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SECTORAL STUDY

Aquaculture

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«Recharging Greek Youth to Revitalize the Agriculture and Food Sector of the Greek Economy»

Final Report

Sectoral Study 2. Aquaculture




Athens, December 2015

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Contents

List of Abbreviations

BP	: Business Plan
CFP	: Common Fisheries Policy
COM	: Communication from the European Commission
DNA	: Deoxyribonucleic acid
EATiP	: European Aquaculture Technology Platform
EC	: European Commission
EMFF	: European Maritime and Fisheries Fund
EU	: European Union
EUMOFA	: European Market Observatory for Fisheries and Aquaculture Products
ESDP	: European Spatial Development Perspective
FAO	: Food and Agriculture Organisation of the United Nations
FCR	: Feed Conversion Ratio
FEAP	: Federation of European Aquaculture Producers
HP	: Horse Power
HELSTAT	: Hellenic Statistical Authority
IMTA	: Integrated multitrophic aquaculture
IRR	: Internal Rate of Return
IT	: Information Technology
IUCN	: International Union for Conservation of Nature
LAR	: Local Available Resources
OP	: Operational Programme
PEA	: Panhellenic Exporters Association
PCBs	: Polychlorinated biphenyls
POAY	: Commercial aquaculture parks
RAS	: Recirculating aquaculture systems
R&D	: Research and Development
RTD	: Research and Technological Development
SWOT	: Strengths, weaknesses, opportunities and threats
SME	: Small and Medium Enterprise
SOFIA	: The State of World Fisheries and Aquaculture
QTL	: Quantitative trait locus

UN : United Nations

UV : Ultraviolet

VAT : Value Added Tax (23%)

VNN : Viral nervous necrosis

Executive Summary

Marine aquaculture is a success story in Greece. Starting in the early 1980s, the first hatcheries supplied the first fingerlings for on-growing in cage farms. Cage farming technology was known from the salmon industry and easily adopted in the Mediterranean conditions. As the European Union (EU) imports of fishery products are much higher than its exports, aquaculture was always in the priorities of the EU strategy. Therefore, major EU funding programs and a few entrepreneurial individuals that have undertaken the challenge and the risks has led to a rapid increase in production and Greece became, and still is, the largest producer of seabass (*Dicentrarchus labrax*) and seabream (*Sparus aurata*) in the world. From 100 tonnes of ready product and 12 fish farms in operation in 1985, in just two decades the production had been increased at 1000% and fish farms exceeded 320. Greece has reached a pick in 2008 by producing more than 450 million fingerlings and 148.509 tonnes, but this production has reduced in order to restore satisfactory prices with 115.580 tonnes of fish produced in 2014.

Mussel culture sector in Greece developed after the successful introduction of the ''innovative'' single longline floating technology during the mid 1980s and there is a limit to the expected expansion of the mussel sector imposed by the small number of suitable estuaries or closed bays. Annual mussel production in Greece ranges from 25,000–40,000 t, with close to a maximum of 45,000–50,000 t projected for coming years. It is mainly an export-oriented activity based on the production of ''raw material'' for the processing and distribution networks of major consumer countries in Europe. However, structural problems in Greek mussel farming, such as poor marketing and lack of organized dispatch centers or purification plants, may put at risk the profitability of relatively small farms.

As investments for the intensive farming of the species sea bass, sea bream, sole, meagre, turbot are quite high (the required capital is in excess of 1 million Euros), this study presents opportunities that are less capital intensive and require a lot less investments for their realization. These include (1) the idea to create small facilities of organic production of sea bass and sea bream of 15 tonnes annual capacity, combined with the provision of ichthyotourism, fishtourism and diving services and (2) the rearing in the sea of mussels with a farm of 4 hectares and 400 tonnes production per year.

For the organic fish farm, the overall total investment cost amounts to € 322.524,75. Own contribution amounts to 40% of the production costs of the investment corresponding to 129,009.90 €. A long term loan of 48,378.71 Euros will be requested from a bank. Public expenditure is projected at 45% of the production costs of the investment corresponding to 145,136.14 €. Revenues of the company will derive from (a) wholesales of organic marine fish, (b) services (diving, fish tourism) and (c) from the seasonal operation (5 months/year) of a fish tavern. Fish tourism activities will be organized in collaboration with local professional fishermen. The investment, suggests that the combination of a small scale organic aquaculture farm offering fishtourism, ichthyotourism and diving services is a profitable business. Positive results require some time as in most aquaculture activities and the investors must be patient as the best results will appear after the 4th year of operation. Cash flow analysis shows a particularly favorable flow (with the exception of the 1st year) as inflows are higher that outputs, especially if the whole operation will be subsidized from EU and National funds. Organic fish production in Greece is currently characterized by small productions. Diversification towards agrotourism (fish tourism and ichthyotourism) makes the whole concept more robust and less vulnerable to unpredictable factors.

Annual income and profitability of Greek mussel farms ranging from 1-6 hectares revealed that for being on the safe side, a mussel farm of 4 hectares with an annual production capacity of 400 tonnes per year must be planned.

The overall total investment cost amounts to € 469,573.16. The investment is expected to benefit from EC and national public expenditure projected at 45% of the production costs of the investment corresponding to 211,307.92 € and own contribution amounts to 55% corresponding to 258,265.24 €. The Business Plan suggests that mussel farm is a profitable business, however, the positive results require some time as in most aquaculture activities and the investors must be patient as the best results will appear after the 5th year of operation. Cash flow analysis shows a particularly favorable flow as inflows are higher that outputs, especially if the whole operation will be subsidized from EU and National funds.

The study highlighted that there is scope for further increase of seafood consumption in Greece as well as Europe. Greek youngsters and scientists must continue to be major contributors to the international scientific and business community, providing relevant input to all stages of the aquaculture value chain. For the promotion of human capital, educational activities related to aquaculture should take place, such as professional training, lifelong learning, dissemination of scientific and technical knowledge and innovative practices and acquisition of new professional skills in aquaculture, with regard to the establishment of viable units and the reduction of the environmental impact of aquaculture operations. The aquaculture sector will be attractive to a wide range of highly educated people, as well as highly skilled workers with positive growth and employment opportunities. The industry will be characterised by its ability to fast-track progress from knowledge development and intellectual protection through innovation, industrial application and product development. Greek aquaculture will adopt cutting edge knowledge management practices to support state-of-the art technological development. This will be the key factor that will allow the aquaculture industry to meet the imminent market demand for fish & shellfish production, due to limited natural resources coupled with a growing world population. This target and its supporting objectives will be met by achieving the following intervention axes:

Intervention axis 1: Manage knowledge efficiently and effectively within the Hellenic and European Aquaculture sector. • Create knowledge that is focused on outcomes and impacts on industry and ensure that research effort is not duplicated.

