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MARKETING OF AQUACULTURED SEABASS AND SEABREAM FROM THE MEDITERRANEAN BASIN

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MARKETING OF AQUACULTURED SEABASS AND SEABREAM FROM THE MEDITERRANEAN BASIN

by

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PREPARATION OF THIS DOCUMENT

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ABSTRACT

Mediterranean finfish species such as the European seabass and the gilthead seabream have, over the last two decades, been attracting considerable attention among aquaculturists and investors. The net result has been a rapid increase in the supply of the finfish to European markets. Accessing these markets with the right product at the right price is a key factor in the success of any commercial aquaculture project. This report describes the current status of the European market for these and other finfish species and the major characteristics of marketing farmed fish in the Mediterranean basin.

Part 1 of the report gives an overview of the global European market, including developments in finfish production and marketing performance. Part 2 reviews major market traits of the European seabass and the gilthead seabream as well as other finfish including tilapia. It discusses suppliers to Europe, prices, marketing strategies and product types. Part 3 presents important European market characteristics such as product quality, consistency of supplies and competitive prices. Part 4 gives key figures regarding aquaculture production by country. Part 5 outlines farming technologies that may be more suited to certain Mediterranean countries and may offer new investment opportunities.

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ABBREVIATIONS AND ACRONYMS

APROMAR	Associacion Nacional de Productores de Cultivos Marinos (Spain)
CIHEAM	Centre International de Haute Etudes Agronomiques Méditerranéennes
CAPMAS	Central Agency for Public Mobilization and Statistics
EAP	European Action Plan
FAO	Food and Agriculture Organization
FEAP	Federation of European Aquaculture Producers
FGM	Federation of Greek Mariculture
GAFRD	General Authority of Fish Resource Development (Egypt)
Ifremer	Institut Français de Recherche pour l'Exploitation de la Mer
Ismea	Istituto di Servizi per il Mercato Agricolo Alimentare (Italy)
NOAA	National Oceanic and Atmospheric Administration (USA)
OFIMER	Office National Interprofessionnel des Produits de la Mer (France)
SIPAM Network	Information System for Promotion of Aquaculture in the Mediterranean (French acronym)
VASEP	Viet Nam Association of Seafood Exporters and Producers

Introduction

The aim of this market report is to offer to participants to the next experts' meeting of the General Fisheries Commission for the Mediterranean an overview of the market and marketing of finfish aquaculture products in Europe, with a special focus on finfish produced in the countries of the Mediterranean basin.

Without a doubt, the recent and widely advertised success stories in the aquaculture sector worldwide (salmon, tropical shrimp, catfish, seabass and seabream) have stimulated investors attention. Today new species are attracting investors and tomorrow they may be augmenting the supply of fish to the region. In this report, the focus is on market considerations of aquaculture products. Getting access to markets at the 'right' price with the right product is a key factor in the success of any commercial aquaculture project.

This report describes the present market status of these new species and the major features of marketing aquaculture products reared in the Mediterranean basin. It is structured along the following lines:

- Part 1 gives an overview of the market, including developments in aquaculture production and the marketing performance of finfish,
- Part 2 reviews major market traits of seabass, seabream, tilapia and other finfish,
- Part 3 presents important market characteristics,
- Part 4 gives key figures regarding aquaculture production by country, and
- Part 5 presents some of the new aquaculture technologies that are suited to the region and that offer investors new tracks for development.

The report prepared by Marie-Christine Monfort, seafood marketing expert, is based on a compilation of existing documents enriched by direct discussions with industry and trade members.

1. Overview of the market

1.1 Production development

The Mediterranean coast is about 46 000 km long, with some 15 000 km suitable for aquaculture production on the northern shore (from Spain to Turkey) and 4 000 km on the southern shore.[1] Since the early days of this industry (in the 1980s), fish farming attracted investors in a large number of countries around the Mediterranean basin. Presently overall production of finfish is more than 700 000 tonnes. Yet fish farming in individual countries grew very differently, depending upon local conditions. While production boomed in Turkey, it did not develop in Morocco.

The various constraints and restrictions facing fish farming are biological (control of the rearing parameters), environmental (control of the impact on local environment), geographical (conflict of usage and access to the coastline) and economic (production costs). These constraints are tackled by new production technologies such as recirculation systems, offshore cages and integrated aquaculture.

Fish farming in some countries (especially on the eastern and southern shores of the Mediterranean basin) is still in its infancy. The important need for technology and know-how will be solved by the transfer of proven technology. The acute need for skilled labour will be solved by the introduction of specific training programmes in production, processing and marketing.

[1] Lacroix, D. 1996.

Access to inputs such as feed and fry on favourable terms is a key factor for successful fish farming. Status of local production and favourable conditions of access to imported products are keys to industry competitiveness.

Fry, an important input, represented 19 percent of total production cost for seabass and seabream (2002 average[2]).

Feed represented approximately 35 percent of total operating cost in the same period. In the past five to ten years, fish feed production capacity in Europe has boomed and reached over-capacity[3] (Spain). At the outset of the fish farming business, Greece imported feed massively from France, but today its domestic production is sufficient for local needs. At the same time, we are entering a period of high prices, which some consider frightening, because of the strong demand for fishmeal (China) and an input shortage. Prices for fishmeal skyrocketed recently. Helga Josupeit (Fishery Industry Officer, Food and Agriculture Organization) wrote in an Eurofish article dated March 2006: "*Fishmeal prices went up steadily in the course of 2005, due to the persistent strong demand, namely from China. Fishmeal prices reached a record level in early 2006, a level never before reached in recent history, at US$ 880/tonne. The opening months of 2006 show a further reduction of production and catch quotas will in turn create further pressure on supply and prices. Peruvian catches for reduction are expected to be lower in 2006 than in 2005, as research shows that the resource is smaller than forecast which will lead to lower catch quotas. In Chile, the horse mackerel quota was reduced by 75 000 tonnes, which will further reduce fishmeal production in this country. Fishmeal prices will probably go down slightly in the coming months, but stay well ahead of the US$ 800/tonne level*."

Research on fry (selection, growth potential) and feed (nutrition and composition of substitution food of vegetal origin) conducted by private companies and public research institutes are expected to contribute to cost reduction and quality improvement in the medium term.

In many countries, and more dramatically where aquaculture is a new industry, national legislation does not take into account the specificity of this industry. Access to the shore, to coastal areas and to input (material, feed) may be administratively complicated and financially costly. A close look at the recent history of the aquaculture industry throughout the world shows that to flourish, aquaculture needs the full support of the national authorities.

In all countries around the Mediterranean Sea, aquaculture gets a boost when there is clear national political will. On the contrary, this risky business may not develop if it is not considered as strategic. In most countries, adopted legislation needs to be enforced.

The Mediterranean coastline is a favourite destination for travellers because of its unique climate. Today, the century-old tourist industry and the nascent aquaculture business are important and promising activities. However, they happen to be complementary and sometimes competing.

In countries with a solid Western-type tourism, hotels and restaurants may offer a dynamic outlet for high-value farmed species. In Morocco, farmed seabass and seabream, not to mention oysters, find their way to upper-class tourist hotels and restaurants. Though we are not aware of any ecotourism projects, offering tourists the chance to visit farming sites may be a promising activity. The combination of tourism and aquaculture is commonly and profitably managed in other parts of the world (Indonesia, Viet Nam, Thailand).

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[2] University of Stirling. 2004.
[3] Communication, Mr Corlay, aquaculture manager. Available at www.legouessant.com

In some countries, aquaculture and tourism may compete for access to favourable sites. This is the case in France and Cyprus. The movement favourable to the protection of the environment may prevent situating fish farming activities in fragile sites.

1.2 Marketing performance

The major markets for seabass and seabream are located in southern Europe, where both species belong to fishing and culinary traditions and where domestic production does not satisfy the appetite of the population for the species. First Italy, and then Spain and France, are the most well established and large-scale markets. From 1996 to 2004 imports of fresh seabass soared from 4 200 tonnes to 16 800 tonnes in Italy, and from 570 tonnes to 6 800 tonnes in Spain. Over the same period, imports of seabream increased from 2 500 to 12 700 tonnes in Italy, from 70 tonnes to 2 200 tonnes in Portugal and from 2 500 tonnes to 12 700 tonnes in France. The double-digit annual growth in those traditional markets is now slowing down to a few percentage points per annum.

Seabass is slightly more widely distributed than seabream, and is known as far north as the Baltic Sea, whereas seabream is better known further south. In Germany, the United Kingdom and the Netherlands, seabream is clearly perceived as an 'exotic' species.

After 15 years of intensive aquaculture, increasing production and declining prices, some markets naturally open to these species are close to saturation for the traditional whole fresh product. Massive and regular supplies at medium prices have given a large proportion of the population access to these products. In the French and Italian markets, further development could come from creation of value-added products if and when production costs decline enough to allow items to be processed at competitive prices.

In northern Europe, where consumers have little appetite for whole fish, sales of whole fresh seabass and seabream have been moderate. Future growth in sales will depend upon the capacity of producers and processors to offer products in demand, namely fillets, at good prices. By contrast, sales of fillets of cheaper farmed fish (tilapia, catfish Pangasius) are doing well.

The €5/10 kg retail price for seabass and seabream is far too high for a large proportion of the population living on the southern rim of the Mediterranean basin. Most of the production of seawater fishes located in countries on the southern coast is directed either to the limited markets serving the upper-class population or to export markets.

By contrast, finfish such as carp or tilapia, which cost less to produce, are predominantly destined for local markets. Moreover, the lack of logistic infrastructure and the deficiencies of the handling, transporting and marketing operations prevent these products from being exported to more demanding markets. For instance, the huge tilapia production in Egypt is marketed entirely within the country.

Seafood consumption is showing a positive trend in most European countries. In a context of wild fish shortage, as a result of both high demand and declining available fisheries resource, market circumstances look favourable for farmed fish. However, commercial success depends upon the ability of sellers to be price competitive (compared to other, same-species producers, and compared to other farmed species) and to comply with buyers' specifications.

Consumers tend to favour the species they know, unless something attractive catches their attention. Price is probably the primary enticing factor. Price was, for instance, a major reason for the success of Nile perch, and explains the recent boom in pangasius sales.

Seabass and seabream are extensively sold as fresh head-on, round or gutted small-sized fish. Despite a potential demand, industrial production of fillets is marginal. Production costs of large-sized fish are high and do not allow for competitive prices. For similar reasons, no other value-added items are available on the market.

Until now the creation of value added was limited to immaterial transformation of products, such as 'labelling' or producing 'organic' fish. In complying with specific organic production standards, some farmers add a true value as perceived by a fragment of consumers. Other farmers have established partnership contracts with retailers that allow their fish to carry the quality label of the retailer. Branding fresh fish is a marketing option rarely used by producers, mainly because of their small size and lack of financial resources. Yet retailers and large-scale wholesalers are developing their own brands to apply to fresh fish, and more specifically to farmed fish. Bass and bream, as well as salmon, are often distributed with retailers' quality brands.

Public authorities have severely strengthened regulations related to the safety of food products. For instance, they consider traceability of product origin of prime importance for the protection of consumers, and made it a compulsory rule. What was considered a value added a few years ago is now a legislative requirement.

Protecting the environment is clearly perceived as a value for today. Some national and private organic standards for aquaculture finfish have been developed, and a few producers launched organic seabass and seabream on the European market. Nonetheless, overall production is estimated to be a few hundred tonnes. The EU standards, which should apply from 2009, are expected to clarify the supply conditions and boost production.[4]

Little collective marketing effort has been deployed for making seabass and seabream known and for promoting their benefits to consumers. Most of the communication efforts have advertised advantageous prices.

2. Major market traits of finfish by species

Important note on statistics utilized

In this report, data referring to fisheries' captures is based on the homogeneous statistics provided by the Food and Agriculture Organization (FAO). In most countries, declaration of captures by professional fishermen of high-value species such as seabass and seabream are underestimated. Nevertheless, the FAO data are considered to give a reasonably sound picture of the overall level of catches by country across time, allowing for temporal and intercountry comparisons.

The aquaculture production statistics used in this report were provided by FAO and the SIPAM Network, and enhanced with 2005 data provided by the Federation of European Aquaculture Producers (FEAP). These statistics are not always accurate. Discrepancies with other sources and with reality have been detected. Default of the fish farming industry statistics was clearly evidenced in the University of Stirling report.

2.1 Seabass (*Dicentrarchus labrax*)

According to official figures, wild fisheries production of seabass in Europe is generally stable at circa 10 000 tonnes per year, with France and Italy being the most significant producing countries. Moreover, leisure catches of seabass are said to be very important, given the popularity of seabass

[4] EC Com 2005 671 Final, December 2005, Proposal for a Council regulation on organic food and labelling of organic products.

with anglers. In France, the French Research Institute for Exploitation of the Sea (Ifremer) demonstrated that non-professional fishermen catch as much seabass as professional fishermen.[5]

Table 1: Capture production of seabass* (Dicentrarchus labrax) *(in tonnes)

Country	1996	1997	1998	1999	2000	2001	2002	2003	2004
Albania	32	14	30	30	50	70	64	2	13
Channel Islands	56	74	79	107	129	80	73	84	159
Croatia	–	–	31	20	22	13	2	5	3
Denmark	1	1	2	1	5	2	1	1	1
Egypt	727	453	559	662	626	800	1 336	1 404	942
France	3 330	3 012	2 793	3 503	4 152	4 208	4 064	4 998	4 792
Greece	455	380	258	289	345	300	469	567	681
Italy	2 481	2 030	1 889	1 881	2 195	2 735	3 428	3 412	3 318
The Netherlands	8	1	49	32	60	79	96	164	192
Portugal	57	40	38	37	49	43	43	47	67
Slovenia	–	–	–	1	1	5	4	–	2
Spain	534	474	457	541	670	584	543	387	530
UK	582	572	501	687	406	457	640	589	621
Total	**8 263**	**7 051**	**6 686**	**7 791**	**8 710**	**9 376**	**10 763**	**11 660**	**11 321**

Source: FAO.

In 2003 and 2004, Turkey landed 700 tonnes and 628 tonnes, respectively, of wild seabass.
By contrast, farmed production has dramatically increased since the mid-1980s, to reach over 60 000 tonnes in 2004. According to FEAP, European production of seabass reached an estimated 60 000 tonnes in 2005. That year, Greece was the largest supplier with 35 000 tonnes produced, followed by Turkey (20 900 tonnes), Italy (9 800 tonnes) and Spain (6 130 tonnes).

Table 2: Farmed production of seabass (in tonnes)

Country	1997	1998	1999	2000	2001	2002	2003	2004	2005*
Croatia	1 450	1 300	1 300	1 300	1 700	1 800	1 702	2 100	1 600
Cyprus	57	205	299	299	383	421	301	765	800
Egypt	2 238	3 612	2 726	10 031	913	1 239	1 789	1 812	na
France	2 185	2 600	3 225	3 310	2 850	3 230	3 580	3 570	4 300
Greece	11 820	13 200	20 000	22 296	23 882	23 494	27 324	25 691	35 000
Italy	4 600	5 850	7 200	8 100	9 500	9 600	9 600	6 831	9 800
Malta	300	80	80	234	206	53	98	131	131
Morocco	568	563	275	250	202	325	389	370	na
Portugal	524	513	1 325	653	925	808	1 384	1 235	1 500
Spain	511	936	1 227	1 837	2 269	3 422	4 177	4 513	6 130
Tunisia	181	300	184	198	461	648	458	466	na
Turkey	6 300	8 660	12 000	17 877	15 546	14 339	20 982	26 297	20 900
Total	**30 734**	**37 819**	**49 841**	**66 135**	**57 912**	**58 571**	**na**	**na**	**na**

Note: na = not available. *FEAP preliminary data.
Source: FAO, Fishstat.

Imports of fresh/chilled seabass (round fish, gutted or not) reached 40 126 tonnes in 2005, compared to 5 404 tonnes in 1996. The bulk of all supplies originated in EU countries, yet the market share of EU products dropped from an approximate 80 percent in the late 1990s to 70 percent in recent years. This reflects the success of Turkish products, whose market share in terms of volume reached 25 percent in 2004.

