) than in Martinique (7.05 €/kg) , because of a lower cost of staff and a better FCR.

Giving the selling prices, the profitability of the small-scale farming is possible only with sales to outlets with the highest prices: directly to consumers or to restaurants in Martinique, to collective restaurants in Mayotte.

	Type of study and farm	Final size	Average FCR	Fry Price (€/p)	Feed Price (€/kg)	Prod. Cost (€/kg)	Prod. cost incl. selling cost / local market (€/kg)	Selling price for local market (€/kg)
Mayotte 2004	a. Survey Small-scale farms 3T	1-2 kg	2.1 - 3.1	0.55 (0.5 g)	1.01	4.7*		3 (market) to 5.5 (collective restaurants)
	b. Simulation 8 T	1-2 kg	1.7					
Réunion 2004	c. Simulation 50 - 120 T	400g - 1 kg	1.4	0.65 (20g)	1	5.6 (50T) 4.0 (120T)	6.6 (50T)	5.5 (Spmkt) to 7.5 (direct sale)
Réunion 2005	d. Simulation 70-180 T	700g - 3 kg	1.4		0.95	4.0 (70T) 3.1 (180T)	5.0 (70T)	
Martinique 2005	e. Survey small-scale farms 10 T	300g - 800g	1.3 - 1.5	0.70 (3g)	1		na	6.5 (spmkt) 8.5 (restaurants)
		300g-2kg	1.8-2.4				5.6 - 9.7	
	f. Simulation 15 T	300-800g	1.48				7.35	9.5 (direct sale)
		300g-1.2 kg	1.84				7.05	

Sources: Lasplaces (2004): a, b Bosc (2004): c Cam (2005) : d Mariojouis & Fischer (2007a): e, f

\* including employee's wages but excluding farmer's income

**Table 2 : Main information available about production costs for red-drum farming in each zone**

In La Réunion, the data concerning the existing 50 T farm are not available. Two studies based on simulations have been done for middle size farm to semi-industrial size farms (50-120 T, and 70-180 T) with offshore cages, using hypothesis of very low FCR (1.4) allowed by the management of a large number of fish. The production costs show clearly the economies of scale, ranging from 5.6 €/kg for a 50 T farm to 3.1 €/kg for the 180 T farm. For average size farms that could focus the local market, taking into account the additional costs for selling (1 €/kg), it appears that the 50-T farm would be profitable only if selling directly to consumers, but could hardly sell to supermarkets, outlet reachable for a 70-T farm.

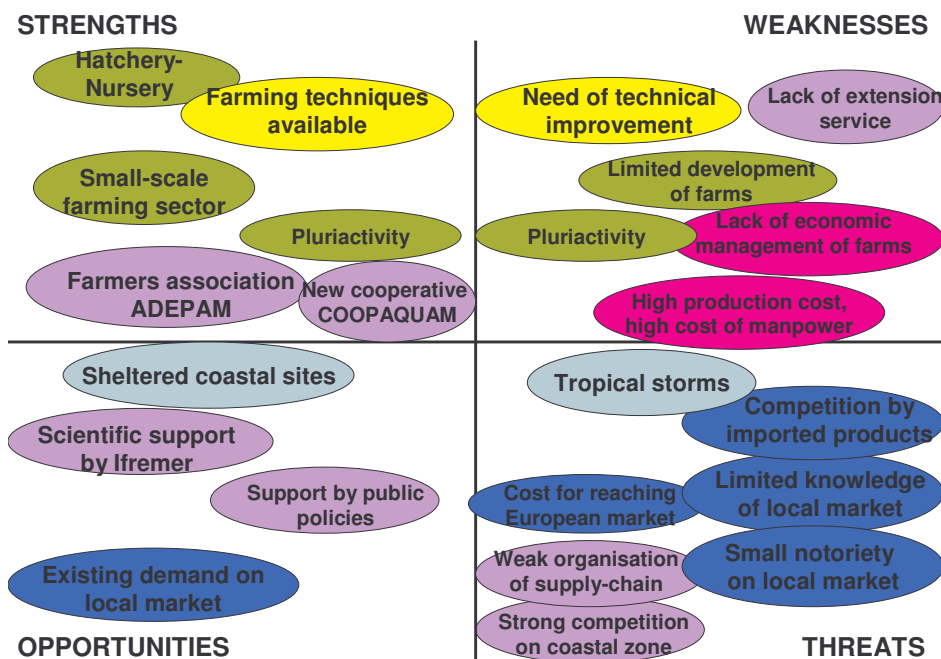
This set of data is not complete and notably is lacking the production cost in the semi-industrial farm existing in Mayotte, supposed to be close to 3 €/kg. Interestingly, it is similar to the results of simulation obtained for a 180 T-farm in La Réunion. If confirmed, those data would show that the manpower cost plays a secondary role in the production costs, giving less weight to the advantage of low cost in Mayotte. As the semi-industrial farm in Mayotte is focusing the export market, must be added the cost for packing and shipping fresh fish to European market, estimated at 2.78 €/kg in 2005 (IEDOM 2006a), almost equivalent to the production cost.