- Promote sustainable aquaculture practices through the transfer and application of knowledge and technology, including the challenges of food production, environmental protection, product safety and economic viability.

Intervention axis 2: Ensure the availability and efficient use of aquaculture research infrastructures across all boundaries to benefit the industry.

Intervention axis 3: Collect and collate evidence for informed communications on the benefits of the Hellenic aquaculture sector for Society and the Environment.

Intervention axis 4: Foster and build the human capital of the Hellenic aquaculture sector.

- Promotion of formal and informal lifelong-learning opportunities at all levels as a central strategy to ensure knowledge transfer for a sustainable, innovative and competent workforce.
- Explore new models and partnerships for learning and its accreditation to encourage career development and innovation in the sector.
- Attract and retain talented, enthusiastic and able individuals to work in the aquaculture sector and to foster entrepreneurship.
- Seek to maximise appropriate career pathways and job satisfaction.
- Promote and enable peer-to-peer networking and collaboration as key components of an innovative Hellenic aquaculture sector.

• Create and sustain effective links between industry and research communities.

From all the above it appears the need to support Universities and Institutes for providing advisory services, education and research to promote human capital, networking, entrepreneurship, competitiveness and innovation in the sector of Aquaculture. There is an apparent need to further create a cluster for aquaculture with the participation of the private sector (enterprises) and the public sector (Universities, Research Institutions), to facilitate and support, especially young entrepreneurs, in their very first steps.

1. Aquaculture spatial differentiation (aquatic cultured organisms, production systems, etc)

Fish accounts for about 15.7% of the animal protein consumed globally. The UN Food and Agriculture Organisation (FAO) estimates that aquaculture provides half of this and that by 2030 it will reach 65%[1]. It is currently about 25% in the EU[2]. It is thus contributing to an overall improvement in human diet. Growth in the aquaculture sector in Asia, which accounts for more than 89% of global production is more than 5% a year, while EU growth in the sector is stagnant[3].

Global fish production has grown steadily in the last five decades, with food fish supply increasing at an average annual rate of 3.2 %, outpacing world population growth at 1.6 %. World per capita apparent fish consumption increased from an average of 9.9 kg in the 1960s to 19.2 kg in 2012. Nowadays, aquaculture contributes about 50 % of the fishery output for human consumption – impressive growth compared with its 5 % in 1962 and 37 % in 2002, with an average annual growth rate of 6.2 % in the period 1992– 2012 (FAO, 2014). This makes aquaculture the fastest-growing animal-food-producing sector in the world (COM(2012) 494 final).

World aquaculture production continues to grow, albeit at a slowing rate. According to the latest available statistics collected globally by FAO, world aquaculture production attained another all-time high of 90.4 million tonnes (live weight equivalent) in 2012 (US$144.4 billion), including 66.6 million tonnes of food fish (US$137.7 billion) and 23.8 million tonnes of aquatic algae (mostly seaweeds, US$6.4 billion). In addition, some countries also reported collectively the production of 22 400 tonnes of non-food products (US$222.4 million), such as pearls and seashells for ornamental and decorative uses. For this analysis, the term "food fish" includes finfishes, crustaceans, molluscs,

[1] FAO 2014.The State of World Fisheries and Aquaculture. Opportunities and challenges. 243 pp. lex.europa.eu/LexUriServ/LexUriServ.do?uri=COM:2012:0494:FIN:EN:PDF) [2] COM (2012) 494 final. Blue Growth opportunities for marine and maritime sustainable growth (http://eur[3] *Ibidem*

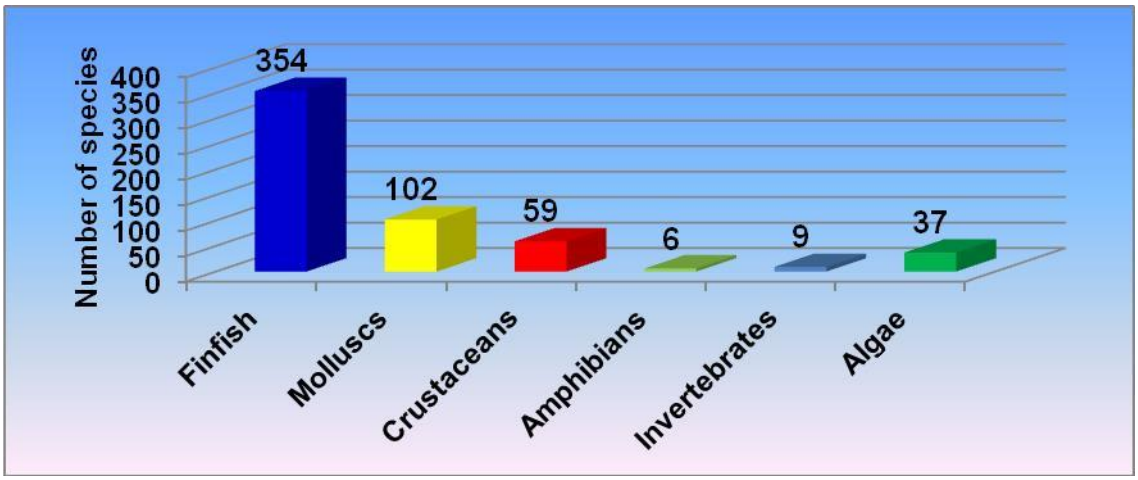
amphibians, freshwater turtles and other aquatic animals (such as sea cucumbers, sea urchins, sea

squirts and edible jellyfish) produced for the intended use as food for human consumption. At the time of writing, some countries (including major producers such as China and the Philippines) had released their provisional or final official aquaculture statistics for 2013 (FAO, 2014).

World food fish aquaculture production expanded at an average annual rate of 6.2 % in the period 2000–2012, more slowly than in the periods 1980–1990 (10.8 %) and 1990– 2000 (9.5 %). Between 1980 and 2012, world aquaculture production volume increased at an average rate of 8.6 % per year. World food fish aquaculture production more than doubled from 32.4 million tonnes in 2000 to 66.6 million tonnes in 2012 (FAO, 2014).