[5] Available at www.ifremer.fr

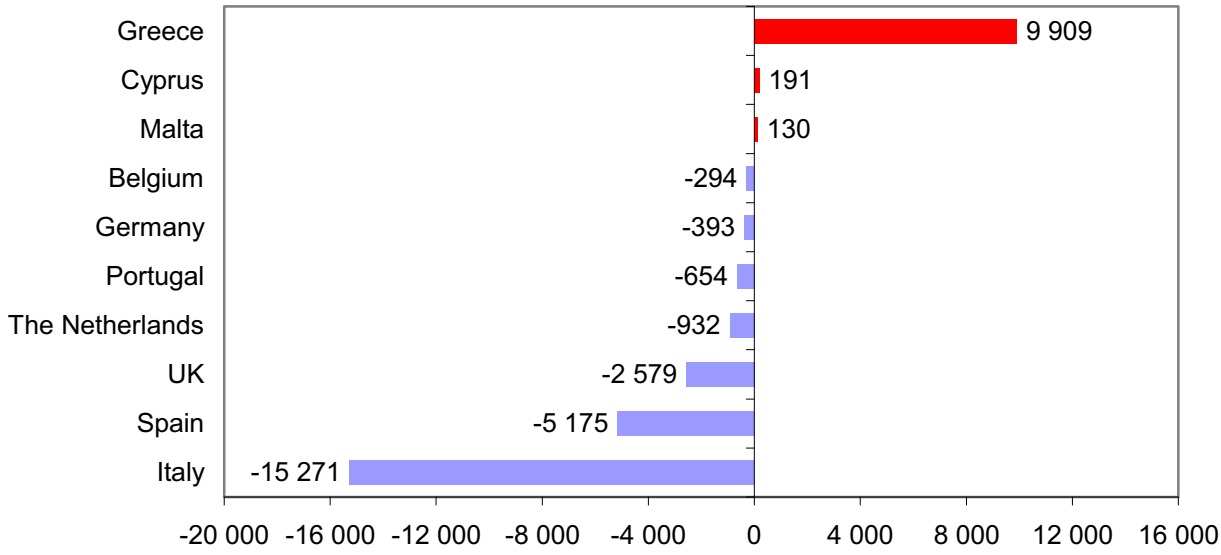
Table 3: EU imports of fresh seabass

Supplier of EU imports	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
World (tonnes)	5 404	8 117	9 486	16 136	19 448	25 650	32 088	30 648	33 399	40 126
EU countries (%)	79%	82%	82%	77%	83%	84%	79%	76%	72%	72%

Source: Eurostat.

Greece is the largest supplier of fresh seabass to Europe (net export worth 9 909 tonnes in 2004), while Italy, despite a considerable production, is the largest importer, with a trade deficit of more than 15 000 tonnes. Countries not mentioned in the following graph are characterized by a balanced trade situation (exports offsetting imports). This is the case of France, with some 3 000 tonnes traded both ways in 2004.

Figure 1: EU trade balance of fresh seabass in 2004, exports-imports (in tonnes)



Source: Eurostat.

Italy (16 000 tonnes), Spain (7 000 tonnes) and France (3 000 tonnes) are the three largest importers of fresh seabass, accounting for nearly 80 percent of all imports in 2004. However, this market share is slowly declining, reflecting the success of this species in other, non-traditional markets.

Table 4: Concentration of imports of fresh seabass into three countries

Country	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
Italy	78%	75%	72%	62%	55%	44%	42%	48%	50%	47%
Italy & Spain	89%	86%	83%	75%	76%	72%	72%	72%	70%	52%
Italy, Spain & France	94%	91%	88%	81%	84%	80%	80%	80%	79%	61%

Source: Eurostat.

Table 5: Imports of fresh seabass into non-traditional markets (in tonnes)

Country	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
UK	63	172	494	1 122	1 070	1 453	2 364	2 655	2 671	3 964
The Netherlands	30	43	87	740	677	861	1 061	931	1 050	1 383
Portugal	17	50	70	260	510	1 470	923	807	864	1 386
Germany	140	182	179	223	443	469	626	427	413	517

Source: Eurostat.

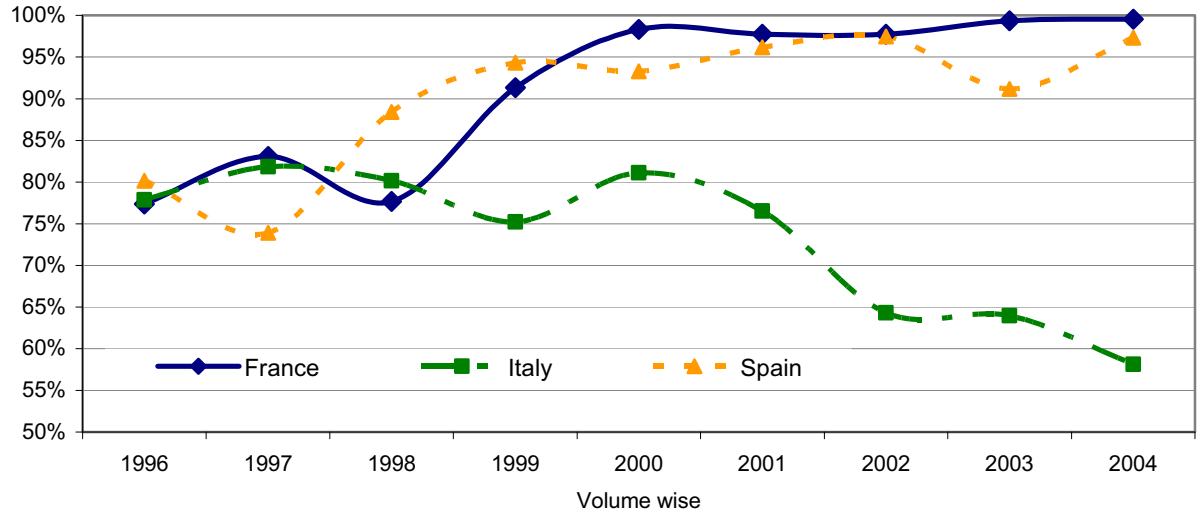
Table 6: EU imports of fresh and chilled seabass

Supplier of EU imports	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
World (tonnes)	5 404	8 117	9 486	16 136	19 448	25 650	32 088	30 648	33 399	40 126
Turkey (tonnes)	376	383	396	2 719	2 070	2 967	5 627	6 100	8 321	10 040
Turkey (%)	7%	5%	4%	17%	11%	12%	18%	20%	25%	25%
Turkey and EU countries (%)	85%	87%	86%	94%	94%	96%	96%	96%	97%	96%

Source: Eurostat.

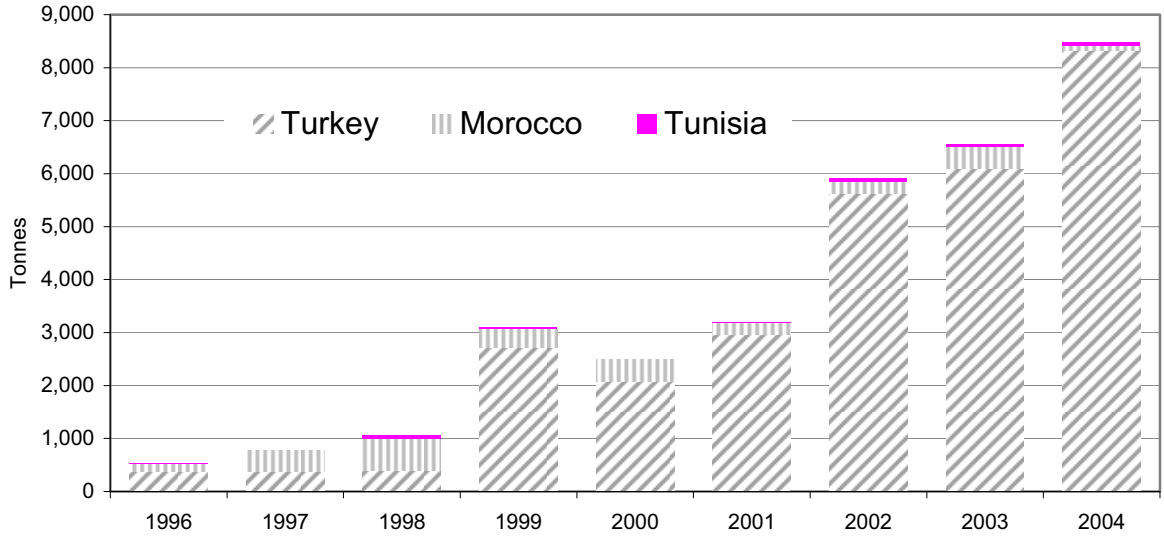
Imports of fresh seabass from other than EU and Turkey are nearly non-existent.

Figure 2: Market share of EU fresh seabass in total imports by country



Source Eurostat.

Figure 3: EU imports of fresh seabass from non-EU countries



Source: Eurostat.

Non-EU supplies other than those from Turkey are very limited. In good years Morocco exports a few hundred tonnes to Europe, and in Tunisia the business is still in the experimental phase.

Table 7: EU imports of fresh seabass from non-EU countries (in tonnes)

Supplier of EU imports	**1996**	**1997**	**1998**	**1999**	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**
Turkey	376	383	396	2 719	2 070	2 967	5 627	6 100	8 321	10 040
Morocco	146	399	594	347	423	214	230	421	90	365
Tunisia	11	2	60	35	0	11	61	40	56	53

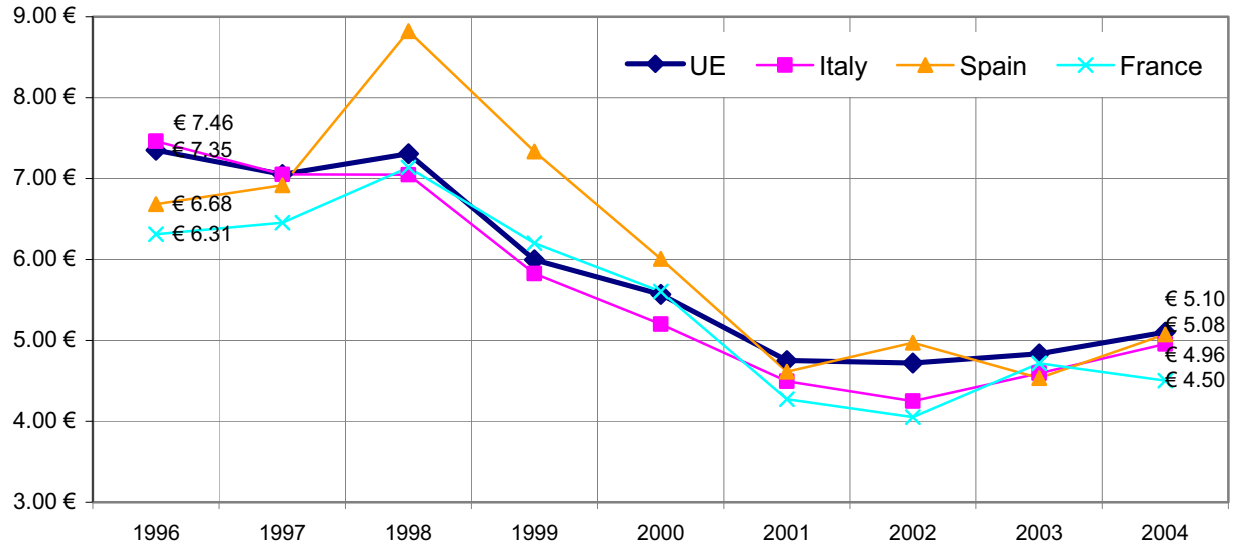
Source: Eurostat.

The import situation of the main importing countries varies greatly. While France and Spain rely extensively on EU products, Italy has opened up its market to external supplies. In 2004, EU products represented 100 percent of French imports, 97 percent of Spanish imports and at no more than 59 percent of Italian imports.

The main feature of seabass marketing in the past ten years is the dramatic drop in prices. In 2004, average import prices ranged from €4.50/kg to €5.10/kg.

The latest ex-farm prices for Greek fish indicate that small-sized fish reach the main market (Italy, Spain, France) at prices below €4.00/kg c.i.f. (costs, insurance, freight all inclusive). Seabass prices place the fish at a median position in the market. In February 2006, in Spain, the price of fresh small-sized seabass was the same as the price of small-sized hake (c.i.f. prices between €2.70/kg and €4.50/kg), above the price of whiting (€0.70/kg and €1.20/kg) and slightly above the price of salmon (€3.00/kg and €3.20/kg).

Figure 4: Import prices of fresh seabass per kilo (1996–2004)



Source: Eurostat.

Table 8: Greek prices of seabass (February 2006)

Grading	€/kg	Market	Grading	€/kg	Market	Grading	€/kg	Market
		Country			Country			Country
	Ex Patra-Greece							
150-200 g		**Greece**	150-200 g	(c.i.f)	**Spain**	150-200 g		**UK**
200-300 g	3.10		200-300 g	3.35		200-300 g	3.55	
300-450 g	3.70		300-450 g	3.95		300-450 g	4.15	
450-600 g	3.90		450-600 g	4.15		450-600 g	4.35	
600-800 g	5.30		600-800 g	5.55		600-800 g	5.75	
800-1 000 g	8.00		800-1 000 g	8.25		800-1 000g	8.45	
1000 + g	9.00		1 000 + g	9.25		1 000 + g	9.45	
150-200 g		**Italy**	150-200 g	(c.i.f)	**Germany**			
200-300 g	3.30		200-300 g	3.43		**Comments**		
300-450 g	3.90		300-450 g	4.03				
450-600 g	4.10		450-600 g	4.23		The situation in seabass is as follows:		
600-800 g	5.50		600-800 g	5.63		The prices remained the same compared to January:		
800-1 000 g	8.20		800-1 000 g	8.33				
1 000 + g	9.20		1 000 + g	9.33		200-300 g zero change		
						300-450 g zero change		
150-200 g	(c.i.f)	**France**	150-200 g	(c.i.f)	**Portugal**	450-600 g zero change		
200-300 g	3.36		200-300 g	3.40		600-800 g zero change		
300-450 g	3.96		300-450 g	4.00		800-1 000 g zero change		
450-600 g	4.16		450-600 g	4.20		1 000 + g zero change		
600-800 g	5.56		600-800 g	5.60				
800-1 000 g	8.26		800-1 000 g	8.30				
1 000 + g	9.26		1 000 + g	9.30				

Source: Globefish.

Thanks to the proximity of production sites to markets and to the appetite of European consumers for fresh products, seabass is predominantly sold fresh, head-on gutted or not.

The bulk of aquaculture production regards small-sized fish (300 g–500 g). Production of larger-sized fish is seen as a means for differentiation, but the high production costs somehow impede the

development of the option. This is the way some French farmers, who are not price-competitive in the production of small-sized fish, attempt to escape from direct competition.

Production of fillets at competitive prices is a challenge for the seabass industry. The cost of producing large-sized fish and the yields for making fillets out of seabass have so far discouraged the development of this product diversification. However, the demand in most markets is real. The northern markets are reluctant to buy whole portion-sized fish, and the southern markets increasingly demand convenience products. Even in those markets which are very open to bass, a proportion of the population is reluctant to buy whole fish, considering that it is more difficult to cook than fillets.

Research on genetics and selection is currently being carried out by private companies (e.g. Aquanord, Nireus) and research institutes (e.g. IFREMER, Palavas) to facilitate the production of larger animals at lower cost.

Box 1: Current European market prices for seabass fillets

Yield for getting a skin-on scaled, belly-off fish from a round fish is circa 42 percent. A 560 g fish would give a 120 g fillet. At today's prices (€5.50/kg c.i.f. major market, + €2.00/kg processing and packaging + a 10 percent mark-up), seabass fillets could be on sale (ex-processing plant) at circa €16.50/kg. Fillet of 100 g each and made of small and cheaper fish at today's prices (March 2006) would be sold by processors at circa €13.20/kg. These prices are prohibitive while white fish fillets, including fillets of highly appreciated species (cod, haddock) are on sale (ex-processing plant) at less than €10.00/kg.

Based on a store check, skin-on fillets made of Greek fish were offered at the discount price of €19.90/kg for a 450 g pack or €20.90/kg for a 250 g pack (at Esselunga, Italy, March 2006)…

…and skin-on seabass fillets made of farmed fish (origin not indicated) and filleted by the fishmonger himself sold at €28.00/kg (fishmonger, Central Paris, March 2006).

In all countries where both wild and farmed fish are available, the farmed fish are priced lower.