**THE SWOT ANALYSIS , THE POSSIBLE STRATEGIES AND NEEDS FOR FURTHER ECONOMIC STUDIES**

Using the available information, we propose a SWOT analysis as an analytical synthesis aiming to determine a possible strategy for each zone :

- Strengths and Weaknesses of the red-drum farming sector itself,
- Opportunities and Threats from the external environment.

The available information is related to different fields : natural conditions, technical ability, existing fish farms, fish farming economics, markets, organizations and public policies



**Figure 2 : SWOT analysis for the red-drum farming sector in La Martinique**

For La Martinique Island, the strengths are an already developed small-scale farms sector, with all steps in the private sector (except broodstock managed by IFREMER) : hatchery-nursery, on-growing, and an active farmers' association which recently created a cooperative for a common commercialization. But the results of fish farming activity are weakened both by insufficient technical results and a limited involvement of a number of farmers, as pluriactivity appears to be both a strength for the beginning of a new activity but a weakness for further development. Also as a weakness of the sector must be pointed out a lack of extension service for technical improvement, but a lack of farms economic management. The farming activity is also weakened by a high cost of manpower and a high production cost in relation with the above points.

Good opportunities have been offered to a fish farming sector by sheltered coastal sites, but tropical storms may cause serious damages sometimes. Also must be regarded as important opportunities the scientific support brought by IFREMER for years, and the support by public policies through financial support to the creation and the operation of farms. Despite a large local market, the selling of red-drum on local market is threatened by the strong competition from imported products and the general poor knowledge of the organization of the supply chain and the market.



In La Martinique, the main scenario for development is the increase of production from a small scale farms sector focusing the local market. The appropriate strategy must aim at mastering the technical and economic management of these farms, and will require a continuous survey of the production costs by an extension body. Another element of strategy would be to enlarge the present market for red drum by studying ways for a better marketing, possibly through the creation of a special Label as a “Label Pays” (regional label) ensuring a premium price. A second possible scenario concerns the creation of middle scale farm, as a project is already existing, but it may question the development of small scale farms sector by occupying an important market share. Such a perspective reinforces the need for a better knowledge of local market. No export is considered today by the stakeholders while it has been existing some years ago and could be a future strategy, focusing European market or North American markets.

