

NEW SPECIES IN MEDITERRANEAN AQUACULTURE: IS IT AN ANSWER TO THE MARKET DEMAND FOR DIFFERENTIATED PRODUCTS ?

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Abstract

Mediterranean aquaculture development is now at a crossroads. The production of seabass and seabream has been increasing at a smart and constant pace for the last ten years. Nevertheless, it is still far behind the Northern European salmonid industry in terms of level of production, reduction of production costs and market internationalisation. Meanwhile, an in depth transformation of market conditions is ongoing in Europe which remains the main target market for Mediterranean aquaculture products. The most important issues are the soaring role of supermarkets in the distribution chain, the development of new processing techniques like pre-packed fresh fish, the growing importance of catering and the evolution of the consumer behaviour. Seafood consumer behaviour results from contradictory attitudes such as scrutiny of products' origin and farming process, research of the best value for money, desire of social image and need for easy to store and ready to cook fish. As in any other seafood industry, product differentiation has become a pre-requisite to fit consumer's demand and reach new consumers thanks to market segmentation. From a theoretical point of view, two kinds of differentiation have to be taken into account: horizontal differentiation based on the diversity of presentations of the same quality and vertical differentiation based on a hierarchy of quality. Examining precedents in the poultry industry and salmonid industry make it possible to assess the potential role new species may play in product differentiation. In the case of Mediterranean aquaculture, an analysis of the market structure for fresh fish in France, Italy and Greece reveals two different ways of product differentiation: new well known species with a good image for connoisseur markets and standard quality fish provided by species with high growth potential for the mass market. In any case, particular attention has to be given to reputation, long term production costs and capacity to provide a large range of products.

Key words : aquaculture, Mediterranean, seafood consumption, marketing

Introduction

Mediterranean aquaculture development is now at a crossroads. The production of seabass and seabream has been increasing at a smart and constant pace for the last ten years. Nevertheless, it is still far behind the Northern European salmonid industry in terms of level of production, reduction of production costs and market internationalisation. At the present time, a lot of research is ongoing about new species in Mediterranean aquaculture. From an industrial point of view, species diversification refers to the economic principle of economies of scope, which means that by diversifying the range of products, the industry takes advantage of shared fixed costs and potential market share (Marchesnay, 1990). Nevertheless, in the case of a new industry which is not totally mature yet, economies of scope may have a negative counterpart in terms of economies of scale and economies of learning. The introduction of new species may induce additional fixed costs, less watchfulness over traditional activity and specific risks, especially in pathology. But new markets have to be found to ensure growth and viability to the industry.

1. Production and trade of marine farmed fish in Europe

Marine fish farming in Europe is mostly salmon farming in northern countries and seabass/seabream farming in southern countries. As for salmon, it is a worldwide market in continuous expansion which has grown from 730 000 t (live weight) in 1987 to more than 1 500 000 t in 1996. Record catches of wild salmon contributed to this growth, but the major new supplies came from farmed salmon. The share of farmed salmon as a percentage of total salmon supply has grown from 12% in 1987 to 40% in 1995, and is expected to grow further and to overtake the wild share within the next five years (Lem et Di Marzio, 1996). The growth in the salmon market has thus been supply-driven and the most important force in this change has been the salmon farmers of Norway. These Norwegian companies have invested in Scotland and Ireland, then in other countries world-wide including Canada, Chile and Australia making this industry really internationalised (Paquette et Harache, 1996). Most of the European salmon supply now is farmed and suppliers of wild catches are out of Europe (USA, Canada, Japan and Russia). At the present time, marine fish farming in Northern Europe is based on two species, i.e. Atlantic salmon (*Salmo salar*) and Sea trout (*Onchorynchus mykiss*) with respective productions of 410 000 t and 50 000 t in 1996. In the same time production was soaring, salmon prices were dramatically decreasing. On the French market which is the most important one in Europe, salmon price was in 1996 four times less in constant terms than in 1978 and two and half times less than in 1988 (Table I). In France, salmon is now the second most common fresh fish behind cod for household consumption with a market share of 15% and has been able to develop its market while the consumption of fish was stable over the period. Two factors may explain this success i.e. the excellent image world-wide of salmon and the ability of this species to be diversified in size (from 1 to 7 kilos) and in presentation (whole or filleted, fresh, smoked or frozen, ready-cooked). The price of salmon is now a reference price on the French market, which means that the price of most wild species is subject to follow the decrease of the salmon price.