As of 2012, the number of species registered in FAO statistics was 567, including finfishes (354 species, with 5 hybrids), molluscs (102), crustaceans (59), amphibians and reptiles (6), aquatic invertebrates (9), and marine and freshwater algae (37) (Figure 1). It is estimated that more than 600 aquatic species are cultured worldwide for production in a variety of farming systems and facilities of varying input intensities and technological sophistication, using freshwater, brackish water and marine water (FAO, 2014). For most farmed aquatic species, hatchery and nursery technology have been developed and established along with suitable husbandry practices.

Figure 1. Number of aquatic species cultured worldwide.



Source: FAO SOFIA, 2014.

For a few species, such as eels (*Anguilla* spp.) and mullets, farming still relies entirely on wild seed[2]. Aquaculture also plays a role in food security through the significant production of some low-value freshwater species, which are mainly destined for domestic production, also through integrated farming (catfish, carps etc).

Global fish production continues to outpace world population growth, and aquaculture remains one of the fastest-growing food producing sectors. In 2012, aquaculture set another all-time production high and now provides almost half of all fish for human food. This share is projected to rise to 62 % by 2030 as catches from wild capture fisheries level off and demand from an emerging global middle class substantially increases. If responsibly developed and practiced, aquaculture can generate lasting benefits for global food security and economic growth (FAO, 2014).

Among the leading producers, the major groups of species farmed and the farming systems vary greatly. India, Bangladesh, Egypt, Myanmar and Brazil rely very heavily on inland aquaculture of finfish while their potential for mariculture production of finfish remains largely untapped. Norwegian aquaculture, however, rests almost exclusively on finfish mariculture, particularly marine cage culture of Atlantic salmon, an increasingly popular species in the world market. Chilean aquaculture is similar to that of Norway but it also has a significant production of molluscs (mostly mussels) and finfish

[2] See Lovatelli, A.; Holthus, P.F. (eds) Capture-based aquaculture. Global overview. **FAO Fisheries Technical Paper.** No. 508. Rome, FAO. 2008. 298 p. http://www.fao.org/docrep/011/i0254e/i0254e00.HTM

farmed in freshwater, and all farmed species are targeted at export markets. In Japan and Korea, well over half of their respective food fish production is marine molluscs, and their farmed finfish production depends more on marine cage culture. Half of Thailand's production is crustaceans, consisting mostly of internationally traded marine shrimp species. Indonesia has a relatively large proportion of finfish production from mariculture, which depends primarily on coastal brackish-water ponds. It also has the world's fourth-largest marine shrimp farming subsector. In the Philippines, finfish production overshadows that of crustaceans and molluscs. The country produces more finfish from mariculture than freshwater aquaculture, and about one-fourth of the mariculture-produced finfish, mostly milkfish, are harvested from cages in marine and brackish water. In Vietnam, more than half of the finfish from inland aquaculture are Pangasius catfish, which are traded overseas. In addition, its crustacean culture subsector, including marine shrimps and giant freshwater prawn, is smaller only than that of China and Thailand. China is very diversified in terms of aquaculture species and farming systems, and its finfish culture in freshwater forms the staple supply of food fish for its domestic market. Its finfish mariculture subsector, especially marine cage culture, is comparatively weak, with only about 38 % (395 000 tonnes) being produced in marine cages (FAO, 2014).

Table 1. Farmed food fish production by top 15 producers and main groups of farmed species in 2012. Values in tonnes.

Producer	Finfish		Crustaceans	Molluscs	Other species	National total	Share in world total
	Inland	Mariculture					%
China	23,341,134	1,028,399	3,592,588	12,343,169	803,016	41,108,306	61.7
India	3,812,420	84,164	299,926	12,905		4,209,415	6.3
Vietnam	2,091,200	51,000	513,100	400,000	30,200	3,085,500	4.6
Indonesia	2,097,407	582,077	387,698	- -	477	3,067,660	4.6
Bangladesh	1,525,672	63,220	137,174	- -	- -	1,726,066	2.6
Norway	85	1,319,033	- -	2,001	- -	1,321,119	2.0
Thailand	380,986	19,994	623,660	205,192	4,045	1,233,877	1.9
Chile	59,527	758,587	- -	253,307	- -	1,071,421	1.6
Egypt	1,016,629	- -	1,109	- -	- -	1,017,738	1.5
Myanmar	822,589	1,868	58,981	- -	1,731	885,169	1.3
Philippines	310,042	361,722	72,822	46,308	- -	790,894	1.2

Brazil	611,343		74,415	20,699	1,005	707,461	1.1
Japan	33,957	250,472	1,596	345,914	1,108	633,047	1.0
Korea	14,099	76,307	2,838	373,488	17,672	484,404	0.7
USA	185,598	21,169	44,928	168,329	- -	420,024	0.6
Top 15 subtotal	36,302,688	4,618,012	5,810,835	14,171,312	859,254	61,762,101	92.7
Rest of the world	2,296,562	933,893	635,983	999,426	5,288	4,871,152	7.3
World	38,599,250	5,551,905	6,446,818	15,170,738	864,542	66,633,253	100

Source: FAO, 2014

In Europe, the vast majority of finfish mariculture subsector is reared in marine cages. More than 90% of aquaculture businesses in the EU are SMEs, providing around 80000 jobs. Aquaculture has the potential to grow by providing more quality merchandise to consumers willing to choose fresh, trustworthy products, increasingly including those that are sustainably or organically produced. Moreover, it can help coastal communities diversify their activities while alleviating fishing pressure and thus helping to preserve fish stocks.

The following Table shows the aquaculture development in Europe.