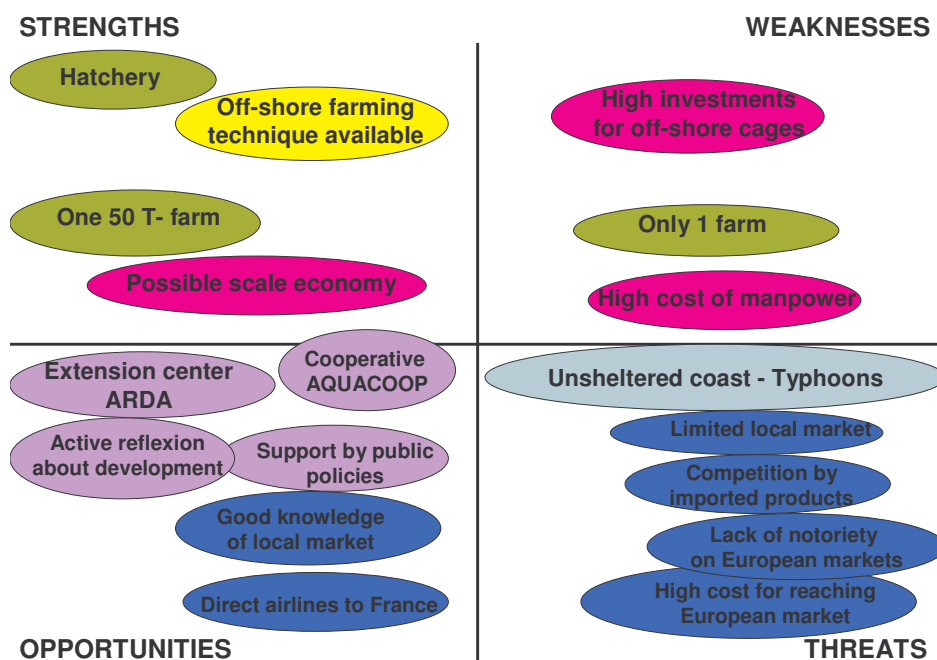


Figure 3: SWOT analysis for the red-drum farming sector in La Réunion

Despite some strengths and good opportunities represented by an existing dynamic structures and public supports, La Réunion Island is facing important threats for a future development, both from natural conditions and economic conditions. A strategy for development must consider several scenarios, the main one being today middle scale farms focusing both local market and export. Local market could also be focused by a cooperative farm which project is considered by a group of farmers. Some projects of semi-industrial farms have been also considered for export. As the study of local market has shown a limited size for standard products, a strategy could be the conception of added value products through processing or certified products, but further investigation is necessary. For export, the high costs for reaching European markets make necessary to develop a strategy, possibly through a grouping with fisheries products, but nevertheless an updating of financial costs is needed before any further development.