The marine fish farming industry in the Mediterranean basin is comprised of more than 500 production units operating in 15 countries (Stephanis, 1995). This new aquaculture industry followed an amazing development over the last ten years with a production of seabass

(*Dicentrarchus labrax*) and seabream (*Sparus aurata*) over 55 000 t in 1996. In Europe, 80% of the supply of these two species is now provided by the aquaculture sector. At the forefront of this impressive development is Greece with a market share of 40%. As a result of the increase in aquaculture production, the price of seabass and seabream has fallen all the more quickly as it was very high at the beginning. Seabass price on the Italian market, which still is the main market for seabass and seabream, was in 1996 three times less than in 1988. Indeed, the connoisseur's market for a small and expensive fish is not so large as the market for a reasonably priced big fish like salmon which is declined in fillets, steaks and other preparations.

Table 1: Salmon and seabass/seabream production in Europe - import prices for salmon in France and for seabass in Italy (prices in Ecu per kilo - production in tonnes)

		1988	1989	1990	1991	1992	1993	1994	1995	1996
salmon	production	100 000	130 000	185 000	185 000	200 000	260 000	300 000	350 000	410 000
	price in France	8,2	6,3	5,8	5,3	5,5	4,8	4,5	3,8	3,4
bass/bream	production	3 000	4 600	6 300	10 000	15 500	26 000	32 400	42 000	57 000
	price in Italy	20,9	20,9	19,3	16,1	12,9	8,1	7,3	7,2	7,2

source : IFREMER, FIOM (prices converted in 1996 currency)

Salmon and seabass/seabream farmings have been both highly involved in international trade from their start up. The level of internationalisation of these species for fresh product is more than 60% for salmon and more than 40% for seabass/seabream. Nevertheless, the seabass/seabream trade is eight times less important than salmon trade and is characterised by two factors : (i) the concentration on the Italian market which is the target for 75% of the exports and (ii) the absence of outlets outside Europe (Table 2). On the contrary, salmon market is more and more diversified among different European countries and Asian markets become important outlets (Table 3). The fantastic success of farmed salmonids on the European market has been got with only two species, Atlantic salmon and Sea trout, which would suppose that species diversification is not a prerequisite for enlarging markets for aquaculture.

Table 2 : main flows in international trade of farmed seabass/seabream (1996)

Country of origin	Country of destination	Quantities (tonnes)
Greece	Italy	12 000
	Other European countries	4 000
Turkey	Italy	6 000
	Other European countries	2 000
France	Italy	1 200
	Other European countries	800
Croatian	Italy	1 500
Other Mediterranean countries	Italy	4 000
	Other European countries	500

Source : SELAM network

Table 3 : main flows in international trade of European farmed salmon (1995)

Country of origin	Country of destination	Quantities (tonnes)
Norway	Denmark	42 933
	France	38 099
	Germany	18 058
	Spain	13 854
	Other European countries	40 766
	Japan	11 146
	Other Asian countries	3 743
Denmark	France	9 960
UK	France	13 524
	Other European countries	9 272
	Japan	914
Ireland	France	5 570
	Other European countries	3 307
Faeroe Islands	Denmark	9 250
	Other European countries	3 500

Source : FAO Globefish

2. Main trends in European markets for fresh fish

An in depth transformation of market conditions is ongoing in Europe which remains the main target market for Mediterranean aquaculture products. The most important issues are the soaring role of supermarkets in the distribution chain, the development of new processing techniques like pre-packed fresh fish, the growing importance of catering and the evolution of the consumer's behaviour. Except in Italy and in the Netherlands where traditional outlets are still dominant, supermarkets are now the first distribution channel for fresh seafood in Europe, although available data are too heterogeneous to make it possible to undertake a precise comparative analysis among European countries (Table 4).