Table 9: Wholesale prices of farmed versus wild seabass in 2006

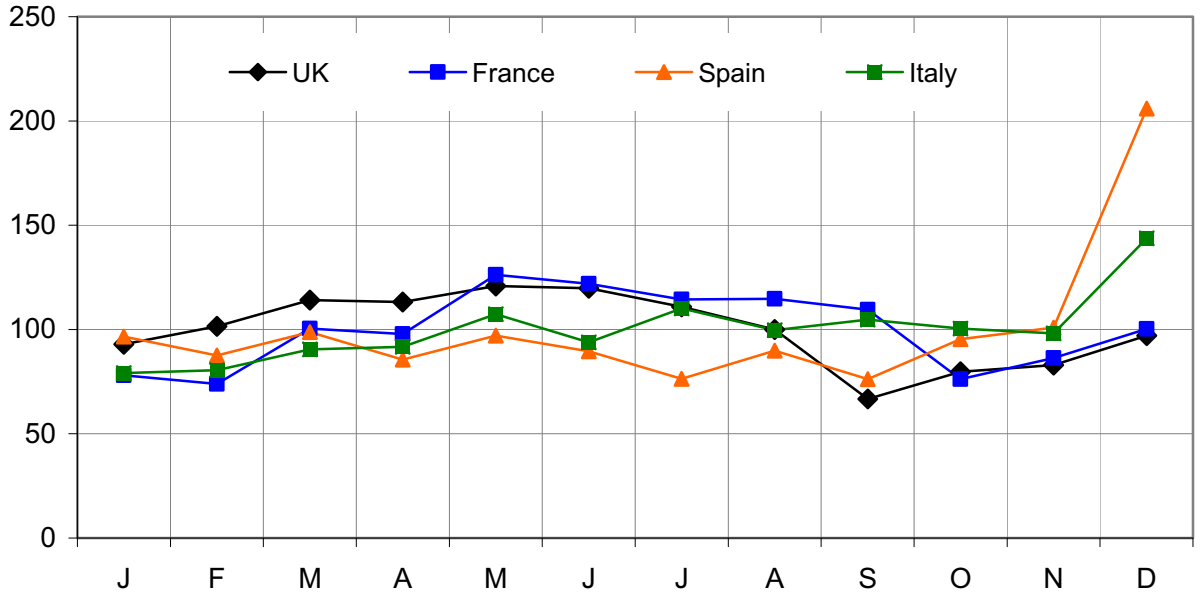
Market	**Farmed seabass**		**Wild seabass**	
	weight	€/kg	weight	€/kg
Marseille wholesale fish market (19 July 2006)	700-800 g	12.00	line caught 800-1 000 g	21.00
Rouen wholesale fish market (19 July 2006)	600-700 g	10.15	trawl caught 1-2 kg	27.25
Mercamadrid (17 March 2006)	na	4.45	na	18.03

Note: na = not available.
Source: Wholesale markets.

Note that the price per kilogram varies not only because of production method but also according to the size: the bigger the fish, the more expensive.

All across Europe, the demand is generally even throughout the year, with a peak in consumption in December in southern countries, where seabass is still favoured for special occasions.

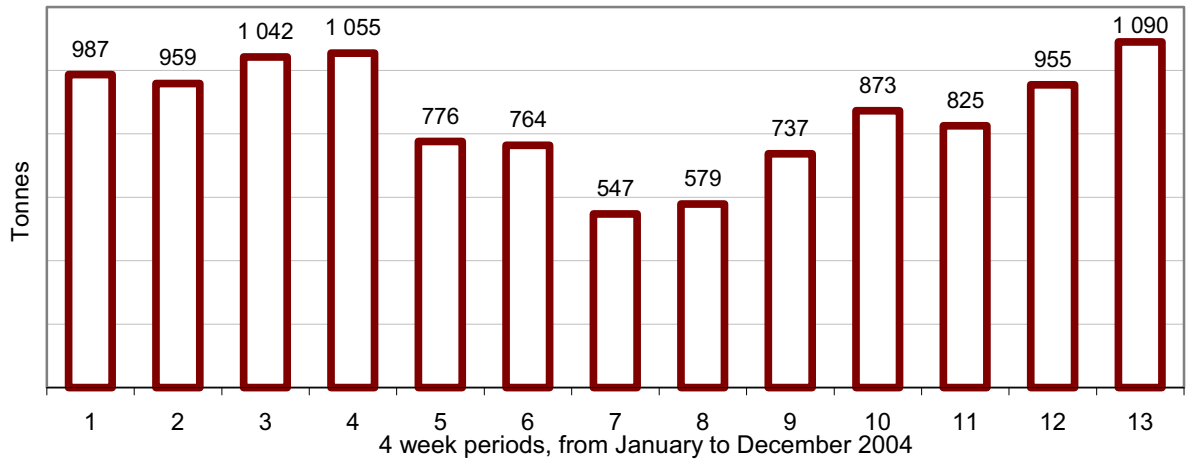
Figure 5: Seasonality of imports of fresh seabass (average monthly imports over the period January 2003–September 2005 = index 100)



Source: Eurostat.

In Italy, demand is lower during the summer months.

Figure 6: Retail sales of fresh seabass in Italy in 2004



Source: Ismea, 2005 bis.

Where is seabass sold?

In countries (France, Italy, Spain) where whole fresh seabass has become a basic item regularly supplied by competing sources, different marketing strategies have been developed by individual suppliers. Developing value-added products was one strategy, which turned out to be very difficult because of the high cost of raw fish products, the structure of the industry and the market situation for fillets, either fresh or frozen.

Based on information collected from wholesalers, the catering industry seems to absorb significant volumes in all major markets (France, Italy, Spain). However, solid data on the subject is not available. The Istituto di servizi per il mercato agricolo alimentare (Ismea) reveals that purchase by commercial restaurants of seabass and seabream in 2003/2004 amounted to 10 000 tonnes per year. In France, restaurants' purchases of seabass (including wild fish) were estimated at 5 000 tonnes in 2004. That year 3 500 tonnes were retailed, of which 2 500 tonnes in supermarkets. In 2005, preliminary figures show overall sales of 4 264 tonnes, of which 2 890 tonnes in supermarkets.

Price promotions as a marketing strategy

In France from 1999 to 2005, retail sales of fresh seabass (product weight) increased dramatically (282 percent). During that period, volumes sold by the modern retailers skyrocketed with an increase of 467 percent, thanks to their abilities and techniques of attracting consumers with low price offers.[6] In 2005, supermarkets' market share reached 70 percent, compared to a mere 40 percent six years earlier. This is far above the average trend. Supermarkets have taken full advantage of the supply conditions of farmed seabass, as they did a decade ago with salmon. We shall see that the picture is similar for seabream.

Fish is traditionally sold in bulk, priced according to weight purchased. However, supermarkets have introduced some new ways to sell fresh seafood. Well organized and well advertised price promotions generate huge sales and good turnover for individual shops. Supermarkets frequently sell fish by the piece, or by two or three fish lots. When sold by the piece, seabass is promoted at prices ranging from €2.00 to €3.00 per piece (2006 prices).

Box 2: Marketing strategy – price promotions

	A 230 g pack of gutted seabass was sold at €2.28 at Esselunga supermarkets during a March 2006 campaign.
Three small-sized un-gutted fish may be found at prices below €10.00 per pack at Esselunga supermarkets. Three pieces, gutted, farmed in Greece sold at €7.68 per pack (800 g, €9.60/kg).	

[6] Secodip, a market research agency.

Product branding as another strategy

When competition is intense, branding the product may be perceived as a winning strategy. However, developing private branding is hardly possible for small-scale seabass farmers. Instead, they have developed partnerships with large-scale buyers. Supermarket chains and wholesalers (cash and carry distributors) offer their customers guaranteed quality products that they acquire at carefully selected farms. Carrefour, Auchan, Coopitalia, Intermarché and Cora are among some of the supermarkets that sell whole fish under their own quality brand. Large-scale wholesalers selling on a national scale to the food service industry have developed concurrently their own labels, which convey safety and quality assurances. In 2005, 30 percent of all fresh seafood sold by wholesaler Métro in France comprised fish of its own brand "Filière metro", created in 2000.

Box 3: Marketing strategy – branding product

	A seabass pack with the Esselunga supermarket label.
In December 2005, Cora sold its branded fish 'EDO' at €3.00 per fish.	

A limited number of producers choose to produce organic fish, and overall supplies of organic seabass in Europe are extremely limited (a few thousand tonnes at most).

2.2 Seabream (*Sparus aurata*)

Official data regarding fisheries of wild gilthead seabream report production that fluctuates between 5 000 tonnes and 10 000 tonnes. The principal fisheries are in Italy, Egypt and Spain.

Table 10: Capture production of seabream* (Sparus aurata) *(in tonnes)

Country	1996	1997	1998	1999	2000	2001	2002	2003	2004
Albania	27	11	20	20	23	90	181	8	8
Croatia	13	44	84	27	25	11	6	6	8
Egypt	1 228	1 087	1 225	1 955	2 478	2 312	2 480	1 373	1 353
France	287	221	213	378	376	369	455	618	748
Greece	199	138	125	142	248	176	170	172	131
Italy	1 743	1 859	1 717	1 754	1 939	2 675	3 004	2 999	3 349
Morocco	–	–	4	–	206	25	9	14	77
Portugal	213	198	173	151	183	213	268	94	175
Serbia and Montenegro	4	4	4	6	6	7	7	7	4
Slovenia	–	–	–	1	1	4	4	2	4
Spain	681	546	508	956	1 229	2 164	1 174	954	978
Tunisia	107	265	333	409	757	399	822	1 026	1 140
Turkey	1 340	1 200	1 400	1 665	830	1 070	700	794	879
Total	**5 842**	**5 573**	**5 806**	**7 464**	**8 301**	**9 515**	**9 280**	**8 067**	**8 854**

Source: FAO.

The European production of gilthead seabream was estimated at 76 000 tonnes in 2005. That year Turkish production reached 15 500 tonnes. In addition, a few hundred tonnes of other Sparidae fish were produced.

Table 11: Farmed production of seabream (in tonnes)

Country	1997	1998	1999	2000	2001	2002	2003	2004	2005*
Algeria	8	6	12	3	32	34	1	1	–
Croatia	350	550	450	800	800	700	808	800	1 000
Cyprus	769	828	986	1 385	1 278	1 267	964	1 457	1 600
Egypt	2 252	3 682	2 733	8 862	1 053	1 662	2 424	2 465	–
France	1 180	1 500	1 200	1 270	1 630	1 200	1 390	1 580	1 900
Greece	13 680	17 700	28 000	28 000	34 226	37 006	44 118	37 394	50 000
Italy	3 900	10 100	5 700	6 000	7 800	9 000	9 000	5 845	7 800
Malta	1 500	1 870	1 922	1 512	1 091	1 122	835	782	800
Morocco	254	161	466	390	304	378	378	350	–
Portugal	742	2 442	1 862	1 815	1 762	1 855	1 449	1 685	2 500
Spain	3 969	4 933	6 117	8 305	9 862	11 653	12 783	13 848	15 560
Tunisia	178	66	39	409	448	352	528	679	–
Turkey	7 500	10 150	11 000	15 460	12 939	11 681	16 735	20 435	15 500
Total	**36 282**	**53 988**	**60 487**	**73 821**	**71 430**	**76 021**	**na**	**na**	**91 100**

* FEAP preliminary data.
Source: FAO, Fishstat.

Table 12: Farmed production of* Diplodus sargus/annularis/puntazzo/vulgaris/puntazzo puntazzo *(in tonnes)

Country	1997	1998	1999	2000	2001	2002	2003	2004
Croatia	–	–	8	15	50	100	40	50
Cyprus	15	21	28	53	64	12	1	–
Greece	–	–	–	–	–	1 957	–	135*
Italy	200	300	350	400	400	400	400	–
Morocco	28	2	–	–	–	–	–	–
Total	**243**	**323**	**386**	**468**	**514**	**2 469**	**na**	**na**

Source: FAO, *Fishstat, Dip. puntazzo/sargus/vulgaris/spp.

In addition circa 48 tonnes of Sparidae and other *Sparus aurata* were produced in Spain and circa 50 tonnes in Croatia.

Table 13: EU imports of fresh seabream

Supplier of EU imports	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
World (tonnes)	3 756	5 648	7 208	13 238	16 783	21 615	20 289	20 296	21 311	24 185
EU countries (%)	70%	63%	77%	82%	89%	93%	91%	91%	93%	90%

Source: Eurostat.

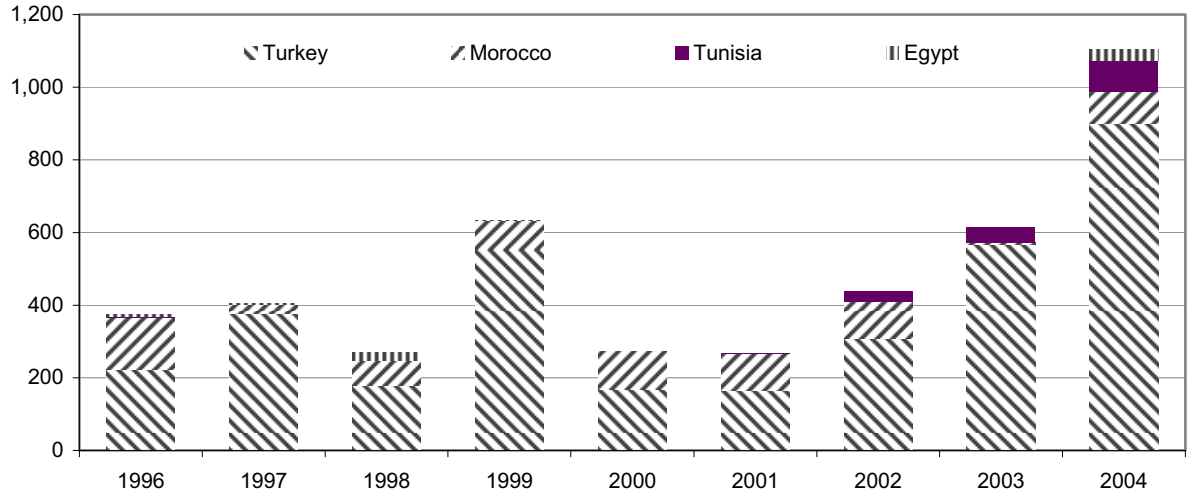
Turkey is again the major non-EU supplier of seabream to Europe. Morocco sells regularly several tens of tonnes per year.

Table 14: EU imports of fresh seabream from non-EU countries

Supplier of EU imports	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
World (tonnes)	3 756	5 648	7 208	13 238	16 783	21 615	20 289	20 296	21 311	24 185
Non-EU countries (tonnes)	1 119	2 077	1 636	2 437	1 871	1 473	1 852	1 855	1 571	2 392
Turkey (tonnes)	222	379	179	554	169	166	309	566	902	180
Turkey (%)	6%	7%	2%	4%	1%	1%	2%	3%	4%	1%
Morocco (tonnes)	144	23	68	78	105	99	99	7	86	80
Tunisia (tonnes)	6	1	0	1	0	3	29	41	86	36

Source: Eurostat.

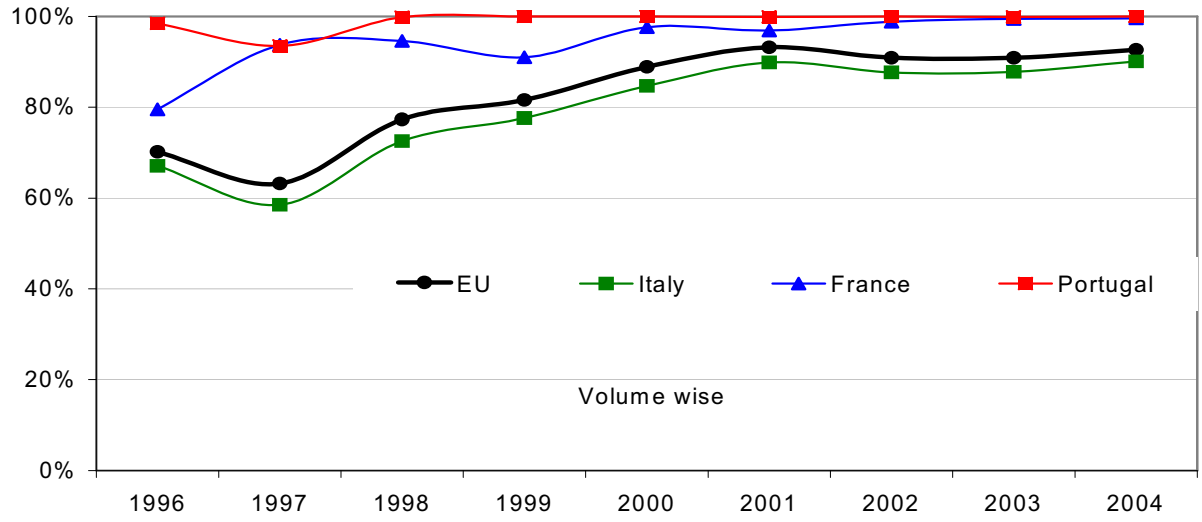
Figure 7: EU imports of fresh seabream from non-EU countries (in tonnes)



Source: Eurostat.

Because of domestic production increase and limited performances of other countries in the Mediterranean basin, the EU is gaining independence from external supplies of fresh seabream.