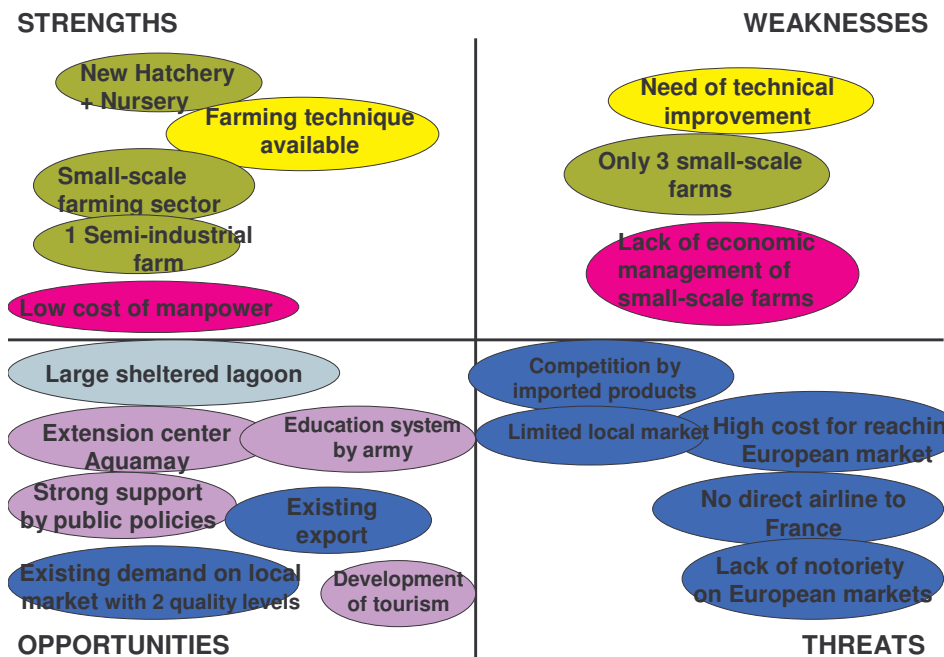


Figure 4 : SWOT analysis for the red-drum farming sector in Mayotte

Mayotte Island today owns very important strengths and opportunities for developing a marine fish farming sector. The development, based on a double scenario : small scale farms for local market and semi-industrial farm for export, requires two different strategies to address the weaknesses and threats. For the small scale farms supplying local market, the priority is to overcome the present weaknesses in the farm management, and a continuous survey of technical and economical results can be recommended. Also, to complete the study of local market would allow to diversify the possible segments.

While the existing semi-industrial farm represents a real strength for the Island, the export strategy is questioned by the absence of direct airline, and by the transportation costs, which need to be updated in a context of growing oil prices. An alternative strategy which deserves a feasibility study is the choice of a faster growing species (cobia is considered) for exportation as fillets.

## DISCUSSION

### - Development and public supports:

The remote situation of the three overseas territories is the reason for special public policies supporting local development. Moreover, La Martinique and La Réunion have an administrative statute of EU's Outermost Regions<sup>3</sup> allowing the application of special supports through Common Fisheries Policy.

As a new activity, the emerging fish farming sector in the three regions is benefiting of public financial supports for investments and for inputs (fry and feed). These supports have several functions: incentive for starting an activity with low recognition from the banking sector, compensation of high costs of inputs : fry issued from recently set-up techniques, feed imported from France mainland. These supports make also possible to compensate an insufficient technical efficiency for new farmers in a learning period. They have been a key-factor for supporting the launching of the activity in the three islands. As shown by the

<sup>3</sup> Outermost Regions, or RUP (Régions Ultra-Périphériques) in French

data presented upper about production costs calculated for present conditions and without taking into account any public support (Table 2), some market segments, as supermarkets, could be hardly reached.

Nevertheless, the question of the real economic efficiency of the activity must be asked, and its capacity to not rely on public supports. In the case of the small scale farms in La Martinique, we realized a sensitivity analysis (Mariojouis and Fischer, 2007a) for two scenarios of farms and three factors: fry price, better technical results (FCR), existence or not of public subsidies. We found a possible profitability, allowing a normal income for the farmer (over the minimum salary) for a scenario without public support focusing average-sized fish (20% 300g, 80% from 800g to 1,2kg) - while the present farms often sell small fish (300g to 800g), with an improved FCR (1.68 vs 1.84) and a cheaper fry (0,5 €/piece). Technical improvement and a strategy favourable to fry valorisation, can make possible to get rid of the need of public subsidies.

#### - About markets

Concerning the question of outlets, it must be underlined that the difficulties faced by the development of aquaculture are common to the capture fisheries sector in the French Overseas Territories. This has been well analysed in a recent report published by the national CES<sup>4</sup> after the end of our programme (D'Abboville, 2007). The situation in most territories is characterized by the existence of a local demand but with often a poor knowledge about the market due to informal landings and channels, a strong competition on these markets open to imports as EU zones under ACP Convention<sup>5</sup>, and difficulties to reach export markets due to the remote situation. The development of markets for farmed products could then benefit of actions in common with the overall fisheries sector (market studies, organization of marketing on local and export markets). For farmed red drum, specific aspects do exist, and an important one concerns the lack of notoriety of a non-indigenous species on markets. On local markets, some progress have been done through promotion campaigns but a real notoriety of red-drum is still to be achieved. On export market for EU, one step forward for the three regions has been to choose in common a commercial name "ombrine ocellée" ("*spotted ombrine*") and to apply for official recognition in France, obtained in 2007. Still, the launching of a new product on the European market is a complex issue, analysed and discussed in another communication (Girard and Mariojouis 2008) in the present conference.