Table 4 : market share of super/hypermarkets for seafood in European countries

Country	Type of product	share	year	source
Belgium	fresh seafood	53%	1995	CFCE
France	fresh fish	65%	1996	FIOM
Germany	all seafood	66%	1996	"Produits de la Mer" magazine
Italy	fresh seafood	20%	1995	Globefish
Netherlands	fresh seafood	16%	1995	CFCE
Spain	fish fresh, frozen and tinned	45%	1993	Ministry of Agriculture
UK	fresh seafood	70%	1995	Globefish

The increasing market share of super/hypermarkets in seafood distribution is a very important issue for aquaculture development. Indeed, Mediterranean marine fish farming has been focusing so far on the market for fresh seafood because of high production costs. Now, thanks to their good equipment in fresh food counters, super/hypermarkets have proved to have positive effects on fresh fish sales in country or regions where fresh fish consumption was traditionally low. That is the case of Germany, the Netherlands and even inland areas of Italy and France. The counterpart of this opportunity is the obligation to have regard for the specific requirements given by the supermarkets. These requirements turn on supply regularity,

availability of a range of products and homogeneity of characteristics for each type of product. It has to be noticed also that the increasing consumption of fresh fish in most European countries is due to steaks and fillets rather than to whole fish. In France for instance, fresh steaks and fillets fish have reached a 60% market share in super/hypermarkets in 1996 (Table 5) but only 45% in traditional outlets.

Table 5 : marketshare of different presentations of fresh fish on the French market (1996)

	super/hypermarkets	traditional outlets
fresh fish	100%	100%
whole	40%	54%
steaks and fillets	50%	43%
prepacked	10%	3%

source : FIOM / Secodip

Prepacked fish has become a major item on Dutch and Belgian markets, and will likely play a more and more important role in other European seafood markets in the following years. It is considered as the most promising way to expand the market for fish and to reach new generations of consumers. Therefore, particular attention has to be given to this form of packaging by aquaculturists in the aim of capturing tomorrow's markets. Nevertheless, not all species are well adapted to this form of processing. Some factors such as high ratio of flesh weight in total weight and easiness to be filleted have to be taken into account in the choice of new species for Mediterranean aquaculture. The growing influence of away from home consumption goes in the same direction since caterers are looking for ready to cook products. The operators of the catering sector look all the more attractive for the aquaculture sector as they need regular, homogeneous and right in time supply.

3. Taking into account consumer's demand : a key issue for aquaculture development

These transformations in fish distribution go as a par with an evolution of consumer's behaviour towards food. Evolution of lifestyles, development of woman work, urbanisation and increasing interest in leisure are some elements among others which orientate food purchase and consumption. Aquaculture will follow the industrialisation pattern currently underway in agriculture. This means tighter linkages between farm production and consumer demand, and increased control of the food system by large agribusiness entities taking into account market conditions as a leading decision factor. The problem is that market driven aquaculture requires an intimate knowledge of consumers' wants, perceptions, beliefs, habits, attitudes and other factors that govern choice (Kinnucan et Wessels, 1997).

This concern is all the more crucial as the demand for animal proteins is stagnant in developed countries. Not only does the population of these countries increase slowly, but the individual demand for meat is already satisfied. That is the reason why aquaculturists have to think in terms of market share competition against other meat products. Market share gains have to be obtained through practicality, image, better adaptation to consumer demand and quality guarantee. Moreover, a dual phenomenon is noticed. On the one hand, consumption habits are more and more standardised from one country to another and from one social class to another, but on the other hand, consumers are willing to find all year long a large variety of products and may jump at any time from cheap products to exclusive items.

Seafood consumer's behaviour results from contradictory attitudes such as scrutiny of products origin and farming process, research of the best value for money, desire of social image and need for easy to store and ready to cook fish. All these considerations do not make it possible to know precisely what types of aquaculture products will be in demand by consumers in 10 years'time, and how might this demand be best met by aquaculturists and those engaged in processing and distribution. But they make understand that like for any other seafood industry, product differentiation has become a pre-requisite to fit consumer's demand and reach new consumers in a context of market segmentation. Indeed, the market can be disaggregated into segments where consumers have different preferences. In order to expand outlets, product differentiation is an adaptative strategy which is often considered as easier to accomplish than trying to change consumer tastes and preferences through marketing devices like advertisement or promotion campaigns.