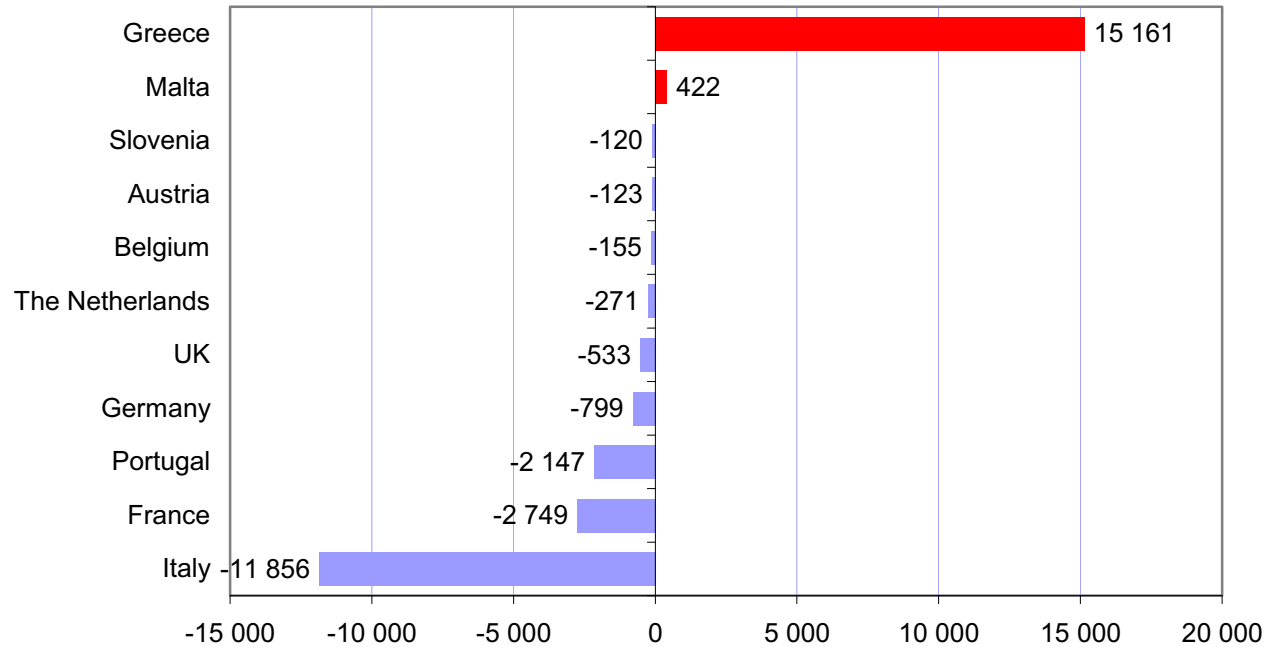
Figure 8: Market share of European seabream in total imports



Source: Eurostat.

Greece enjoys the largest positive trade balance, with over 15 000 tonnes in 2004. Italy, despite a production of 9 000 tonnes, remains by far the largest import market.

Figure 9: EU trade balance of fresh seabream in 2004, exports–imports (in tonnes)



Source: Eurostat.

Market

Seabream is predominantly traded as fresh head-on fish, gutted or not. Non-traditional markets (northern Europe) have been less attracted to seabream as compared to seabass. Seabream, which is not fished in northern Europe, carries, like all other fish of the Sparidae family, a clearly 'southern' or 'exotic' image.

In 2004 the United Kingdom imported 533 tonnes of fresh seabream, compared to 2 670 tonnes of seabass. The Netherlands imported 270 tonnes of seabream and over 1 000 tonnes of seabass. Austria imported only 30 tonnes of seabream in 2004, compared to 210 tonnes of seabass.

For seabream as well, the preference is for wild fish. This is reflected in the price gap between wild and farmed fish.

Table 15: Wholesale prices of farmed versus wild seabream

Market	**Farmed seabream**		**Wild seabream**	
17 March 2006	weight	€/kg	weight	€/kg
Marseille wholesale fish market	500-800 g	8.50	500-800 g	13.50
Rouen wholesale market	500-800 g	7.00	na	na
Mercamadrid	na	5.00	na	12.02

Note: na = not available

Source: Individual Wholesale Markets

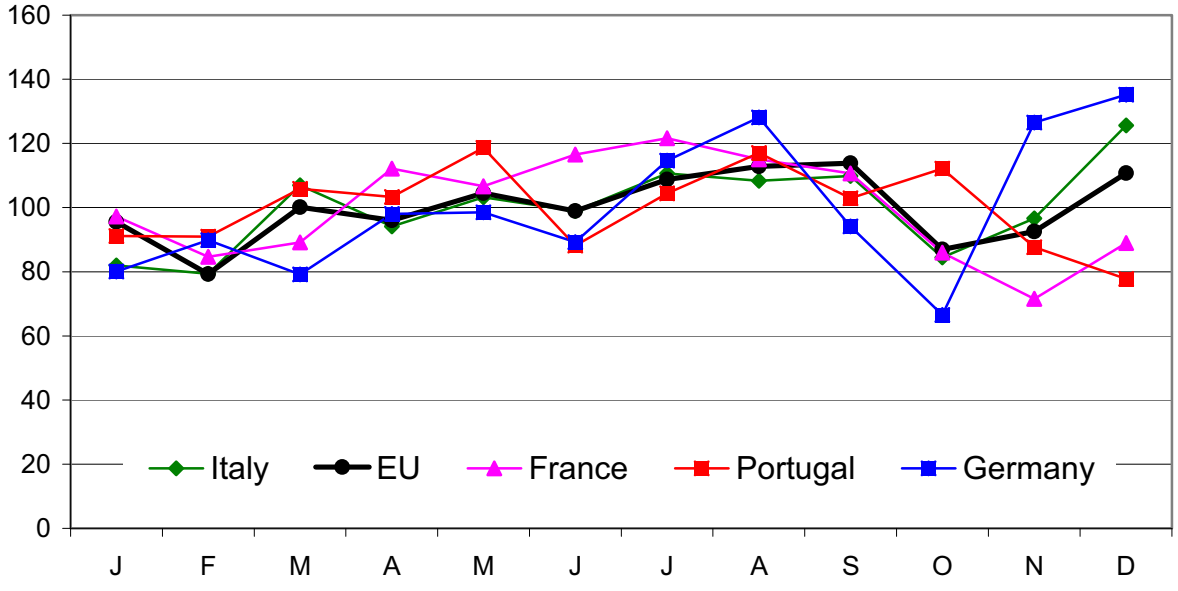
Table 16: Greek prices of seabream (February 2006)

Grading		Market	Grading		Market	Grading		Market
	€/kg	Country		€/kg	Country		€/kg	Country
	Ex Patria-Greece							
150-200 g		**Greece**	150-200 g	(c.i.f.)	**Spain**	150-200 g	(c.i.f.)	**UK**
200-300 g	3.80		200-300 g	4.05		200-300 g	4.25	
300-450 g	4.10		300-450 g	4.35		300-450 g	4.55	
450-600 g	4.20		450-600 g	4.45		450-600 g	4.65	
600-800 g	5.30		600-800 g	5.55		600-800 g	5.75	
800-1 000 g	9.00		800-1 000 g	9.25		800-1 000 g	9.45	
1 000 + g	10.00		1 000 + g	10.25		1 000 + g	10.45	
150-200 g	(c.i.f.)	**Italy**	150-200 g	(c.i.f.)	**Germany**			
200-300 g	4.00		200-300 g	4.13		**Comments**		
300-450 g	4.30		300-450 g	4.43				
450-600 g	4.40		450-600 g	4.53		The situation in seabream is as follows:		
600-800 g	5.50		600-800 g	5.63				
800-1 000 g	9.20		800-1 000 g	9.33		The price increases compared to January:		
1 000 + g	10.20		1 000 + g	10.33		200-300 g increased by 11.7%		
						300-450 g increased by 5.1%		
150-200 g	(c.i.f.)	**France**	150-200 g	(c.i.f.)	**Portugal**	450-600 g increased by 5.0%		
200-300 g	4.06		200-300 g	4.10		600-800 g increased by 1.9%		
300-450 g	4.36		300-450 g	4.40		800-1 000 g increased by 2.3%		
450-600 g	4.46		450-600 g	4.50		1 000 + g zero change		
600-800 g	5.56		600-800 g	5.60				
800-1 000 g	9.26		800-1 000 g	9.30				
1 000 + g	10.26		1 000 + g	10.30				

Source: Globefish.

Imports are generally stable throughout the year, with a peak at the end of the year in most countries. Note that in France and Germany the highest import period is the summer, when seabream is a favourite fish for cooking on an outdoor grill.

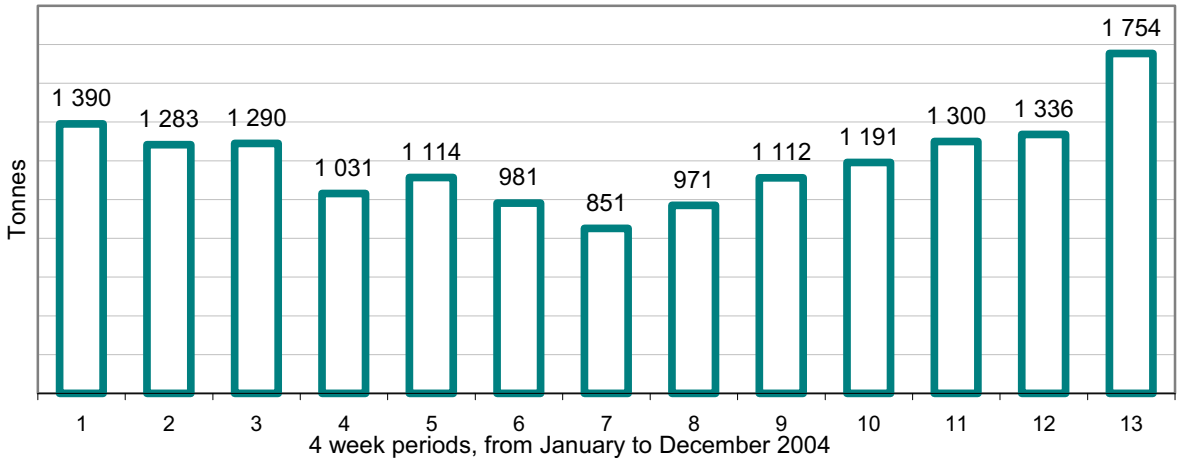
Figure 10: Seasonality of imports of fresh seabream (average monthly imports over the period January 2003–August 2005 = index 100)



Source: Eurostat.

By contrast, in Italy, the lowest consumption is in the summer, while traditional family gatherings festive occasions for eating high-status seabream.

Figure 11: Purchases of fresh seabream in Italy in 2004



Source: Ismea, 2005.

How and where is gilthead seabream sold?

Based on information collected from wholesalers, the catering industry is expected to absorb significant volumes of seabream in all major market (France, Italy, Spain).

The species is retailed to consumers by traditional fishmongers and by large-scale retailers. The market share of supermarkets has considerably increased as sales soared.

Box 4: Marketing of gilthead seabream by piece, pack and promotional offer

Sold by the piece, this head-on fish is currently retailed by large-scale retailers at prices below €10.00/kg. 230 g tray sold at €9.90/kg (March 2006).	
Sale by the piece instead of by the kg is quite common. The fish below retailed at Carrefour at €2.90 per fish (December 2005).	

<table>
<tr><td>  </td><td>These fish (each 300 g minimum weight) were sold at €2.60 per piece in Géant/Casino supermarkets (September 2005).</td></tr>
<tr><td>These small-sized fish are often promoted during a ‘buy two, get three’ promotional campaign. Or, more commonly, supermarkets offer three pieces at a very attractive price of less than €10.

In March 2006, Esselunga supermarkets offered three gutted seabream (900 g the pack) farmed in Greece at €9.60/kg.</td><td>  </td></tr>
<tr><td>  </td><td rowspan="2">Sales of fillets are rare, for the same reason as for seabass – high production costs. When on sale, fillets are priced at over €20.00/kg. In March 2006, Esselunga supermarkets offered two fillets of seabass farmed in Greece at €5.22 per 250 g pack (€20.90/kg).

  </td></tr>
<tr><td>Other processing forms are rarely on display.

Shown here is a 150 g tray of carpaccio made of seabream fillets and sold at €4.04 (€26.90/kg) at Esselunga supermarkets.</td></tr>
<tr><td>Branded fish, carrying the name of the supermarket and guaranteeing buyers good quality is sold at higher prices. This Esselunga ‘Naturama’ gutted seabream retailed at €15.50/kg (regular sale) while the Cora brand seabream ‘EDO’ shown below was sold at €9.90/kg (promotion).</td><td>  </td></tr>
</table>

Cora supermarket, 'EDO'.[7] 	

Price promotions are a very common way to sell this species. In Italy, 30 percent of all gilthead seabream was sold during promotional campaigns in December 2004.[8]

2.3 Tilapia

Tilapia is a relatively fast-growing fish with low feed requirements. It can be fed practically any feed and still delivers first-class fish proteins. The feed may sometimes have a very high vegetable component. Beside these farming advantages, the fish has intrinsic food quality. It gives nice colour fillets, and has a firm flesh and medium fat content.[9]

Egypt is the largest producer of tilapia in the Mediterranean basin, with over 200 000 tonnes produced per year. The bulk is consumed within the country. Production of other countries is limited. It is worth noting the development of farming projects in several countries in the region, on both the northern and southern shores of the Mediterranean.

In Algeria, private investors and the authorities in charge of aquatic production intend to utilize important groundwater resources for tilapia farming. The first actions were taken in 2001, namely the importing of tilapia breeders from Egypt.

Today, tilapia farming projects have been identified in the Netherlands, Belgium, the United Kingdom, France and Spain. According to FEAP, total 2004 production in Europe was estimated at 450 tonnes, with farms of commercial size recorded in Belgium and the Netherlands only. Production of other countries is currently (2006) still marginal. Annual production is expected to reach 5 000 tonnes in a few years.

Table 17: Farmed production of tilapia in Europe (in tonnes)

Country	1996	1997	1998	1999	2000	2001	2002	2003	2004 *	2005 *
Belgium	250	300	300	200	150	150	150	150	150	na
The Netherlands	–	–	–	–	–	–	–	300	300	550

Note: – indicates < 10 tonnes. *FEAP provisional data.
Source: FEAP.

Ex-farm prices for European produced tilapia are circa €1.75/kg.

In the Mediterranean basin, tilapia is destined to three market sub-segments:
- local markets in North Africa
- European markets for whole fish
- European markets for fillets

Local markets in North Africa

[7] EDO stands for Engagement dès l'origine or "Responsible from farm to plate".
[8] Ismea. 2005.
[9] Josupeit, H. 2005.

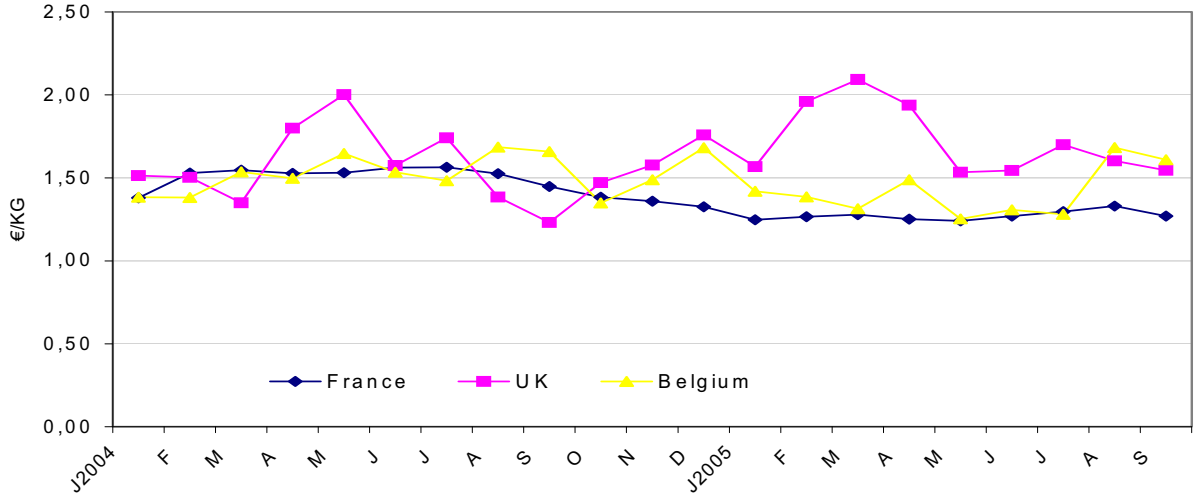
To date, local markets in North Africa are predominantly in Egypt, by far the largest producer of tilapia. There fish is sold locally. The other Arab countries represent other important markets. In 2002, they imported 6 200 tonnes of frozen whole fish, and the region is perceived as an increasing market.[10]

European markets for whole fish

In 2003, the supply of tilapia to the EU-25 was estimated at 10 000 tonnes, including 8 000 tonnes of frozen whole fish, a few hundreds of frozen fillets, and a few hundred tonnes of chilled fillets.[11]

In Europe, the largest market is the United Kingdom, where this fish is favoured by the important Asian, African, Indies and West Indies communities. In other countries, whole fish are sold in large cities to Asian and African communities. Imported fish enters major markets at circa €1.50/kg and reaches end buyers at prices below €4.00/kg. Main sources of supplies include Taiwan Province of China, Zimbabwe and Zambia.