Nevertheless, the available elements about production costs show that red drum produced in the considered French overseas territories will hardly be below 3 €/kg, in the best case of semi-industrial farm. It cannot compete for the same market segment as some low price products supplied through international trade, like farmed *Pangasius* from Vietnam which ex-farm price is today below 1 USD/kg (Source: personal inquiry, 2008). The red drum farmed in the French overseas territories must, on the contrary, be considered in the same group as high value species farmed in Europe.

#### - Aquaculture development and economic studies

As mentioned in our introduction, the development of marine fish farming in the considered overseas territories has been initially driven by technical aspects, then some economic questions have been studied, but, in this early development phase, focused basic questions: production costs, markets and marketing chains, and are still to be completed.

We added in our analysis some available information about social aspects - organizations - and public policies, but these aspects would deserve much further analysis. More generally, the limits of both the conception of the fish farming development in these zones, and of the performed studies, must be underlined. A more comprehensive approach of the question of aquaculture development should deepen a

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<sup>4</sup> CES : Conseil Economique et Social (Social and Economic Council ), the French third national Chamber after the National Assembly and Senate

<sup>5</sup> ACP Convention: for Africa Caribbean Pacific countries, allows export to European Union zone with very low or no tariff.

number of other important socio-economic aspects still insufficiently considered : access to production factors (space, quality water, finances, manpower, etc), profitability and risks, legal and institutional framework. While the development of aquaculture sector appears favourable for economic development and food security, the choice to focus that activity have up-to-now not included a global approach allowing to compare the different options possible for those purposes. La Réunion and La Martinique are in a situation of a broader range of possible economic activities, while Mayotte having a limited economic development and very favourable natural conditions is a best candidate for choosing aquaculture as a priority.

Around the aquaculture sector itself, a more integrated vision of the development is nevertheless indispensable, especially in tropical islands, where tourism is - or is becoming for Mayotte- an important economic activity, in addition to other usages of the coastal zone that can all generate conflicts for resources use. Moreover, the important challenges for conservation of biodiversity in tropical islands of high ecological value, underlined in a recent Conference<sup>6</sup> in la Reunion, must be taken into account and may question the aquaculture development.

It appears that the question of aquaculture development in the overseas islands invites to a larger approach. In addition to classic tools for assessing the socio-economic aspects of development projects for agriculture or aquaculture productions (Dufumier, 1996), it may be useful to think of new methodologies including other criteria, like environmental impacts and sustainability, through interdisciplinary methods.

## CONCLUSION

The short history of the marine fish farming in the three overseas islands show important steps passed : technical mastering, setting up of a private farming sector and of some professional organizations in each zone, while on the other hand there are clear needs for a better management in small-scale farms and more acute knowledge of markets and marketing. The feasibility of a development focusing the export market is nevertheless questioned by competition on European markets and, increasingly, the cost or air fret in the context of the present oil crisis. As for an agriculture production, must be underlined the role of extension centres, and the lack of it in Martinique vs the other two islands. Beyond assessing a promising situation created by existing professional bodies, their capacity to structure an efficient organization for the farming sector and the marketing of products are now under expectation.

Our initial question “*Is marine fish farming a way for economic development in the French overseas territories ?*” thus appears to have various answers, regarding to the situation of each considered zone, but in all cases the answers are still very much under conditions.

A more integrated approach in the development planning seems adequate for the future, and should notably include the concepts of Integrated Coastal Zone Management, and Sustainability, both conditions and opportunities for a significant development. Such wider perspectives would require new tools for analysing the development projects.

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<sup>6</sup> “The European Union and its Overseas Entities, Strategies to counter Climate Change and Biodiversity Loss”, 7-11 July 2008, La Réunion Island.  
<http://www.reunion2008.eu/pages/en/en-conf-conference.html>

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