4. Product differentiation and species diversification : the examples of poultry and salmon industries

Product differentiation is a two steps concept, divided in horizontal differentiation and vertical differentiation. Horizontal differentiation makes it possible to respond to the diversity of tastes, life-styles and schedules in food consumption by offering different varieties or presentations without notion of grading. Vertical differentiation is aiming at proposing different levels of quality based on the geographical origin, the making process or measurable characteristics. Examining the poultry industry and salmon industry are useful to assess the potential role new species may play in product differentiation (Paquette, 1995).

In both cases, horizontal differentiation has been developed first, in order to expand the market and to establish a powerful industry able to reduce costs thanks to economies of scale and to satisfy the super/hypermarkets demand for heavy supply and a range of products. In the poultry industry this differentiation has been accomplished mainly through the supply of chicken pieces. In France and Italy, a large part of the supply is done with different species in addition to chicken such as turkey, duck, goose and guinea fowl. On the contrary, salmonid horizontal differentiation has not focused on species diversification (trout and salmon only) but on processing with a range of products from whole fish to ready to cook meals through fillets, raw specialities and smoked items (Monfort, 1996). The impressive zootechnical progress which has occurred in salmon farming is at the origin of this successful product differentiation. Indeed, thanks to higher fish growth due to genetic improvement and more efficient pellets, the average production time at sea to produce salmons till the weight of 4 kg decreased from 20 months in 1980 to 12 months in 1993. In the meantime, the average slaughter weight passed from 3 kg to 5 kg (Lucet, 1994).

As for vertical differentiation, it has been largely developed for poultry in France thanks to the implementation of «Label Rouge », a quality sign based on the farming process which guarantees slow growth, natural food and low farming density. In Germany, traditional « farm-raised » products have got a large market share. Quality signs based on farming process have been applied also to farmed salmon products. But, perhaps in order to alleviate the lack of salmonid species diversification, the distributors strive to implement a differentiation based on the country of origin albeit without much objective criteria. As a par with the dramatic decrease in price, the development of a full range of products, although based almost entirely

on one species, has been the key to the huge success of salmon farming in most European markets.

5. Identification of markets segments for new species in Mediterranean aquaculture

So, it is important to have a good knowledge of the market segmentation in order to lead decision in terms of product differentiation. In response to the aquaculture industry need for more market knowledge, the past decade has seen a surge in the number and variety of market analyses of fisheries products (Wessels et Anderson, 1992). The research has ranged from studies which are highly aggregated across nations and species, to highly disaggregated analyses of specific species, product forms and consumers. Many studies concerning consumer's attitude towards aquaculture products have been published recently, but their response does not really fulfil the need of decision makers in aquaculture. Indeed, market studies other than purely descriptive analysis, focus on understanding consumer/buyer behaviour based on limited groups of consumers. Although results can be obtained quickly and in great detail, the approach is relatively expensive, is usually difficult to generalise because of small sample size and may be influenced by the inherent biases and poor seafood knowledge of the focus group. It has also been shown that there was no direct causality between attitude and effective behaviour in food and particularly seafood consumption, which underlines the need for objective data in complement to this type of study. That is the reason why the study of time series purchase data based on consumer panels is an important step in market analysis.

Such an analysis has been done on the French market with the help of consumer panel data recorded by Secodip for the FIOM, a body of the Ministry of Agriculture. The distribution of fresh fish at home consumption per category of price shows that for whole fish, there is a wide range of price with quite homogeneous quantities from less than 4 Ecus/kg to more than 10 Ecus/kg (Table 6). Because of the continuous price decrease of salmon, there is now a first pick around 5 Ecus/kg, under the average price for whole fresh fish which is around 7 Ecus/kg. But there is still a strong demand for more expensive fish between 10 and 12 Ecus/kg, like sole, turbot, anglerfish and seabass. For species the average price of which would be beyond 12 Ecus/kg, there is a limited market at the present time and no large potential market is easily predictable.

Table 6: distribution of whole fresh fish at home consumption in France (1996)

Ecus/kg	volume (t)	species
<4	11 684	herring, mackerel, sardine
4 to 6	24 678	salmon, whiting, plaice, trout
6 to 8	12 006	cod, carp, gurnard, saithe, lemon sole, cat shark
8 to 10	7 515	sparids, ling, hake
>10	13 740	seabass, anglerfish, goatfish, sole, turbot

Source : FIOM - Secodip 1997

As for fillets and slices, their distribution is much more concentrated in the range 8 to 10 Ecus/kg where most of the popular species are mixed. It looks like the name of the species was less important for steaks and fillets than for whole fish, since on the one hand there is a limited number of available species and on the other hand there is very few price differentiation between species (Table 7).