Figure 12: Import prices of frozen freshwater species* (2004–2005)



* Freshwater species other than salmonids, carp and eels. *Source:* Eurostat.

European markets for fillets

Tilapia fillets are sold in small quantities to the United Kingdom, France and the Netherlands. They are traded skinless, boneless, either fresh, frozen or de-frozen. Part of the supply is sold to commercial restaurants, looking for a good quality product available all year at competitive and stable prices. Another part is sold through the retail segment at the wet fish counter of multiple supermarket chains or frozen food stores.

[10] Josupeit, H. 2005.
[11] Josupeit, H. 2005/Source Eurostat

Box 5: Current European market prices for fresh tilapia fillets

System U supermarket (February 2006).

Fresh tilapia fillets enter the EU at prices ranging from €4.50/kg to €5.50/kg and are retailed at prices from €10.00/kg (promotions) to €15/18.00/kg, which is about the price for ground fish fillets (cod, whiting, haddock, ling).

However, tilapia does not have the good reputation of a traditional North Atlantic wild species and is considered expensive by some consumers.

Moreover, because of high prices, the fillet form of this species has not met with the success of other exotic species recently introduced in Europe, namely Nile perch from Africa and more recently pangasius "panga", from Asia. During discount price promotions, tilapia is sold at about €10.00/kg, while Nile perch may fall into shoppers' baskets at €7.00/kg and panga at less than €6.00/kg.

Box 6: Current European market prices for fillets of Nile perch, panga and hake

Nile perch €8.95/kg France (December 2005)	Panga fillet €5.95/kg France (January 2006)	Fresh hake ('Merluzzo fresco') €9.92/kg, Italy (March 2006)
		

Tilapia, Nile perch and panga are all positioned in the market segment for skinless, boneless, white fish fillets. They compete with one another, but in most cases are considered as second choice to wild North Atlantic products (cod and haddock in the United Kingdom, cod and grenadier in France).

As regards the market for frozen fillets, the Netherlands and Germany are insignificant markets. There, products are traded either in fillet or loin forms.

Box 7: Marketing successes of pangasius and value-added products

According to Eurostat, Germany imported 4 403 tonnes of frozen fillets of freshwater fish during the first eight months of 2005, an increase of 67 percent compared to the same period in 2004. Viet Nam has now overtaken Russia to become the biggest supplier of frozen freshwater fillets to Germany, with a market share of 37 percent in 2005. The strong performance of Viet Nam appears to have been helped by low prices. The import unit price for Vietnamese products was €2.16/kg.

In Italy, Viet Nam has also achieved a good growth rate in 2005, with Italian imports of frozen freshwater fillets from Viet Nam up 122 percent for the first eight months of 2005.

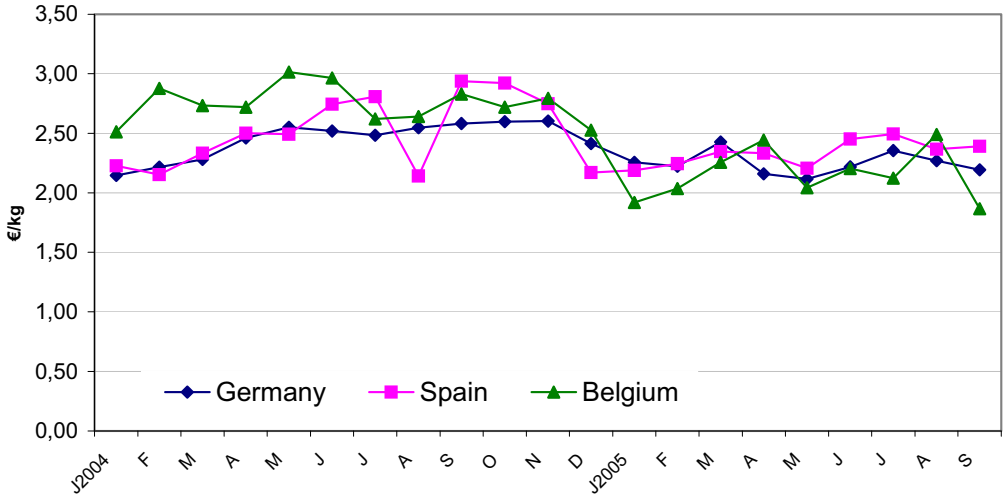
In Spain, the average import unit price for Vietnamese frozen fillets, at €2.37/kg, is also lower than the overall average of €2.58/kg. The average unit price for Vietnamese product is down 7 percent this year, while unit prices for competing products have been increasing. The Vietnamese share of Spanish volume imports remains strong at almost 70 percent, an increase over the 65 percent share during the first nine months of 2004. Until now, the competitive advantage of Vietnamese pangasius has been based on lower prices.[12]

As regards the market for value-added products, panga is again a serious competitor to tilapia. Panga skews and rolls have now been developed by Dutch processors.[13] Breaded and prefried fillets, based on frozen fillets imported from Viet Nam, are made in the Netherlands and Germany mainly for the German market.

Photo Bofrost.
Battered pangasius fillets are sold frozen in 1 kg packs at €20.30 – Bofrost offer (March 2006).

Note that while seawater fish is very appreciated in southern countries, freshwater finfish hits record high per capita consumption in Finland (13 kg), Estonia (5 kg), Norway (3.5 kg), Russia (1.8 kg)[14] and all new EU member countries.

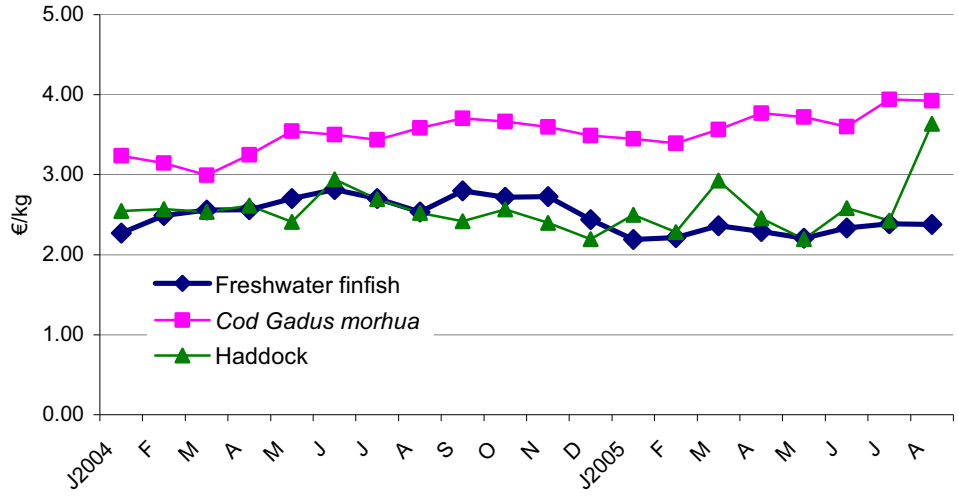
Figure 13: Import prices of frozen fillets of freshwater finfish by importing country



Source: Eurostat.

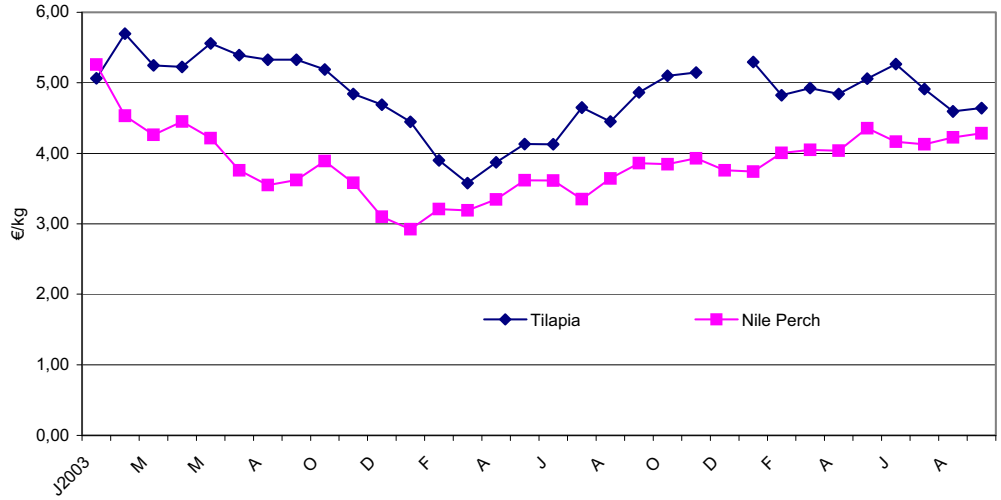
[12] Truong Tri Vinh, Vietnam Association of Seafood Exporters and Producers (VASEP), in Eurofish, December 2005.
[13] Seafood International, June 2005.
[14] Tribiloustova, E. 2005.

Figure 14: EU imports of frozen selected fish (average monthly prices)



Source: Eurostat.

Figure 15: EU imports of freshwater fresh fillets (average monthly prices)



Note: Tilapia = freshwater fish other than salmon and carp from Zimbabwe and Zambia.
Nile perch = freshwater fish other than salmon and carp from Tanzania, Kenya and Uganda.
Source: Eurostat.

3. Mediterranean farmed fish: What do markets want?

3.1 Southern Mediterranean local markets

In the southern Mediterranean countries, where consuming fish is a local tradition, low-priced fish are sold locally, close to production sites, or are sold in cities, when transport conditions allow. International trade of fish products such as tilapia and carp is very limited. Egypt, the champion of the tilapia, does not export this fish, which is entirely consumed domestically.

Aquaculture in the southern Mediterranean countries is a source of high quality proteins for the local population. If this industry were to target European markets, aquaculture projects would need to be formulated very differently, and according to the market area targeted. The choice of species, technology, and commercial and marketing methods would definitely vary.

In the following section, some of the European market's main expectations on imported seafood are discussed.

3.2 European markets

European markets are increasingly demanding in terms of product quality, service consistency and 'competitive' price.

Seabass and seabream are today positioned as middle-priced species. Total sales vary greatly according to the prices at which these fish are offered to end buyers, and to the price for substitutes. The unfavourable price position of tilapia fillets compared with Nile perch does explain its relative lack of success.

Table 18: Retail prices of fresh finfish (1987–2004)

Type of fish	Italy €/kg	France €/kg
Whole		
Anglerfish	19.27	14.01
Hake	13.23	8.74
Red mullet	16.08	na
Salmon	6.29	5.22
Sardine	3.88	3.29
Seabass	**12.12**	**11.65**
Seabream*	**9.97**	**8.52**
Sole	18.81	16.02
Trout	5.69	4.10
Whiting	na	6.64
Fillets, slices		
Cod	na	13.79
Saithe	na	5.99
Salmon	na	11.46
Seabass	**na**	**13.54**
Seabream*	**na**	**12.92**
Trout	10.20	8.38
Tuna	17.07	11.82
Nile perch	**na**	**9.12**

* Seabream, France: data given above comprise all Sparidae species, including *S. aurata* and significant volumes of *S. cantharus*.
Note: na = not available.
Source: France, Secodip for year 2005; Italy, Ismea for year 2004.

Product quality

Quality is a variable concept. Basic marketing teaches that a good quality product is a product demanded by the market. When it comes to seabass, seabream and all farmed finfish, quality encompasses:

- freshness, obtained with proper icing after slaughtering and down to the end sites where it is sold, and fast distribution,
- right shape, meaning the shape consumers expect for the fish (neither too fat, nor too long),
- no wounds on the skin and no damaged scales.

In countries with a solid tradition of eating fish, consumers and restaurant chefs usually think they can easily choose a good quality fish. However, some traits are more difficult to judge from external features only. Some characteristics are invisible. How does the buyer know if the fish offers the expected taste (taste of the wild, not of mud) and the proper flesh texture (usually not too soft), and

is safe? Consumers want to be reassured about the feed and all other inputs utilized in the farming process (water quality, whether GMO feed has been used).

In response to buyers' concerns about safety and quality, European fish farmers took a first step to harmonize their practices and comply with minimum standards. The primary goal of the code of conduct prepared by FEAP was to promote the responsible development and management of a viable aquaculture sector in order to assure a high standard of quality food production, while respecting environmental considerations and consumers' demands. The FEAP code of conduct can be found at www.aquamedia.org. For their part, many retailers have developed their own home-made, quality brands (cf. below).

According to EU legislation, food, including seafood, must carry mandatory labelling, which includes the name under which the product is sold, the list of ingredients (in descending order of weight), net quantity of prepacked food stuff in metric unit, date of minimum durability (except for fresh produce), any special storage conditions or conditions of use (except for fresh produce) and name of the manufacturer, packer or EU seller (except for non-packed fresh produce).

In addition, EU regulation lays down specific labelling requirements for fishery and aquaculture products. All products offered for retail sale in the EU must be properly labelled and provide the following information:

- **the commercial name** of the species,
- **the production method** ("caught in…" for wild fish, "farmed" or "cultivated" for aquaculture products),
- **the catch area** (for products caught at sea, a reference to areas (FAO zones); for products caught in freshwater, a reference to the country of origin; for farmed products, a reference to the country in which the product undergoes the final development stage).

In addition to mandatory labels, producers may choose voluntarily to provide more information to consumers. They may want to inform about the production methods used, about the specificities of the output (taste, nutritional elements). Some of these optional labels are **official**, i.e. strictly defined by national or European authorities.

In the farmed fish business, several official labels have been applied by individual farmers:

- origin or production (value promoted: local production),
- 'Label Rouge', French quality label (value promoted: quality),
- organic/biological, French quality label (value promoted: environment-friendly).

Official labels: protected geographical indication
The EU has established three official systems of food products identification.

- PDO (protected designation of origin).  This term designates foodstuffs that are produced, processed and prepared in a given geographical area using recognized expertise.

- PGI (protected geographical indication).  This term indicates that the product has a link to a geographical area in at least one of the stages of production, processing or preparation. Furthermore, a product carrying a PGI label which is a sign of a reputable product, may well benefit from this designation. The regulation serves to protect geographical names of agricultural products and foodstuffs against commercial use or exploitation.

- TSG (traditional specialty guaranteed). This term concerns foodstuffs other than seafood. It highlights the traditional character of the product in terms of its composition or means of production.

The rationale behind this labelling is that the products have developed a reputation associated with the place of production which makes them valued by consumers. The ownership of PDO and PGI is collective. All farmers belonging to the defined geographical area and respecting the specifications have the right to use the geographical name recognized by the appellation of origin. At present, two salmon farming companies have applied for and received PGI appellations. Dairy products' producers have extensively used these quality certification programmes. The Greek cheese Feta, the Danish Danablu and the Italian Grana Padano are among 142 cheeses protected by these European programmes.

When it comes to farmed seafood, six production areas are protected, two of which are for farmed fish (Clare Island Salmon, from Connemara, Ireland, and Scottish Farmed Salmon Fresh fish).

Official label: Label Rouge

Label Rouge is a quality label established by the French Ministry of Agriculture in 1960. It was designed to differentiate high-quality food products that offer a real and perceivable difference from standard products of the same sort. Forty years after its introduction, this label has a very good image and enjoys widespread recognition. It is today France's most reputable quality food label, recognized by 80 percent of the French consumers.[15] The best known farmed seafood that carries the label is Scottish farmed salmon, since 1992. In 1999, a producer of farmed seabass obtained the quality label. More recently (2002) several turbot farmers obtained it. Only farmed fish produced under certain conditions and complying with strict criteria are allowed to be marketed with this well known label.

Organic farmed fish

EU regulation protects the denominations 'biological' or 'organic', sets production rules and standards, and defines the procedures of controls and inspection. When it comes to 'organic' seafood, the EU has not yet defined a specific regulation but is preparing one. The EU Commission in December 2005 adopted a proposal for a new regulation on organic fish farming production, which aims to improve clarity for both consumers and farmers. Producers of organic food will be able to choose whether or not to use the EU organic logo. If they choose not to use it, their products must be labelled as EU-organic. At least 95 percent of the final product must be organic to be labelled as such. Products containing GMOs cannot be labelled as organic, except those containing up to 0.9 percent of GMO content through accidental contamination. Imports of organic products would be allowed as long as they comply with EU standards or come with equivalent guarantees from the country of origin.

[15] When questioned about food quality, 45 percent of poll's respondents mentioned spontaneously 'Label Rouge', through assisted questions 80 percent mentioned 'Label Rouge'.

Box 8: Organic farmed fish labelled with the French organic logo

Photo Provence aquaculture.

The only official organic farmed fish standard was set up by the French Ministry of Agriculture. Today, two seabass and seabream farms are allowed to use the specific logo.

The supply of fish carrying official labels is limited to only a few hundred tonnes. For fulfilling consumer demand for quality guarantees, less stringent private brands established by retailers and large-scale wholesalers have boomed in the past ten years.