PRODUCTION (tonnes)	YEAR									
COUNTRY	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
NORWAY	656,547	693,122	842,521	904,623	967,235	1,018,201	1,093,300	1,325,550	1,270,150	1,370,090
TURKEY	114,206	124,530	136,573	149,589	155,802	164,197	187,136	210,824	231,672	232,152
UTD. KINGDOM	137,994	131,882	143,721	144,031	154,949	158,268	161,033	175,292	174,897	178,417
GREECE	90,958	115,392	130,872	148,509	138,513	122,590	111,217	116,073	125,580	115,580
FAROE ISLANDS	22,677	17,222	29,183	45,506	57,900	47,190	62,400	76,800	76,480	86,449
SPAIN	52,685	61,862	62,293	65,835	69,866	63,200	61,992	59,920	55,694	59,356
ITALY	62,258	62,534	63,815	64,073	65,137	64,382	64,781	58,100	57,590	57,990
FRANCE	48,908	50,987	49,491	47,110	45,954	44,342	45,980	44,540	40,205	41,641
DENMARK	38,674	36,288	40,068	39,831	38,216	37,904	38,548	33,447	39,176	39,170
POLAND	34,425	34,685	34,898	34,370	35,048	29,250	28,745	32,524	33,535	37,070
CZECH REPUBLIK	19,963	18,993	19,794	19,765	19,464	19,953	20,393	19,407	18,201	19,092
GERMANY	34,840	35,038	35,038	34,964	33,356	33,453	16,464	15,155	16,150	16,406
HUNGARY	17,721	17,717	14,942	15,860	13,976	13,524	15,297	14,433	14,251	14,378
FINLAND	13,693	14,000	11,000	12,000	12,700	10,400	9,220	9,000	9,954	12,448
IRELAND	13,176	11,607	13,060	12,020	14,500	13,934	13,434	13,434	12,450	11,400
SWEDEN	5,670	6,792	4,956	6,703	7,023	9,171	11,963	12,441	11,657	11,144
CROATIA	6,699	7,343	6,913	7,635	9,946	9,823	10,681	8,822	8,512	10,201
ICELAND	8,415	9,931	5,588	5,014	5,116	5,018	5,260	7,368	6,886	8,289
NETHERLANDS	9,700	9,450	9,640	9,340	7,095	6,560	6,110	5,560	6,155	6,155
PORTUGAL	4,166	4,367	4,274	4,024	4,097	4,674	5,130	7,000	3,635	5,760
CYPRUS	2,118	2,552	2,229	2,452	3,343	4,118	4,665	4,313	6,171	4,810
AUSTRIA	2,580	2,657	2,669	2,206	2,260	2,279	2,813	3,001	3,115	3,115
Grand Total	1,398,073	1,468,951	1,663,538	1,775,460	1,861,496	1,882,431	1,976,562	2,253,004	2,222,116	2,341,113

Table 2. Development of Fish Farming in Europe (tonnes) 2005-2014.

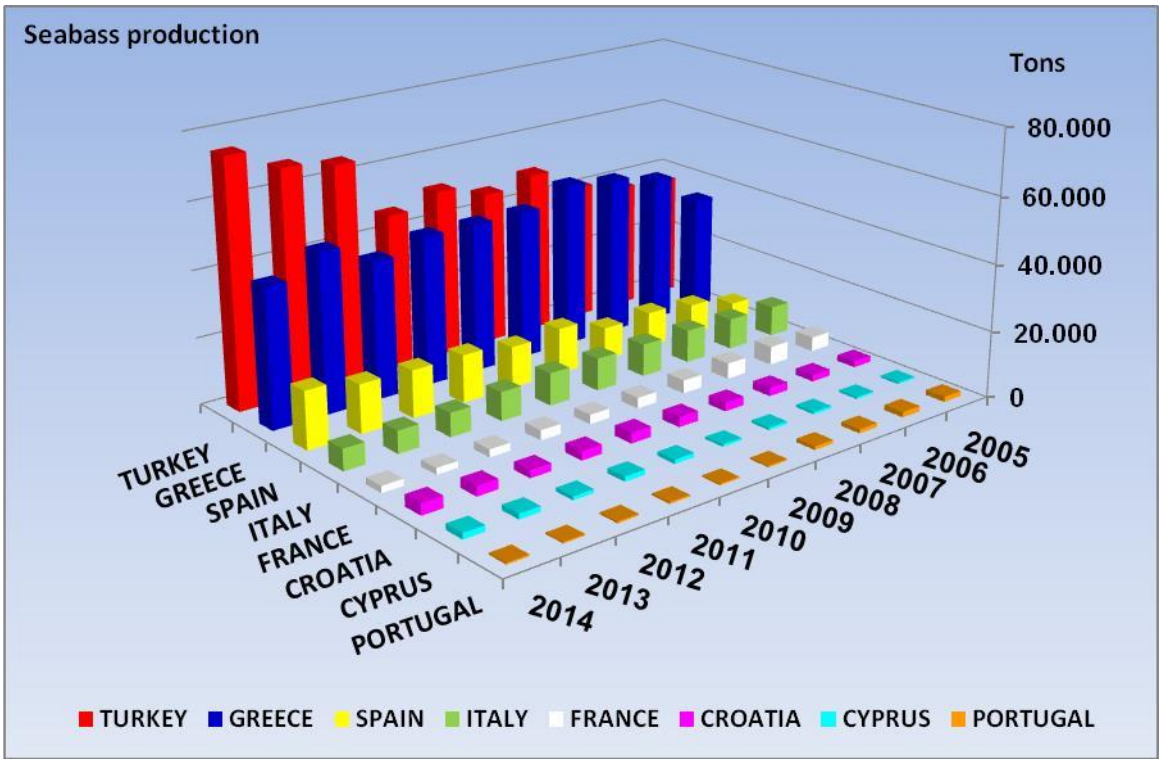
Source: FEAP,2015

1.1. The Mediterranean marine aquaculture production

The Mediterranean is the largest inland sea in the world with more than 460 million people living in the region. This sea is 3,860 Km wide from east to west and 900 Km maximum distance from north to south covering an area of 2.5 million Km^2. Since the beginning of the 1990s, Mediterranean aquaculture has experienced considerable growth, going from 700,000 to 1,000,000 tonnes produced in 2012 (FAO). The major reared species include, sea bass, sea bream, turbot, sole & meagre.

Table 3. Sea bass production (tonnes) 2005-2014.