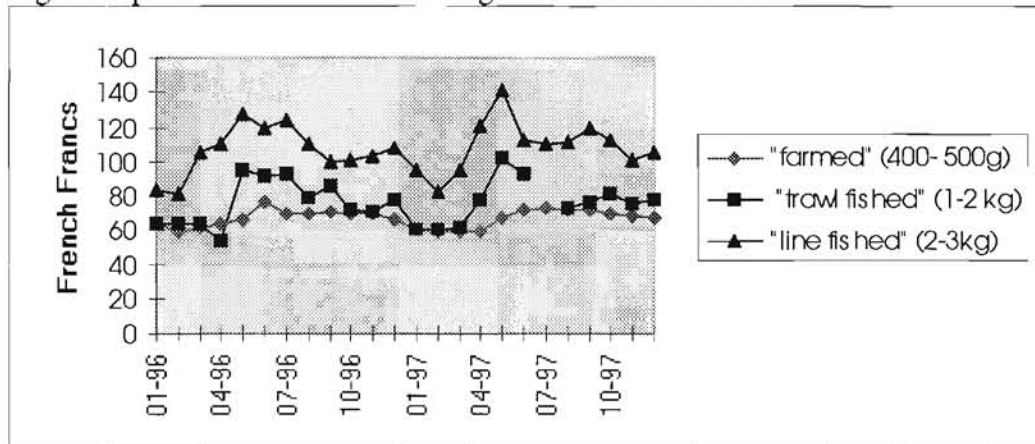
Table 7: distribution of fresh fish in steaks and fillets at home consumption in France (1996)

Ecus/kg	volume (t)	species
<4	0	
4 to 6	0	
6 to 8	18 329	saithe, ling, cat shark
8 to 10	59 815	cod, whiting, hake, salmon, trout, tuna, skate
>10	6 975	lemon sole, anglerfish, haddock, deep sea fish

Source : FIOM -Secodip 1997

In addition, information about the relative price of farmed and wild fish may be of great interest in order to assess what position can farmed fish pretend to when entering the market for fresh fish. In the case of seabass in France, a clear difference exists in favour of wild caught seabass, especially if it comes from line fishing vessels (Fig 1). This difference is partly due to a bigger size (2 to 3 kg instead of 400 to 500 g), but most studies on consumer's behaviour show that propensity to pay a high price is lower for farmed fish than for wild fish.

Figure 1: price of seabass on the Rungis French national market



Source : Service des Nouvelles de la Marée - Rungis

7. How to conciliate zootechny, economics and marketing constraints in Mediterranean aquaculture diversification

Although panel data do not take into account the catering sector which should be investigated with the same accuracy given its growing influence, they show that there is a huge potential market in France for reasonably priced fish, either whole around 6 Ecus/kg or in steaks and fillets around 9 Ecus/kg. The fact that salmon is dominating this market segment proves that aquaculture is in good position to take advantage of such a market opportunity. The fantastic success of catfish and the more recent one of tilapia on the US market, with a consumption above 200 000 and 30 000 tonnes respectively in 1997 (Harvey,1998), give evidence of the large market potential there is for a species providing white fish flesh at low cost. Given the converging world-wide evolution of markets in developed countries due to free trade and to similar evolution of lifestyles, the same situation is to be expected in European countries. One of the main advantages to target this type of market is that an increase in production due to aquaculture would not have a major effect on the total supply in this category of product and

would not lead to such a price crush as it has been observed for seabass and seabream. Nevertheless, zootechnical, economic and marketing constraints have to be taken into account.