Box 9: Brand labels of a few European retailers and wholesalers

The table below gives some examples of private labels that assure consumers that the fish was farmed according to specific conditions and complies with some of their expectations.

Table 19: Private labels offering quality assurance

Supermarket chains	**Cora**	**Intermarché**	**Al Campo (Auchan)**	**Carrefour (France, Italia)**	**Coop Italia**	**Métro**	**Esselunga**
Brand	EDO	Gulf stream	Filière qualité	Filiera de qualita	Coop Italia	Filière qualité	Naturama
Which values garanteed?							
Full traceability	yes	yes	yes	yes	yes	yes	yes
Flavoursome, tasty	yes	yes	yes	yes	yes	yes	yes
Environment-friendly	yes	yes	yes	yes	yes	no	no
Eco, socially acceptable	no	no	yes	yes	yes	no	no
Other values	good value for money	convenience				packaging + freshness	minimum use of artificial components
Which species concerned?							
Seabass	yes	yes	no	yes	yes	yes	yes
Seabream	no	yes	no	yes	yes	yes	yes

Source: MCM compilation.

Trading conditions: consistency of supplies

Though the trade of fresh fish is still done in very traditional ways (telephone and fax are the most common communication tools, even in international trade), professional buyers, as importers, wholesalers and retailers, expect to receive exactly what they ordered. And more and more

frequently, prior to any purchase, they select their suppliers according to the ability of suppliers to understand and comply with product and service specifications.

The international fish trade is definitely moving from verbal to procedural, paper-based transactions.

Business environment

The market's moderate growth heightens competition among operators involved in the food chain. To capture consumers' attention, they deploy numerous marketing ploys in addition to low price offers.

Major protein producers compete to gain access to the limited space on supermarket shelves and to generate consumer demand for their products. How to catch the attention of householders who spend less than 40 minutes in supermarkets, compared to 90 minutes some 20 years ago,[16] and no more than 12 seconds choosing and placing selected items in their shopping trolleys?[17] In this context, in-store promotions certainly make the difference. In 2004, 30 percent of all fresh seabream sold in Italian supermarkets was sold during promotional programmes.

When clearly advertised, as in free catalogues distributed to thousands of families, price discounts boost sales by as much as two to three times.

Box 10: Eating habits are changing

An ageing population

More single people

Family structures have changed, with an increasing number of single people.

Economic factors

Several countries in Western Europe are experiencing a lasting period of high unemployment. This gloomy economic situation, with an enlarged low-income population, has favoured low-price, subsegments of the food market. When it comes to food, development of low-price retailers (hard discount) and caterers (fast food, low-budget restaurants, sandwiches) are the most visible effects. In the catering industry, the need for cost control to maintain competitiveness has induced some changes in purchasing attitudes, with preferences given, for example, to better yield and no-loss products (such as fixed-weight portions).

Choice of products

It is women who predominantly choose food products for domestic consumption. They perform the so-called 'gatekeeper' function, operating as filters for the whole family. Compared to one or two generations ago, women today have the benefit of a higher level of education and enjoy a higher employment rate. Being better educated, they have easier access to and a better understanding of a wide spectrum of information (daily newspapers, women's magazines, doctors' prescriptions). Being employed, they demand time-saving products. These more-educated consumers are also more health-oriented.

Meal structures

One subject that has been most frequently investigated by sociologists concerns the development of new eating habits (snacking, fast food consumption) versus the traditional meal model. Though the 'grazing' – or 'Americanization'– of food patterns meets some resistance in Europe because of the important social role of meals, snack food and sandwiches are growing in importance.

Loss of cooking know-how

The loss of culinary expertise traditionally passed from generation to generation is a result of the reduced time spent in the kitchen by those with the knowledge (generally the mother/grandmother) as well as by those learning (children/young adults) and possibly also is because of a lack of interest. This phenomenon has stimulated the demand for ready-made products, including starters, main dishes and desserts).

Time-saving products

The growing need for time-saving products for householders and catering chefs and its impact on the seafood industry were demonstrated earlier. Cleaning, cutting into portions, precooking and assembling is performed increasingly by industrialists, and less and less by end users. Not only do consumers yearn for preprocessed products at competitive prices, they tend to give their preference to items that carry 'positive' values.

[16] MarketingScan. 2005.
[17] Les échos. 2005.

An analysis of the market of aquaculture finfish in Europe in the past 20 years reveals that the success of a new species' introduction relies heavily upon a limited number of factors:

- the status of the species at the moment of its introduction to markets,
- its price relative to substitutes,
- its availability (volume throughout the year),
- the overall appetite for fish in the countries concerned.

Table 20: Market performance of farmed species

Farmed species	Image	Market performance
Cod	Positive image, not yet price competitive	+
Meagre	No image in France, good image in Italy, so far limited sales	+
Nile perch	No image but attractive name (confusion in some countries with another high-priced fish Perca fluvia), very price competitive	+++
Pangasius	No image, entering low-price segments (supermarket promotional programmes, collective restaurants, outlets), very price competitive	+++
Salmon	Image of luxury species, prices competitive a few years after introduction	+++
Seabass	Image of luxury species, prices competitive a few years after introduction	++
Seabream	Image of luxury species, prices competitive a few years after introduction	++
Tilapia (fillet)	No image, not known, introduction at high prices, limited sales	+
Tilapia (whole)	Known by non-European population, low prices, good sales to specific population	++
Trout	Well known, price competitive	+++
Turbot	Image of luxury species, medium to high prices	+

Source: MCM compilation.

A non-European, non-finfish species, yet a very successful farmed species is tropical shrimp.

Tropical shrimp	Image of luxury species, prices competitive a few years after introduction	+++

Other factors that contribute to the success or failure of a species, such as the name, size, shape, presence of bones and colour of flesh, are believed to be of minor importance.

4. Aquaculture production by country

In this section, key data, when available, describe aquaculture production in each Mediteranean country.

The sources of information are the World Bank, FAO, FEAP and SIPAM, and the data are presented in the following way:

Population	World Bank (2004)
Gross national income per capita	World Bank (2004)
Seafood consumption	Kilo per capita per annum FAO Food Balance Sheet (2003)
Farmed seabass production Farmed seabream production Other farmed fish production	The latest available figures from FAO, FEAP and SIPAM. – indicates >1 tonne na (not available)

4.1 Albania

Population	3.2 million
Gross national income per capita	US$2 080
Seafood consumption	5.7 kg of which 4.4 kg pelagic
Farmed seabass production	–
Farmed seabream production	–
Other farmed fish production	–

4.2 Algeria

Population	32.4 million
Gross national income per capita	US$2 270
Seafood consumption	3.4 kg of which 2.8 kg pelagic
Farmed seabass production	–
Farmed seabream production	–
Other farmed fish production	na

Algeria offers limited potential for coastal fish farming because of rough, unsheltered coasts and few protected areas. The domestic market for high-priced products is very limited. Tilapia farming is considered by officials as a promising sector to be developed in the desert.

4.3 Croatia

Population	4.5 million
Gross national income per capita	US$6 590
Seafood consumption	11.9 kg of which 4.4 kg pelagic
Farmed seabass production	1 600 tonnes (2005)
Farmed seabream production	1 000 tonnes (2005)
Other farmed fish production	4 000 tonnes tuna (sea cages)

Croatia offers a huge potential for aquaculture development thanks to its 5 800 km-long coastline and its 1 100 islands, offering a very good geomorphology with areas sheltered from main winds. The country's objective is to produce annually some 10 000 tonnes by 2015.[18] Today, the bulk of all farmed fish is exported (tuna to Japan, and seabrass/seabream to continental Europe) and provides a stable source of income to islanders. The domestic market is said to offer good prospects as well, as present domestic consumption of farmed fish is very low.

4.4 Cyprus

Population	775 000
Gross national income per capita	US$17 580
Seafood consumption	28.3 kg
Farmed seabass production	800 tonnes (2005)
Farmed seabream production	1 600 tonnes (2005)
Other farmed fish production	na

Exports of farmed seabass and seabream represent about 7 percent of all seafood exports, in terms of value.

Aquaculture offers full time employment to about 100 persons.

[18] Ubifrance Monthly Market Review, February 2004.

4.5 Egypt

Population	68.7 million
Gross national income per capita	US$1 310
Seafood consumption	14.7 kg
Farmed seabass production	1 789 tonnes (2003)
Farmed seabream production	2 424 tonnes (2003)
Other farmed fish production	tilapia 200 000 tonnes, mullet 136 000 tonnes, carp 88 000 tonnes

Egypt has become one of the biggest seafood markets in the region, because of a rapid increase in demand in recent years and the rapid development of domestic supplies, after aquaculture had been identified as the best answer to reducing the increasing gap between supply and demand for fish in Egypt. Farmed fish production increased from 35 000 tonnes to 430 000 tonnes.[19]

Box 11: Reasons for the success of aquaculture in Egypt

In 2004, total aquaculture production reached 471 535 tonnes. As regards tilapia, production concerns the mono-sex fish. Total production reached 199 038 tonnes in the private sector, while the government produced 3 699 tonnes.[20] There are several reasons for Egyptian aquaculture success as observed during the past years.

Availability of fresh water
The wide availability of fresh water is an undisputed advantage. Most of Egypt's aquaculture production is from brackish water surface areas of its delta lakes and lagoons in the north.[21]

Revised statistical data collection system
A change in the system of statistical data collection since the year 2000 allows the harvest of both licensed and unlicensed farms to be recorded, In addition, the introduction of a field data collection system allows staff to collect real harvest data rather than the data given by farmers, especially after exempting aquaculture from taxation for 10 years.

Move towards intensive pond aquaculture
Farming systems are changing from traditional, semi-extensive or semi-intensive aquaculture to intensive pond aquaculture, a system introduced by the government on two of its pilot farms in 1998.

Adoption of industrial approaches towards production
Industrial approaches towards production are being adopted, following the involvement in aquaculture of new, middle-class investors (highly educated), who are replacing traditional farmers (who are satisfied with the proportionally limited harvest that fills covers their modest requirements).

Improved national economy
The improvement in Egypt's economy of has created more demand for fish.

High rate of return on investment
The internal rate of return on investment in aquaculture is very high, currently around 47.8 percent.

Increased support facilities
The sharp increase in supportive facilities (feedmills increased from only 2 in 1997 to more than 32 currently, and fish hatcheries from 14 in 1998 to 520 currently).

Increased production per unit area
The new approach towards utilization of small farms (2–4 ha) instead of traditionally large ones (50–200 ha) as a result of sharp competition for very limited land suitable for pond aquaculture (78 percent of production) forced farmers to increase production per unit area to obtain sufficient returns.

Development of local technologies
The development of local technologies solved many production problems, especially those related to overwintering of tilapia.[22]

[19] General Authority for Fish Resources Development (GAFRD).
[20] Feidi, Izzat. 2006.
[21] Feidi, I. 2005. Fish Supply and Demand in the Near East Region, *FAO GLOBEFISH Research Programme*. Vol. 83. Rome, FAO. 67 pp.
[22] Saleh, Magdy. 2006. (Personal communication.)

Table 21: Farmed fish production in Egypt in 2004

State farms	Private farms	Cages	Rice fields	Total (in tonnes)
1.6%	87.0%	7.2%	3.8%	445 181

Source: GAFRD, 2004.

Tilapias (*Oreochromis* spp.), with 44.6 percent of the total aquaculture production in 2002, are the main cultured species. Nile tilapia (*Oreochromis niloticus*), Blue tilapia (*Oreochromis aureus)* and Tilapia galillae (*Sarotherodon galilaeus*) are the three main tilapia species cultivated in aquaculture farms. Thirty percent of the total aquaculture production in 2002 was represented by mullets (*Mugilidae*), notably Flathead grey mullet (*Mugil cephalus*) and Thinlip grey mullet (*Liza ramada*). Gilthead seabream (*Sparus aurata*) and European seabass (*Dicentrarchus labrax*), with less than 1 percent of the total aquaculture production, are currently cultured, depending mostly on fry collected in the wild.[23]

A large-scale study conducted by CAPMAS[24] in 2000 of 48 000 Egyptian families showed that more than 68 percent of seafood expenses were dedicated to fresh fish, 22 percent to frozen fish, 8 percent to canned fish and 2 percent to dried fish. Finfish processing is a very limited activity. The processing is limited to traditional drying and salting, and run by small-scale enterprises.[25] Despite the very large production, very little finfish is exported. In 2003, finfish exports were estimated at 3 000 tonnes.[26]

4.6 France

Population	60.0 million
Gross national income per capita	US$30 090
Seafood consumption	31.2 kg
Farmed seabass production	4 300 tonnes (2005)
Farmed seabream production	1 900 tonnes (2005)
Other farmed fish production	trout 37 500 tonnes, carp 6 000 tonnes, turbot 900 tonnes, salmon 1 500 tonnes

Despite some successes, available skilled personnel and capital, the difficulty in obtaining licences is hindering the development of marine aquaculture with current technology. The local market is quite active, and demand is quite strong for quality certified products.

4.7 Greece

Population	11.1 million
Gross national income per capita	US$16 610
Seafood consumption	23.3 kg
Farmed seabass production	35 000 tonnes (2005)
Farmed seabream production	50 000 tonnes (2005)
Other farmed fish production	trout 3 000 tonnes, eels 500 tonnes

Greece is the largest EU producer of seabass and seabream. Finfish aquaculture provides full-time employment for about 3 200 persons. The sheltered, extensive coast of Greece, which offers many suitable sites, constitutes a solid strength for aquaculture. In addition, the ideal proximity to Italy, the largest seabass market, constitutes an advantage for developing marine aquaculture, which is considered strategic by the Greek government. In 2004, exports of seabass and seabream represented 42 percent of total seafood exports, in value terms, compared to 26 percent in 1998.

[23] General Authority for Fish Resources Development (GAFRD). Annual Statistical Report 2003.
[24] Central Agency for Public Mobilization and Statistics.
[23] FAO National Aquaculture Sector Overview.
[26] Ubifrance Monthly Market Review, December 2004.

4.8 Israel

Population	6.8 million
Gross national income per capita	US$17 380
Seafood consumption	21.6 kg
Farmed seabass production	na
Farmed seabream production	na
Other farmed fish production	na

4.9 Italy

Population	57.6 million
Gross national income per capita	US$26 120
Seafood consumption	26.2 kg
Farmed seabass production	9 800 tonnes (2005)
Farmed seabream production	7 800 tonnes (2005)
Other farmed fish production	trout 35 500 tonnes, eels 1 200 tonnes

Finfish aquaculture provides full-time employment for about 2 150 persons. Italy is the largest EU market for seabass and seabream. The farming sector, which produces over 16 000 tonnes, does not cover the domestic demand. Italy is the largest importer of fresh seabass and seabream. In 2004, Italy imported fresh seabass worth €83 million and fresh seabream worth €58 million.

4.10 Lebanon

Population	4.6 million
Gross national income per capita	US$4 980
Seafood consumption	12.0 kg
Farmed seabass production	na
Farmed seabream production	na
Other farmed fish production	na

4.11 Libyan Arab Jamahirya

Population	5.7 million
Gross national income per capita	US$4 450
Seafood consumption	6.9 kg
Farmed seabass production	na
Farmed seabream production	na
Other farmed fish production	na

The coast of Libyan Arab Jamahirya is not favourable to finfish farming, considering existing technology.

4.12 Malta

Population	401 000
Gross national income per capita	US$12 250
Seafood consumption	50.0 kg of which 29.0 kg pelagic
Farmed seabass production	131 tonnes (2005)
Farmed seabream production	800 tonnes (2005)
Other farmed fish production	na

Farming seabass and seabream has brought to Malta and its 401 000 inhabitants important export income. In 2004, 33 percent of the country's total exports of seafood related to these two species.

4.13 Morocco

Population	30.6 million
Gross national income per capita	US$1 520
Seafood consumption	8.7 kg of which 5.5 kg pelagic
Farmed seabass production	389 tonnes (2003)
Farmed seabream production	378 tonnes (2003)
Other farmed fish production	na

Morocco started fish farming on an industrial scale over two decades ago. Several mariculture projects of high-value species such as shrimps, seabass and seabream were undertaken along the Mediterranean coast and in lagoons. None of them became profitable and successful enterprises. The nascent industry met several obstacles. The high summer temperatures and recurrent eutrophic phenomenon were threats to productivity. Moreover, production costs were high because of expensive input (energy), lack of a local supply of feed and seeds, a non-favourable tax system, lack of well trained manpower, and lack of specific aquaculture legislation.[27] The lack of fish farming traditions explains the deficiency of this activity in the inner parts of country.