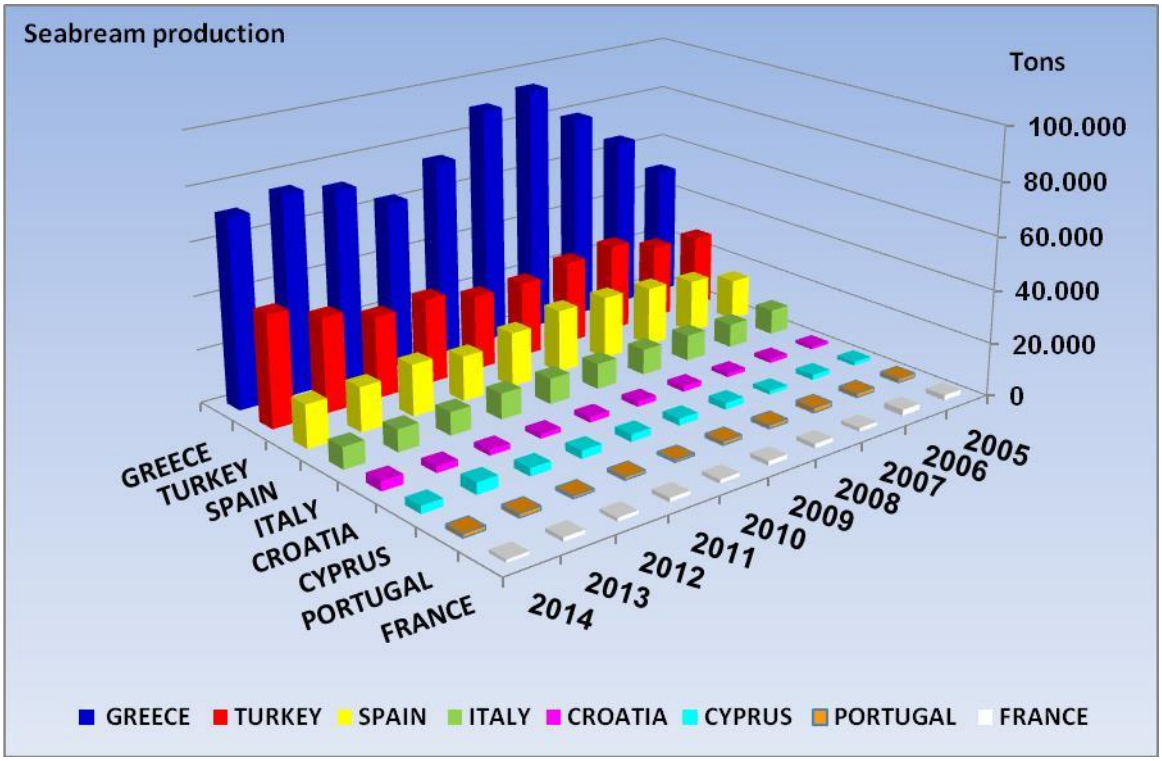
	YEAR									
	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
TURKEY	37,290	38,408	41,900	49,270	46,554	50,796	47,013	65,512	67,912	74,653
GREECE	35,000	45,000	48,000	50,000	45,000	45,000	45,000	41,500	48,000	42,000
SPAIN	5,492	8,930	10,480	9,840	13,840	12,495	14,370	14,270	14,700	17,376
ITALY	9,100	9,300	9,900	9,800	9,800	9,800	8,700	7,200	6,800	6,500
FRANCE	4,300	5,585	4,764	3,968	3,204	2,779	3,000	2,300	1,970	2,021
CROATIA	1,850	2,000	2,500	2,700	3,000	3,200	2,785	2,375	3,014	3,500
CYPRUS	583	589	740	752	703	1,237	1,500	1,096	1,621	1,817
PORTUGAL	1,530	1,584	1,205	1,069	444	396	480	500	400	500
Total	95,145	111,396	119,489	127,399	122,545	125,703	122,848	134,753	144,417	148,367



Source: FEAP

Table 4. Sea bream production (tonnes) 2005-2014.

	YEAR									
	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
GREECE	50,000	66,000	79,000	94,000	90,000	74,000	63,000	72,000	75,000	71,000
TURKEY	27,634	28,463	33,500	31,670	28,362	28,157	32,187	30,743	35,701	41,873
SPAIN	15,577	20,220	22,320	23,690	23,690	20,360	16,930	19,430	16,800	16,230
ITALY	9,500	8,900	9,800	9,600	9,600	9,600	9,700	8,700	8,400	8,200
CROATIA	1,200	1,500	1,500	2,000	2,000	2,000	1,793	2,105	2,466	3,640
CYPRUS	1,465	1,879	1,404	2,572	2,572	2,799	3,065	3,121	4,444	2,919
PORTUGAL	1,519	1,623	1,930	1,383	1,383	851	1,200	1,000	1,500	1,500
FRANCE	1,900	2,200	1,392	1,648	1,648	1,377	1,500	1,300	1,477	1,105
Total	108,795	130,785	150,846	165,871	159,255	139,144	129,375	138,399	145,788	146,467



Source: FEAP

Table 5. Turbot, sole & meagre production (tonnes) 2005-2014.

PRODUCTION (tonnes)		YEAR									
	COUNTRY	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
Turbot	FRANCE	791	870	850	850	531	394	300	250	255	279
	ICELAND	115	47	70	51	68	46	20	28	58	0
	PORTUGAL	214	185	167	351	1,276	2,424	2,500	4,500	700	1,700
	SPAIN	4,275	5,815	6,080	7,870	8,320	6,910	7,760	7,970	6,810	7,808
Turbot Total		5,395	6,917	0	9,122	10,195	9,774	10,580	12,748	7,823	10,787
Sole	FRANCE	0	0	0	0	0	142	200	220	223	261
	ITALY	0	0	8	19	14	14	10	0	0	0
	PORTUGAL	11	9	60	13	14	14	50	100	35	60
	SPAIN	60	80	68	55	180	204	110	194	313	786
Sole Total		71	89	68	87	208	374	370	514	571	1107
Meagre	CROATIA	0	0	0	0	20	20	40	40	32	50
	CYPRUS	0	0	0	0	0	12	30	30	48	33
	FRANCE	267	282	235	206	121	268	500	420	200	377
	ITALY	320	280	335	300	320	320	300	300	190	190
	PORTUGAL	47	23	27	15	44	38	0	0	0	0
	SPAIN	273	385	810	1,300	1,660	3,250	2880	1,640	90	1,090
	TURKEY*										3,281
Meagre Total		907	970	1,407	1,821	2,165	3,908	3,750	2,430	560	5,021

Source: FEAP

1.2. Marine Fry Production

According to data provided by the FEAP, Greece ranks as the 1st sea bass and sea bream producer country in the European Union and the Mediterranean area, with a production of 412.000.000 fingerlings, accounting for 39,50% of the total sea bream production in 2014 and 35,56% of the total

sea bass production accordingly. Greece, before 208, used to produce almost 50% of the fry for sea bass and sea bream.