From a zootechnical point of view, targeting such a market segment requires to have a fast growing species at low cost, which means easy to reproduce, with a good food conversion ratio and open to be reared at high density. Some species have been identified in this purpose and experimentations have already started with cod, tuna, yellowtail, meagre, red-drum or dolphinfish (Paquotte et al., 1996). But a lot has to be done in zootechnical research for these new species before industrial farming at low cost can be achieved. On the contrary, according to the example of salmon, seabass and seabream still have a large potential of productivity gains thanks to the ongoing research in nutrition, pathology and genetics. This prospect makes it possible to consider product differentiation on the basis of the present species. It could be either horizontal differentiation with the supply of larger sized fish, fillets and pre-packed ready to cook fish with seasoning or vertical differentiation with labels or quality signs based on the geographical origin. Nevertheless, the basis of this last approach has to be really objective in order to get credibility and has to be restricted to a limited number of products in order to avoid confusion in consumer mind. During a price decreasing period, market segmentation and product differentiation are one of the possibilities to keep the industry profitable, but producers have to strive to keep links between quality, prices and cost structure (Lassaut et al., 1997).

At the present time, the market for fresh fish is characterised in southern European countries by a large number of species. In France, for instance, the turn-over of the meat-poultry sector is the same as the one for seafood, with six species only instead of sixty. In Italy, France and Spain, fish stalls have to be diversified to please the consumers, even if the purchases are concentrated on a limited number of species. There is of course a connoisseur's market of consumers who are looking for specific species, but first its importance is not the same in all the countries and second it is receding with the new generations of consumers. Even in Italy where fish is a well known food item, only 34% of the families could be included in the connoisseurs' groups according to a Nielsen survey conducted on behalf of the Italian Association of fish Producers in 1996 (Corbari, 1996).

The results of a survey among Greek producers show that species diversification in Mediterranean aquaculture has been aiming so far to reach the connoisseur's market looking for a wide range of species available on the stall. The three main new species presently in production (*Puntazzo puntazzo*, *Pagrus pagrus* and *Dentex dentex*) have been till now reserved to the Greek market in order to supply the « niche » segment of expensive small sized fish (Table 8). That is the reason why more differentiated products seem necessary to reach other market segments.

Table 8: marketing of new species by Greek fish farmers (source : SELAM network)

		puntazzo	pagrus	dentex
motivations for production	range of species	x	x	x
	"niche" market	x	x	x
	low production costs			
commercial size	< 400 g	x		
	400 g to 800 g		x	x
	> 800 g			
level of ex-farm price	< 8 Ecus/kg			
	8 to 10 Ecus/kg	x	x	
	> 10 Ecus/kg			x

Two issues have to be pointed out in this approach. First, at such a high level of price, the market potential is very low and a price fall has to be expected soon in case of bigger supply. So, production costs have to be under control but it is difficult to justify a large public research effort if only a limited « niche » market is at stake. Private companies which can afford such an investment in research can thus expand their market share in the segment of Mediterranean fish connoisseurs. Second, connoisseurs are very demanding consumers. The farmers are thus required to produce a fish with exactly the same characteristics as the wild product, which is not always easy to do. For instance, farmed pagrus encounters marketing problems because the pink red colour of wild pagrus is difficult to reach in farming conditions (Stephanis, pers. com.). An other example is the disappointing result of tilapia on the French Caribbean market despite the red colour of the fish which should have fit the local consumers' preferences. But this tilapia does not look really like wild Caribbean fish and people do not want to pay as much for it. Moreover, consumers' attitude towards farming is rather ambiguous and it turns out that a price premium would usually be given to wild fish in that market segment (COPA COGECA, 1996). In any case should be the present market price of wild species considered as a long term price for aquaculture.

Conclusion

When taking into account the market trends for fish in European countries, it is not possible to say that new species in Mediterranean aquaculture answer totally to the demand for differentiated products. Other factors of differentiation are necessary to cover all market segments for seafood. Undertaking the farming of new species is risky and requires many years of research while it is very difficult to predict so long in advance what the demand for aquaculture products will be. So, in order to ensure viability to the industry, these species should be well controlled from a zootechnical point of view and clearly positioned from a marketing point of view. Whatever market segment is chosen, from consumers looking just for fish flesh to connoisseurs, three parameters have to be kept in mind when selecting a new species: reputation, expected production cost and ability to give a range of products. The importance of these three parameters will depend on the market segment. Their combination should help the public authorities and the producers to assess the market potential of new species and to make their investment decision in research and development. But consumer's behaviour is still full of mystery and may not be modelled so easily as a growth curve. Other social sciences like sociology, ethnography and demography are necessary to help economists and biologists in the search of new species for aquaculture.

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