4.14 Slovenia

Population	2.0 million
Gross national income per capita	US$14 810
Seafood consumption	7.7 kg
Farmed seabass production	na
Farmed seabream production	na
Other farmed fish production	na

4.15 Spain

Population	41.3 million
Gross national income per capita	US$21 210
Seafood consumption	47.4 kg
Farmed seabass production	6 130 tonnes (2005)
Farmed seabream production	15 560 tonnes (2005)
Other farmed fish production	turbot 4 350 tonnes, eels 390 tonnes, sole 75 tonnes

Finfish aquaculture provides full-time employment for about 800 persons. According to the Spanish Association of Marine Fish Farmers (APROMAR), domestic production of aquatic products supplies 20 percent of all domestic needs. As regards seabream and seabass, market share of domestic products is estimated at 95 percent. Local supply of farmed turbot covers 60 percent of the country's needs. Spain is characterized by a strong demand for fresh seafood, with a clear preference for local products. In order to stimulate demand for national items, APROMAR set up a quality scheme 'Crianza del Mar' dedicated to farmed fish produced in the country. This collective brand offers guarantee in terms of origin (produced in Spain), traceability, respect for the environment, freshness (the fish is marketed within 24 hours after slaughtering). It will be applied to seawater farmed fish from the end of summer 2006.

[27] FAO Technical Cooperation Programme. 1997. Aquaculture potential in Morocco.

4.16 Syrian Arab Republic

Population	17.8 million
Gross National Income per capita	US$1 190
Seafood consumption	2.6 kg
Farmed seabass production	na
Farmed seabream production	na
Other farmed finfish production	carp (4 285 tonnes), tilapia (3 650 tonnes), African catfish (747 tonnes)

The Syrian Arab Republic is endowed with only 200 km of coastline and has no fish consumption traditions. Aquaculture accounts today for nearly 10 000 tonnes, which is approximately the volume landed by fishermen (inland plus sea captures). The country sees cage culture at sea and inland as a potential means of increasing production. The country's development strategy includes the promotion of family fish ponds, and fish culture in irrigation canals and surface water retention lakes.

4.17 Tunisia

Population	10.0 million
Gross national income per capita	US$2 630
Seafood consumption	11.0 kg of which 6.3 kg pelagic
Farmed seabass production	466 tonnes (2004)
Farmed seabream production	679 tonnes (2004)
Other farmed finfish production	na

Tunisia has a 1 300 km-long shoreline, in addition to seven lagoons, bordering a large continental shelf. Today aquaculture accounts for only 2 percent of total landings. Initiatives of mariculture in lagoons along the Mediterranean coast (Laguna of Boughrara) were not successful because of high temperatures during summer and high eutrophic phenomenon.

The country is dry and does not have any rivers of importance. In addition, there are no fish farming traditions in the country.

The public authority has drawn up an Aquaculture Directing Plan (ADP), and in the 11th National Development Plan (2007–2011) aquaculture objectives have been set to produce 12 000 tonnes, compared to less than 3 000 tonnes today. Currently Tunisia is in the process of identifying potential sites suitable for sheltering floating cages.

4.18 Turkey

Population	71.7 million
Gross national income per capita (2004)	US$3 750
Seafood consumption	7.2 kg of which 4.7 kg pelagic
Farmed seabass production	20 900 tonnes (2005)
Farmed seabream production	15 500 tonnes (2005)
Other farmed finfish production (2004 figures)	trout 43 432 tonnes, carp 683 tonnes

Turkey has become one of the largest finfish producers in the region, producing over 35 000 tonnes of seabass and seabream last year. This industry provides full-time employment for about 850 persons. The country is endowed with extensive and sheltered coastline, low production costs and a

strong domestic demand. Distance from the main markets, including Spain, France and Italy, results in transportation costs of over €0.30/kg.

5. New farming technologies

5.1 New production technologies used in fresh and marine fish aquaculture in Mediterranean countries

The development of marine farming around the Mediterranean basin is a result of the application of intensive production systems, particularly cages. The bulk of all seabass and seabream (80 percent in 2003) is grown in sea cages moored near the seashore in depths less than 40 m.

Table 22: Finfish farming modes

Country	Tanks	Ponds/lagoons	Cages
Egypt	rice fields 3.8%	private farms 87%	7.2%
France	53%	2%	45%
Greece	0%	1%	99%
Italy	0%	63%	37%
Portugal	11%	81%	8%
Spain	3%	25%	72%
Turkey	1%	2%	97%

Source: University of Stirling, 2003.

It is now acknowledged that fish supplies from the world's fisheries are unlikely to increase substantially and that the expansion of the aquaculture sector will probably provide the solution to the problem of projected shortfalls. In the Mediterranean region, from 1996 to 2000, total aquaculture production increased by 49 percent, from 907 000 tonnes (87 000 tonnes for marine fishes) to 1 350 500 tonnes (251 600 tonnes for marine fishes), with a yearly increase estimated at 10 percent (30 percent for marine fishes).

However, fish farming activity is facing various restrictions. Biological (control of the rearing parameters), environmental (control of the impact on local environment), geographical (conflict for space on and use of coastline) and economical (production costs) constraints are prominent. Recently, new production technologies such as recirculation systems, offshore cages and integrated aquaculture have been developed in Mediterranean countries to overcome some of these restrictions.

Recirculation systems

Fish farming using a recirculation system can be an efficient solution to most of above-mentioned constraints.

The quality of water that goes through either marine or freshwater fish farms is often subject to wide fluctuations. In open systems, it is very difficult, if not impossible, to control. Recirculated water systems provide a rearing medium that is constant and adjustable, with minimal heat loss in recirculation systems that normally operate at above ambient water temperature. The general characteristics of the system are summarized in Figure 16 below.

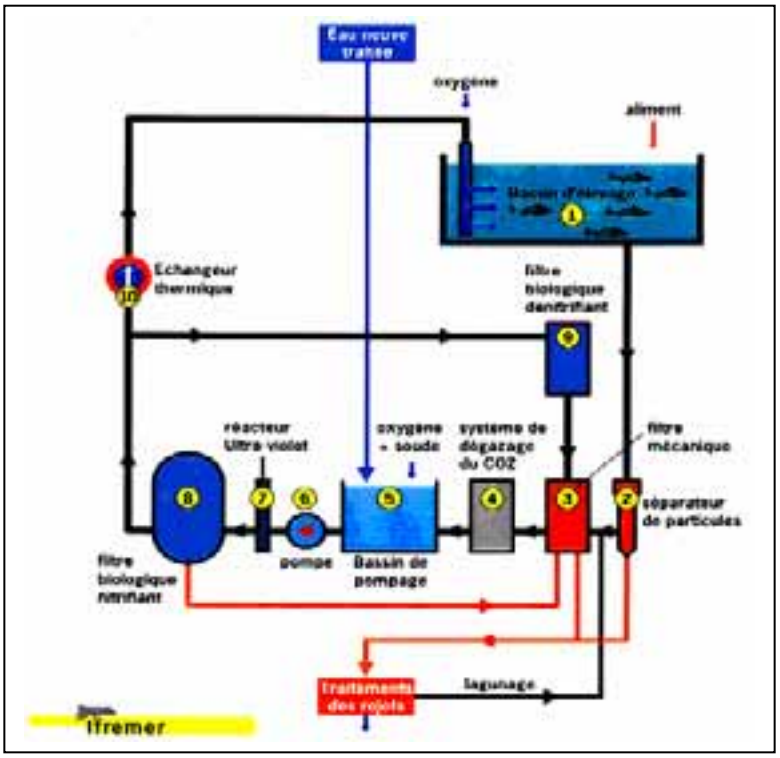
The recirculation system is used mainly for hatchery and pregrowing activity. The up-scaling of this system to industrial size for growing activity is also progressing, and for some species is already developed. A synthesis of species reared in recirculation systems for hatchery/pregrowing, growing and broodstock maturation activity in Mediterranean countries is presented in Table 23.

Table 23: Aquaculture species production in recirculation systems

Type of activity	Marine water species	Freshwater species
Hatchery/pregrowing activity	- seabass (*Dicentrarchus labrax*) - seabream (*Sparus aurata*) - croaker (*Argyrosomus regius*) - turbot (*Scophthalmus maximus*) - Senegal sole (*Solea senegalis*)	- tilapia (*Oreochromis niloticus*) - sheatfish (*Silurus glanis*) - trout (*Salmo trutta*)
Growing activity	- seabass (*Dicentrarchus labrax*) - seabream (*Sparus aurata*) - turbot (*Scophthalmus maximus*)	- tilapia (*Oreochromis niloticus*) - sheatfish (*Silurus glanis*) - trout (*Salmo trutta*) - sturgeon (*Acipenser baeri*)
Broodstock maturation activity	- seabass (*Dicentrarchus labrax*) - seabream (*Sparus aurata*) - croaker (*Argyrosomus regius*) - turbot (*Scophthalmus maximus*) - Senegal sole (*Solea senegalis*)	- tilapia (*Oreochromis niloticus*) - sheatfish (*Silurus glanis*) - trout (*Salmo trutta*) - sturgeon (*Acipenser baeri*)

Different levels of production intensification are applied in recirculation systems depending on the species: from 15 kg/m^3 for pregrowing activity to 40 kg/m^3 for turbot growing activity, and 80 kg/m^3 for tilapia and 200 kg/m^3 for sheatfish.

Figure 16: Recirculation aquaculture production system (Ifremer, ASC team, 1998)



1- Fish tank
2- Particules separator
3- Mechanical filter
4- CO_2 degassing system
5- Pumping tank
6- Pump
7- UV sterilizer
8- Nitrifying biological filter
9- Denitrifying biological filter
10- Heat exchanger

Offshore cages

The main advantages of the recirculation systems are:

- better control of the rearing parameters (temperature, water quality, feeding),
- reduction of production costs by 57 percent compared with the flow through system for seabass hatchery activity,[28]
- possibility of collecting and treating waste waters and limiting impacts on the environment.

[28] Blancheton, J.P. 2000. Developments in recirculation systems for Mediterranean fish species.

Offshore cages have been developed recently for tuna (*Thunnus thynnus*) production in the Mediterranean Sea. This technology offers very high rearing volume with little restriction to coastline access. Offshore cages are anchored several hundred metres from the coastline, requiring that feeding and harvesting be done by boat. The diameter of offshore cages ranges from 50 m to 90 m, for a rearing volume of 30 000 m^3–200 000 m^3 per cage, respectively.

This technology is used for tuna fattening. Juvenile tuna (10 kg weighted) or mature tuna (70–250 kg weighted) are captured by fishery boats and stocked in offshore cages to be fattened before being distributed on the Japanese market. The production intensification of this system is quiet low, with stocking densities ranging from 2 to 4 kg/m^3. Today, the feeding process based on trash fish (sardines mainly) is characterized by a very unfavourable Feed Conversion Rate (from 12 kg to 20 kg fish feed for 1 kg commercial fish). Studies on feeding are currently underway, with the objective of initiating the use of pellets. The production cycle duration is from 6 to 8 months, for a 30 percent increase in biomass.

The main advantage of offshore cages is that they overcome all restrictions (geographical, political) regarding the use of the coast near the shore. Theoretically, the farming capacity is unlimited. Yet the Mediterranean Sea is not always calm as a lake, as some postcards suggest. Cages need to be resistant to heavy storms, high waves, and mighty winds. The technology is improving; cages are becoming more and more adapted to open-sea conditions. Thanks to today's solid structures, tuna projects have developed. Still, high-sea projects, with all premises attached to the farm (feed stock, premises suited to human occupation), belong to a distant future.

Integrated aquaculture

Integrated, intensive aquaculture approaches developed from traditional, extensive polyculture combine the culture of fish or shrimp with production of vegetables, microalgae, shellfish and/or seaweeds. Integrated aquaculture can take place in coastal waters or in ponds and can be highly intensified.

Several freshwater, integrated fish–vegetable farms and a couple of modern fish–algae–shellfish/abalone integrated aquaculture farms exist today (Israel), and several additional farms are planned. A 1-ha, land-based, integrated seabream–shellfish–seaweed farm can produce annually 25 tonnes of fish, 50 tonnes of bivalves and 30 tonnes fresh weight of seaweed. Another farm model can produce in 1 ha 55 tonnes of seabream or 92 tonnes of salmon, with 385 or 500 tonnes fresh weight of seaweed, respectively, without pollution.

Three major international R&D projects are evaluating the possibility of developing this technology further. (Cf. the Genesis Project, below.)

Integrated aquaculture experiments are of great interest for reducing environmental impacts and improving the production capacity of fish farms, using natural production methods and complementarities between species.

Other main trends in Mediterranean aquaculture

In parallel with the adaptation of new technologies to the Mediterranean region are the following recent trends:

- increasing specialization of fish farm activity. Fish farms are becoming more and more specialized in hatchery or pregrowing or growing activity, without integrating all stages of the production cycle;
- increasing diversification of the target species (development of grass-eating species such as Mugilidae) for fish farm activity, in order to adapt the supply to the market demand; and

- development of quality certification procedures for better traceability and promotion of products.

All recent technologies mentioned above have been developed by aquaculture industrialists and researchers with the objective of creating conditions for sustainable fish farming, which is economically, socially and environmentally viable and acceptable.

The challenges that the industry will face in furthering developments are numerous, but environmental parameters and human skills are considered by most observers as key factors for success.

Section 5, was elaborated by www.ideeaquaculture.com

GENESIS Project

Development of a generic approach to sustainable integrated marine aquaculture for European environments and markets

The EU GENESIS Project (2001-2004), in its search for viable alternatives to open-sea cage systems, developed the generic sustainable integrated mariculture system. This system is expected to be cost effective and applicable for key European environments and markets. The system consists of three components: culture of fish or shrimp, which are the nuclear culture species and whose effluents are treated by micro- or macroalgae biofilters; production of algae, which are utilized to feed marine herbivores (e.g. shellfish, sea urchins or brine shrimp); and production of marine herbivores, which convert the algal low-value by-product into a high-value commodity. The system gives special attention to product quality and health parameters of the cultured organisms. The integration concept is a versatile one, which will increase both mariculture product variety and job opportunities, while reducing energy use, pollution, and the depletion of wild stocks (refer http://genesis.ocean.org.il/main.htm).

Appendix 1: Customs duties

The table below indicates the tariff rates applied to EU imports of fish from several Mediterranean countries.

Table 24: Tariff rates on EU imports of fish by Mediterranean country

Taric code	Albania	Turkey	Israel	Lebanon	Syria	Egypt	Libya	Tunisia	Algeria	Morocco
0302 69 1900	0%	0%	8%	0%	4.5%	4.5%	4.5%	0%	0%	0%
0302 69 9400	0%	0%	15%	0%	11.5%	11.5%	11.5%	0%	0%	0%
0302 69 9500	0%	0%	15%	0%	11.5%	11.5%	11.5%	0%	0%	0%
0303 79 1990	0%	0%	15%	0%	4.5%	4.5%	4.5%	0%	0%	0%
0304 10 3880	0%	0%	18%	0%	14.5%	14.5%	14.5%	0%	0%	0%
0304 10 3885	0%	0%	18%	0%	14.5%	14.5%	14.5%	0%	0%	0%
0304 10 1990	0%	0%	9%	0%	5.5%	5.5%	5.5%	0%	0%	0%
0304 20 9450	0%	0%	15%	0%	11.5%	11.5%	11.5%	0%	0%	0%
0304 20 9460	0%	0%	15%	0%	11.5%	11.5%	11.5%	0%	0%	0%
0304 20 9490	0%	0%	15%	0%	11.5%	11.5%	11.5%	0%	0%	0%

Source: Taric, EU.

Preferential tariffs lower than the conventional third country duties are applied to products from several Mediterranean countries. These products are listed below.

Table 25: Fish products subject to preferential tariffs

Taric code	Product
0302 69 19 00	fresh/chilled freshwater fish other than salmonids and carp
0302 69 94	fresh seabass (*Dicentrarchus labrax*)
0302 69 95	fresh gilthead seabream (*Sparus aurata*)
0303 79 19 90	frozen freshwater fish other than salmonids and carp
0304 10 38 80	fresh fillet of seabream (*Dentex dentex* and Pagellus spp.)
0304 10 38 85	fresh fillets of seabass (*Dicentrarchus labrax*)
0304 10	fresh or chilled fish
- - - 0304 10 19	- - - of other freshwater fish
- - - - 0304 10 19 90	- - - -other
0304 20	- frozen fillets
- - - 0304 20 19	- - - of other freshwater fish
- - - - 0304 20 19 90	- - - - other
- - - - 0304 20 94 50	frozen fillets of seabream (*Dentex dentex* and Pagellus spp.)
- - - - 0304 20 94 60	frozen fillets of seabass (*Dicentrarchus labrax*)
- - - - 0304 20 94 90	frozen fillets of fish other than otherwise stated

Source: EU Taric codes.