For other species (sharpsnout sea bream, meager, red sea bream etc), the production is about 8 -10 million fingerlings per year and for freshwater species trout production is about 6 million fingerlings per year, in Greece (HELSTAT, 2014).

It should be noted that the data provided by the FEAP (originally collected and submitted by the Federation of Greek Maricultures) are significantly different than the respective data provided by the Hellenic Statistical Authority. Each of the afore-stated bodies adopts an entirely different methodology for the collection of the data, and thus significant differences are observed in the reported Figures.

Thus, an attempt to accurately evaluate the national sea bass and sea bream fry production, based on the reported data, becomes a highly problematic exercise. The research team of the current project, acknowledging the deficit for reliable data and information, in the aim of providing a more pragmatic and 'working' estimate of the national sea bass and sea bream fry production, contacted a large number of producers and adopts the values reported by FEAP which are not far from the reality.

Table 6. Sea bass & sea bream fry production in Europe (in thousands) 2005-2014.

	YEAR									
COUNTRY	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
	Sea bass									
TURKEY	110,000	105,000	147,000	180,000	117,500	105,000	149,000	205,000	172,000	178,000
GREECE	140,000	152,000	130,000	195,700	180,000	180,000	174,000	184,000	192,000	175,000
FRANCE	33,000	36,000	34,420	35,307	39,732	39,800	45,742	46,000	46,542	48,382
SPAIN	23,228	24,400	29,200	34,000	24,650	28,199	33,150	36,423	31,125	43,328
ITALY	50,000	49,000	55,000	55,000	55,000	55,000	48,000	40,000	45,000	42,000
CYPRUS	3,337	3,300	3,117	3,500	3,610	2,522	4,359	5,280	3,955	4,334
CROATIA	5,000	10,000	11,000	13,000	8,100	9,000	8,600	8,100	5,100	1,000
PORTUGAL	5,531	3,556	2,371	2,214	2,182	1,290	1,500	0	0	0
Sea bass Total	370,096	383,256	412,108	518,721	430,774	420,811	464,351	524,803	495,722	492,044
	Sea bream									

GREECE	207,000	273,000	220,000	214,000	150,000	160,000	242,000	245,000	266,000	237,000
TURKEY	75,000	93,000	103,000	80,000	72,000	85,000	140,000	185,000	138,000	149,000
ITALY	45,000	61,000	52,000	50,000	48,000	48,000	62,000	70,000	65,000	67,000
SPAIN	56,235	56,757	67,370	47,282	32,180	36,451	52,900	54,985	51,420	65,786
FRANCE	34,000	33,000	26,740	31,317	22,300	29,100	41,742	30,400	43,728	47,103
CYPRUS	8,086	8,176	12,502	13,000	8,589	8,929	18,479	7,976	14,267	23,588
CROATIA	2,000	5,000	6,000	7,000	6,000	8,929	18,479	7,976	14,267	10,500
PORTUGAL	14,794	19,252	29,722	21,722	3,810	1,378	1,000	0	0	0
Sea bream Total	442,115	549,185	517,334	464,321	342,879	377,787	576,600	601,337	592,682	599,977
Grand Total	812,211	932,441	929,442	983,042	773,653	798,598	1,040,951	1,126,140	1,088,404	1,092,021

Source: FEAP

1.3. Fresh water aquaculture: Rainbow trout

The rainbow trout (*Oncorhynchus mykiss*), named after the many rainbow-coloured spots on its skin, is one of the main species bred in freshwater. Native to the Pacific coast of the United States, it was brought to Europe at the end of the 19th century and today it is farmed in nearly all European countries.

The optimum water temperature for breeding trout is below 21°C. Growth and maturation are influenced by water temperature and food. Under normal conditions, trout usually mature at 3-4 years. They are carnivorous and need a diet rich in protein.

Trout larvae are reared in round tanks made of fiberglass or concrete, which maintain a regular current and a uniform distribution of the larvae. The larvae hatch with a yolk sac that contains the food they need for their initial development. Once the sac has been absorbed, the fry swim up to the surface to look for food and begin to regulate their buoyancy. They are fed small flakes (proprietary feed) containing protein, vitamins and oils. Hand feeding is preferred in the first stages of rearing to avoid overfeeding.

The fry are then fed small pellets until they reach a weight of 50g and are 8 to 10 cm long. At this point, the young fish are transported to grow-out units, either floating cages in lakes or, most often, tanks located beside a river. These tanks, which are generally rectangular in shape and made of concrete, operate on two techniques: flow through, an open system where river water flows

through the units via a raceway; or recirculation, a closed system that consists of circulating water in the tanks and recycling it or a system with partial recirculation. The advantage of recirculation is that the water temperature can be controlled all year long, so that effluents to the environment are very limited. In the right environment, a trout farmed in fresh water can grow to 350g in 10 to 12 months and to 3 kg in two years.

Trout are also grown in floating cages at sea, in the low saline waters of the Baltic and in the protected waters of the Scandinavian fjords, and off the west coasts of Scotland and Ireland. The ocean-farmed trout is generally farmed to higher weight than fresh water trout.

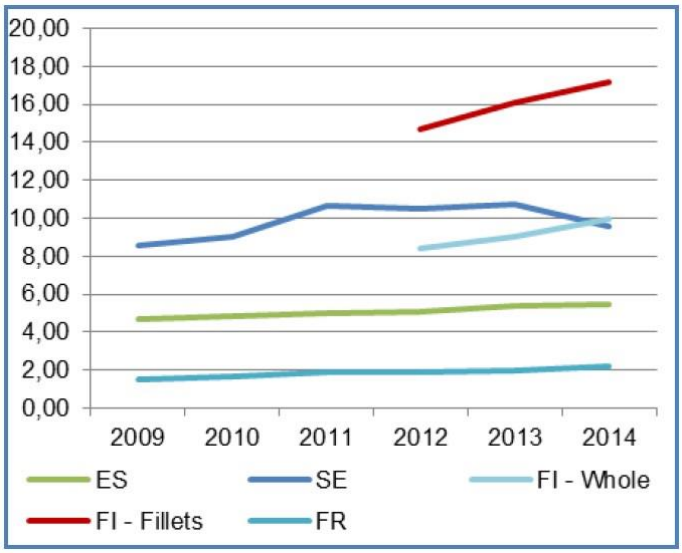
The largest producer in the world of ocean-farmed trout is Chile. In seawater, trout are fed a diet similar to salmon, which accounts for their pink-coloured meat. When the fish have reached commercial weight, the trout are collected with a net or are pumped on to land. Ocean-farmed trout (in Scandinavia) can grow to 1-1,5 kg in 12 months and to 3-4 kg in 18 months).

The world's main trout producers are the EU, Chile, Turkey and Norway. Today, nearly all rainbow trout on the EU market comes from aquaculture. EU supply of trout is locally produced. The main EU- producer countries are Italy, France, Denmark, Spain and Poland.

For trout farming in general, prices of fish feed have increased over the last years. Feed is the main production cost in trout farming accounting for 35-50% of the total – depending on the scale of production.

1.3.1. Consumption of trout

EU production of trout has declined fairly consistently over the last years. At the same time, imports to the EU have increased. However, until 2013 the increase in imports have not fully compensated for the fall in production. Export volumes from EU producers to markets outside the EU remained relatively stable.



It therefore appears that consumption has trended down.

In 2013, extra EU imports more

Figure 2. Retail price trends for fresh trout products than compensated for the fall in in the EU (EUR/kg). *Source: EUMOFA.* production, From 2012 to 2013,

EU consumption of trout rose by 1,3%.

1.4. Marine Aquaculture Sector Dynamics

Greece is a unique country in the region with special characteristics that could support the growth of mariculture. Although the country is relatively small (131,940 Km^2), it is blessed with an extensive coastline of 15,000 Km, with favorable climatic characteristics and while it is currently the leading mariculture producer in Mediterranean there is scope for further growth and increased productivity.

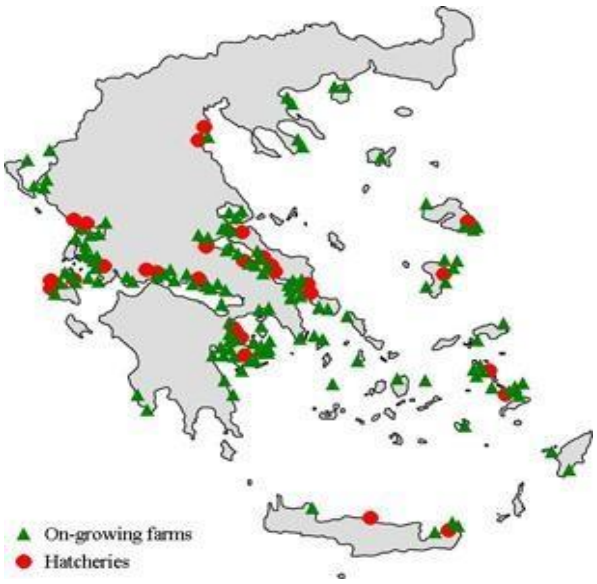


Figure 3. Distribution of ongrowing marine aquaculture farms and hatcheries in Greece. 106 Companies employ directly or indirectly 10,000 people in remote areas of Greece. Main characteristic of the sector is the intense export orientation, with about 75% exported contributing considerably in the fisheries product balance and in Gross Domestic Product by the high volume of exports and the surge of important capital in our country, established recently as the leading agricultural sector in Greek Exports, a very prominent position in the current difficult years for the Greek Economy. Eight (8) Aquaculture groups are Publicly Registered Companies in the Athens Stock Exchange with 38.000 Shareholders. The Greek industry is vertically integrated with 16 companies as well as large impoundment owners and 3 companies who own feed production plants.

The Sector of Greek Maricultures, with a 30 - year history, has a leading place in the Mediterranean in the production of gilthead sea bream and European sea bass and it is characteristic that in 2008 Greece with a production of 450 million juveniles had the 41% of the total hatchery production with a Production of 120.000 tonnes of gilthead sea bream and European sea bass the 47% of the fresh final product.

The growth of the Greek Mariculture industry was fast in the last 15 years with 318 active licenses that today operate mainly in remote rural areas. Two market crisis (20022004) and (2007-2010) were initiated mainly due to lack of market information and increased pulsed flux in the market while demand was increasing much slower. In 2011 the market prices especially in sea bream are the best of the last decade so the industry is getting into yet another growth period that we have to ensure that will not be followed again by dip crisis. There are 59 hatchery licenses with production of 465 million of

European sea bass and gilthead sea bream for 2007 and 399 million in 2013. This segment is even more concentrated than the on growing production sector with three companies accounting for close to 90 % of total production. Most juvenile production is used nationally except for some quantities exported to subsidiary or affiliated companies in Turkey and Spain.

There are 106 companies operating in the sector but the industry has become highly concentrated over the past ten years with six companies controlling 60 % of national production and 16 companies or group of companies controlling between 70–75 % of production. The industry in Greece is vertically integrated, with the 16 largest companies owning their own hatchery production facilities and the three largest companies owning their own feed production plants (representing about 60 % of feed production in Greece) and processing plants.

In recent years there has been some expansion of Greek companies into other countries, namely Turkey and Spain, through the outright purchase or part participation in the shareholding of Turkish and Spanish companies. Expansion into Turkey was motivated by a perceived lower cost of production combined with the direct export subsidy afforded to Turkish production. Investment into Spanish production was motivated by the advantage of a national supplier in one of the largest consuming markets for European sea bass and gilthead sea bream in Europe. In the last two years and during the market crisis, Greek Mariculture attracted foreign investor interest and involvement in the three leading groups namely Dias, Nireus and Selonda. Investor's acquisition and merger plans have yet to be fully implemented.

The Greek exports are gradually extended in markets except Italy, Spain and France and in the Emerging markets of UK, Germany, Belgium, Netherlands, Luxembourg, Austria, USA and Canada, where new distribution networks are being developed. Gradually but steadily Greek fish with high nutritional value, quality and hygiene have conquered a sovereign place in the plate of European consumers playing important role in the recent turn to the healthy `Mediterranean Diet'.