Appendix 2: EU imports data

Table 26: 2005/2004 imports variation (8 month period from January to August)

Country	Fresh seabass	Fresh *S. aurata*	Fresh freshwater fish (other than salmon)	Fresh Dentex & Pagellus	Frozen seabass	Frozen freshwater fish	Frozen Dentex & Pagellus	Fresh freshwater fish fillets (other than salmon)	Frozen freshwater fish fillets (other than salmon)
EU	**19%**	**7%**	**25%**	**-13%**	**-6%**	**19%**	**26%**	**6%**	**42%**
France	29%	-3%	17%	1%	-65%	47%	98%	34%	14%
The Netherlands	12%	266%	32%	-68%	-89%	10%	640%	-29%	45%
Germany	14%	26%	-24%	-10%	-86%	54%	-6%	9%	50%
Italy	14%	4%	13%	-16%	20%	57%	26%	27%	59%
UK	14%	28%	3%	72%	139%	13%	-32%	-57%	123%
Ireland	-1%	-59%	-100%	-16%	-17%	40%	122%		75%
Denmark	44%	202%	-13%	-95%	-100%	-31%		2%	-14%
Greece	3%	56%	-88%	-81%	-11%	78%	-23%	-5%	31%
Portugal	59%	-2%	37%	-7%	-5%	4%	-100%	402%	38%
Spain	30%	-59%	-30%	-4%	-70%	225%	119%	38%	4%
Belgium	-13%	17%	23%	7%	-11%	-18%	-15%	-13%	34%
Luxembourg	-32%	21%	-78%	97%				-38%	443%
Sweden	-19%	0%	-5%	-100%		-32%	100%	-77%	113%
Finland		-46%	-88%			-31%		-5%	248%
Austria	-58%	3%	9%	-83%		-43%		-70%	-11%
Malta	162%			615%		356%	-39%		188%
Estonia	200%	167%	126%			27%		160%	353%
Latvia						246%		0%	1383%
Lituania						-14%	170%		160%
Poland	175%	208%	391%			288%		-24%	356%
Tchekia	320%	197%	160%	179%	138%	6%		241%	83%
Slovakia			0%	-50%	-100%	160%			505%
Hungary	188%	67%	-100%		-100%	329%		111768%	65%
Slovenia	93%	102%	13427%	109%	50%	2%	15%	20313%	160%
Cyprus				597%		-57%	288%		205%

Source: Eurostat.

Appendix 2: EU imports data (cont'd)

Table 27: Imports in 2004 (in tonnes)

Country	Fresh seabass	Fresh *S. aurata*	Fresh freshwater fish (other than salmon)	Fresh Dentex & Pagellus	Frozen seabass	Frozen freshwater fish	Frozen Dentex & Pagellus	Fresh freshwater fish fillets (other than salmon)	Frozen freshwater fish fillets (other than salmon)
EU	**33 776**	**21 489**	**8 693**	**14 460**	**1 624**	**29 415**	**3 890**	**87 240**	**56 761**
France	2 921	3 601	1 562	1 505	154	4 518	335	15 785	4 127
The Netherlands	1 068	279	760	314	47	1 785	65	15 187	8 864
Germany	475	913	967	431	54	361	92	6 973	13 308
Italy	16 716	12 754	231	2 472	732	1 164	213	8 861	3 106
UK	2 671	534	79	238	123	11 820	839	51	1 629
Ireland	35	4	2	6	60	99	7	0	58
Denmark	16	8	830	81	0	80	0	4 980	1 999
Greece	1 100	283	4	1 417	2	116	1 464	147	2 849
Portugal	864	2 208	464	714	35	2 319	8	16	714
Spain	7 056	426	211	6 919	356	370	792	8 665	8 887
Belgium	396	171	1 299	219	53	5 231	8	14 452	6 078
Luxembourg	68	22	146	35	0	0	0	1 112	49
Sweden	13	4	132	0	0	115	0	269	361
Finland	1	4	33	0	0	2	0	285	83
Austria	209	133	156	30	0	44	0	9 192	1 374
Malta	5	0	0	26	0	1	9	0	32
Estonia	1	1	1 283	0	0	523	0	769	332
Latvia	1	0	0	0	0	259	0	2	8
Lituania	0	0	11	0	0	31	27	0	887
Poland	7	18	497	0	0	280	0	55	1 375
Tchekia	13	8	1	3	3	41	0	5	114
Slovakia	0	0	2	0	3	50	0	0	120
Hungary	3	1	15	0	1	37	0	251	346
Slovenia	136	120	11	9	0	10	5	184	7
Cyprus	0	0	0	40	1	160	28	0	54

Source: Eurostat.

Appendix 3: Organic fish farming EU project

The new regulation (COM2005 671, Organic production and labelling of organic products) regarding organic standards for farmed fish responds to the conclusions of the Council of October 2004 on the European Action Plan for organic food and farming (EAP) of June 2004, which provided an overall strategic vision for organic farming's contribution to the Common Agricultural Policy. For the import regime, the new rules will apply from 1 January 2007. According to the proposal, the new regulation will go into effect from 1 January 2009.

The new regulation will:

- define the objectives and principles of organic production while accounting for local conditions and stages of development,
- assure that the objectives and principles apply equally to all stages of organic livestock, aquaculture, plant and feed production as well as the production of organic foods,
- clarify the GMO rules, notably that the general GMO thresholds apply, that GMO products cannot be labelled organic and that specific thresholds for seeds can be adopted,
- render compulsory either the EU logo or – in its absence – a stylised indication 'EU-ORGANIC', imposing restrictions on labelling and advertising claims in order to promote the "common concept" of organic production,
- reinforce the risk-based approach and improve controls by aligning the control system to the official EU food and feed control system applying to all foods and feeds,
- improve the free circulation of organic goods by ensuring that EU rules guarantee the highest standards, reinforce the impartiality of the control system, mutual recognition of standards and reduce the room for control bodies to authorise less strict rules,
- develop permanent import rules based on direct access for fully compliant products or access based on equivalency.

Appendix 4: Development of products and marketing options: the example of salmon in France

The development of the salmon industry followed some 20 years later along the same lines as that of the chicken industry. In the late 1980s, a few years after the start of large-scale production, the salmon industry faced an 'early-age' crisis, and massive volume was withdrawn from the fresh fish market (Norwegian frozen salmon "mountain") to halt a price crash. From 1990, some producers in Scotland worked at differentiating their products to escape from frontal competition and developed specific quality standards that received the French quality label, Label Rouge (1992). On the market side, the decline in prices stimulated consumption at home and in restaurants and encouraged the use of this species by the processing industry.

Consumers certainly want quality labels, but require convenience as well. In the early years of this century, a new generation of products filled the supermarket shelves: quality certified prepacked and prepared meals, such as Label Rouge pieces in spices.

In the 1990s, the retail market moved from whole head-on gutted fish to more fillets and cuts. Though introduction of ready meals dates back to the1980s, the development of precooked steak and minced-meat steak is more recent (late 1990s). In the 1990s, criticisms addressed by environmentalists emerged and public debates amplified the usage of certain methods and inputs. At that time, some producers chose to rear salmon according to more environmentally friendly methods. First organic fish arrived on the market in the mid-1990s, and some companies received the Official Organic Label salmon, from 2002 onwards. Today, innovative companies continue to launch new products.

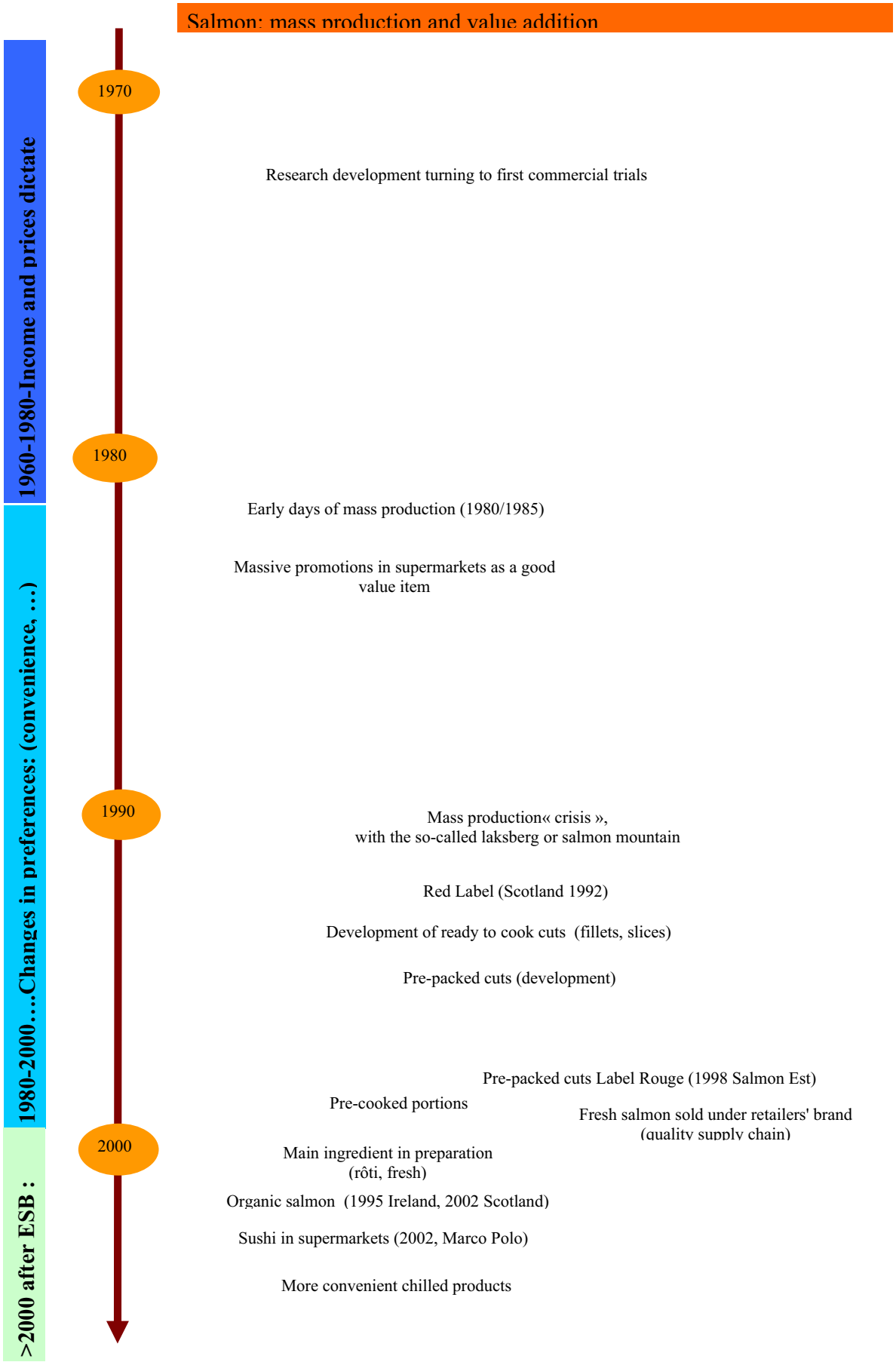
Yet along with farmers and manufacturers, today retailers are becoming masters of the game; the power of farmers is negligible and that of manufacturers is declining. We see that salmon producers and processors are entering into collaborative arrangements with dominant players in the business. We see the establishment of value-added supply-chain alliances with the objectives of increasing the market assurance and confidence of buyers (private labels) at competitive price.

Under the assumption that seabass and seabream marketing will follow the same path as that of salmon, the Mediterranean industry has taken all initial steps. Large investments based on research results allowed for mass production and price promotion campaigns. The industry suffered its first severe production crisis in 2001–2002. During that period, differentiation strategies emerged (production of labelled products). The industry is now facing the challenge of adding value through processing or through branding/labelling in order to create products tailored to the demands of large segments of the market.

The figure on the following page shows the various steps in the development of the salmon industry from 1970 that were taken in response to changes in the preferences of fish products.[29]

[29] Monfort, M.C. 2005.

Figure 17: Development of salmon industry and marketing options from 1970



Appendix 5: Large-scale offshore fish farms in the Pacific

In National Public Radio (NPR), Washington DC, USA, March 21, 2006.

Feeding the World with Deep-Sea Fish Farms
by Chris Arnold

The world's ever-growing population is eating more and more fish and the oceans can't keep up. Fishing has depleted wild stocks of tuna, swordfish, cod and many other species. Some scientists say the answer is a massive growth of fish farming -– a so-called "blue revolution" to help feed the planet. So far, fish farming has occurred on land or in protected harbors. But some see a future with large-scale off-shore fish farms in waters hundreds or thousands of feet deep. One of the first companies venturing off-shore is Hawaii-based Kona Blue. It is raising fish in giant, netted cages off the coast of Hawaii, submerged in waters some 200 feet deep. Some scientists say that farming in such deep waters can avoid environmental concerns raised by fish farms close to shore. If you get too many caged fish in a harbor, the fecal matter will pollute it. But offshore at the Kona Blue site, powerful ocean currents constantly flush so much water through the farm that Kona Blue reports it can't detect any change in nutrient levels up-current versus down-current of the farm. A big challenge, of course, for off-shore aquaculture is designing a fish farm that can survive the open ocean. Anyone who read the book or saw the movie *The Perfect Storm* got a sense of the forces that are unleashed on the ocean's surface. The trick has been to sink the giant cages down well below the surface of the water and tie them to a series of anchors using high-strength polymer ropes. The only things exposed above water are several large metal feed buoys. One experimental fish farm off the coast of New England has survived several northeasters with 40-foot waves and high winds.

'Going Green' with the Blue Revolution
by Chris Arnold

A Kona Blue worker checks on the 'farm': This giant, 80-foot-tall netted cage is used to house fish submerged in waters off the coast of Hawaii that are about 200 feet deep. Courtesy Kona Blue

Fish farms have been a boon to fish lovers around the world. About 30 percent of the seafood eaten in the United States this year will come from so-called "aquaculture" farms, most of them in Asia.

But fish-farming operations, which traditionally operate near the shore, have raised environmental concerns. According to one study, a fish farm with 200,000 salmon releases nutrients and fecal matter roughly equivalent to the raw sewage from 20,000 to 60,000 people.

Kona Blue's Neil Sims says inshore farming has become much cleaner in recent years. And he and other scientists say farming far offshore – in waters hundreds of feet deep, with strong currents – goes a long way toward diluting any waste, making it a very appropriate place for large-scale aquaculture.

Some environmentalists, though, are still concerned about the environmental controls in new federal legislation that would set up a regulatory framework for open-ocean aquaculture. Rebecca Goldburg of Environmental Defense, an advocacy group, worries that, in its current form, the legislation leaves too much environmental regulation up to the discretion of the National Oceanic and Atmospheric Administration (NOAA).

Goldburg worries this could leave the door open for irresponsible deep-water aquaculture that might create pollution problems, perhaps similar to those seen from large-scale industrial hog-farming on land. (Hog farms have been linked to groundwater pollution, not to mention olfactory unpleasantness.) For example, a big enough fish farm in the Gulf of Mexico, where waters are already nitrogen-saturated, could cause problems.

Escapes present another area of concern. When the fatter, slower farmed salmon get loose, they can breed with threatened species of wild salmon. Goldburg says that's like breeding dogs and wolves. It pollutes the wild gene pool with much slower and dumber wild salmon that have trouble surviving and making it back up river to spawn.

That said, even Goldburg says that Neil Sims and the other top scientists and executives at Kona Blue are being environmentally responsible. The Kona Blue team is monitoring the sea water around their farm, and the company says it has found no discernable environmental impact. Goldburg notes that the company is also farming a species native to the area, and is not genetically altering or selectively breeding the fish in any way. So any escapes that occur won't affect the surrounding wild species of fish.

There is one other potential problem. Right now, carnivorous fin fish such as salmon are fed a fish-meal made with wild-caught feed fish such as herring. Goldburg says it takes about three pounds of feed fish to raise one pound of salmon on a farm. She says that's not exactly a "sustainable" model, since farming fish relies on catching so many wild fish out of the oceans.

But Kona Blue's Sims says big strides have been made in replacing some of the fish in the fish meal with vegetable products. He expects the percentage of wild-caught fish in fish meal will fall sharply in years to come. And he's hopeful that more of the fish feed can be made with fish byproducts: heads, tails and trimmings which would otherwise go to waste.

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Mediterranean finfish species such as the European seabass and the gilthead seabream have, over the last two decades, been attracting considerable attention among aquaculturists and investors. The net result has been a rapid increase in the supply of the finfish to European markets. Accessing these markets with the right product at the right price is a key factor in the success of any commercial aquaculture project. This report describes the current status of the European market for these and other finfish species and the major characteristics of marketing farmed fish in the Mediterranean basin. Part 1 of the report gives an overview of the global European market, including developments in finfish production and marketing performance. Part 2 reviews major market traits of the European seabass and the gilthead seabream as well as other finfish including tilapia. It discusses suppliers to Europe, prices, marketing strategies and product types. Part 3 presents important European market characteristics such as product quality, consistency of supplies and competitive prices. Part 4 gives key figures regarding aquaculture production by country. Part 5 outlines farming technologies that may be more suited to certain Mediterranean countries and may offer new investment opportunities.

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