The Vision of the European Aquaculture Technology Platform, presented scenarios for 2030 and demonstrated the differences in views on potential growth in the different sectors, whether this be for technology, markets,

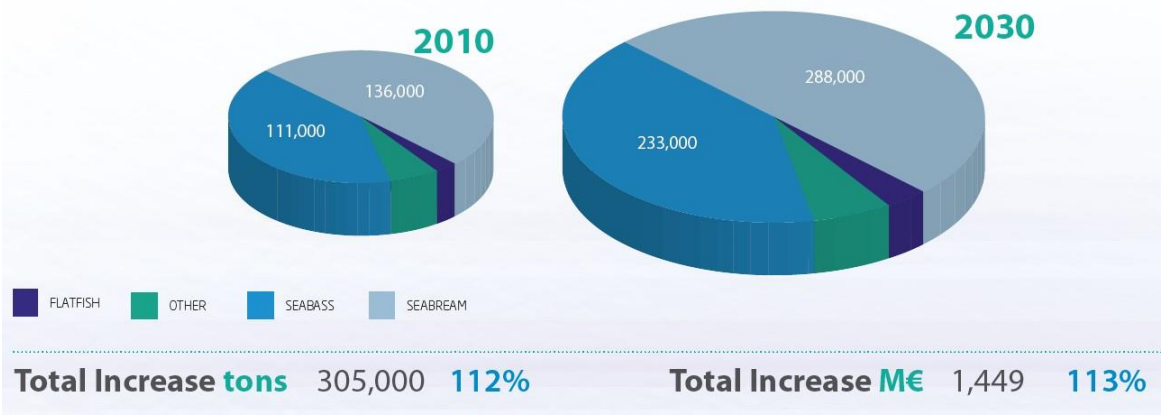
legislation, knowledge and/or other factors that might influence development. Overall, several common views can be summarised as follows:

- The main species produced in each sector will continue to dominate production, while diversification will contribute to competitiveness in different ways.
- Integrated multitrophic aquaculture (IMTA), diversification in species and activity are all seen as opportunities.
- Significant improvements in feed composition and conversion, combined with new management and operational technologies, will contribute to higher productivity
- Improved husbandry will target such characteristics as robustness, disease resistance and overall product quality, resulting in higher levels of performance and consumer acceptance
- The achievement and recognition of environmental sustainability, where new tools for governance are recommended, will be shared throughout European aquaculture.

Especially for the Mediterranean Sea it is predicted that:

- There will be a production growth of more than 100% which is equal to a minimum of 4%/year
- Main species will be sea bass, sea bream, sole, meagre, turbot.
- Higher expansion rates for meagre and sole. " Productivity/employee increases by 20%
- FCR decreases to 1.2 (35% improvement)
- Juvenile survival increases by 20%
- Aquaculture will diversify – functional additives, bio-energy (algae).

Figure 4. EATiP growth forecasts for the Mediterranean aquaculture by 2030.



Source: The Future of European Aquaculture - EATiP 2012

In order to achieve the above targets the following challenges must be efficiently addressed:

1. Understand consumer perceptions,
2. Effective marine & coastal spatial planning,
3. Obtain robust fish, selected broodstock,
4. Disease control & prevention,
5. Overcome climatic challenges, severe weather,
6. Ensure innovation and best knowledge management.

Therefore, the Action Plan must include:

- Access to new production sites, licenses,
- Understand consumer choice,
- Diversify species profile,
- Communicate quality aspects of Mediterranean products,
- Simplification of legislation,
- Incorporate technological developments,
- Assure environmental sustainability,
- Encourage diversification and integration,
- Integrated spatial planning for aquaculture development.

If the above Action Plan will be implemented, then the following effects may be expected by 2030:

- Production of more than 600,000 tonnes of fish.
- €2.7 billion ex-farm value but €5 billion increase in total value. " 10,000 more jobs.
- Total sea farm space of 2,100 hectares.
- Hatcheries to supply nearly 3 billion juveniles.
- Feed demand increases by 200,000 tonnes.

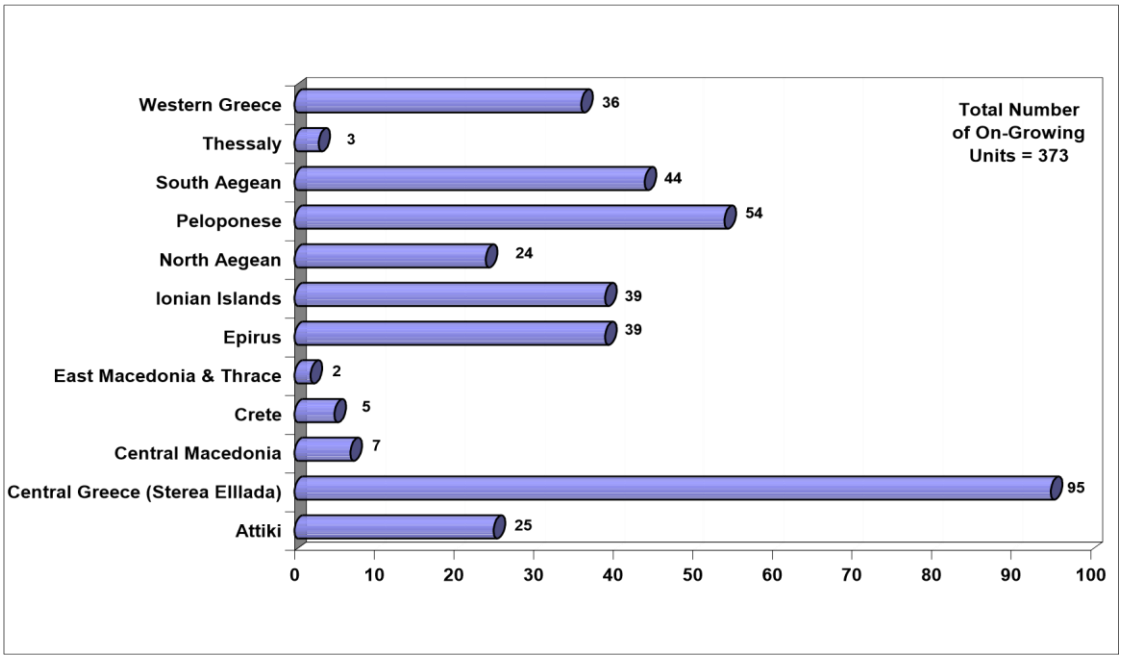
TON

1.5. Marine fish farming in Greece

The on-growing units are spread all over the country's coastline. They are however more concentrated in areas where there is less conflict with other uses, such as tourism, and in areas where the geomorphology provides sheltered conditions along with good recirculation of the waters. Under these constraints and often allowing for the parameter of distance from the main

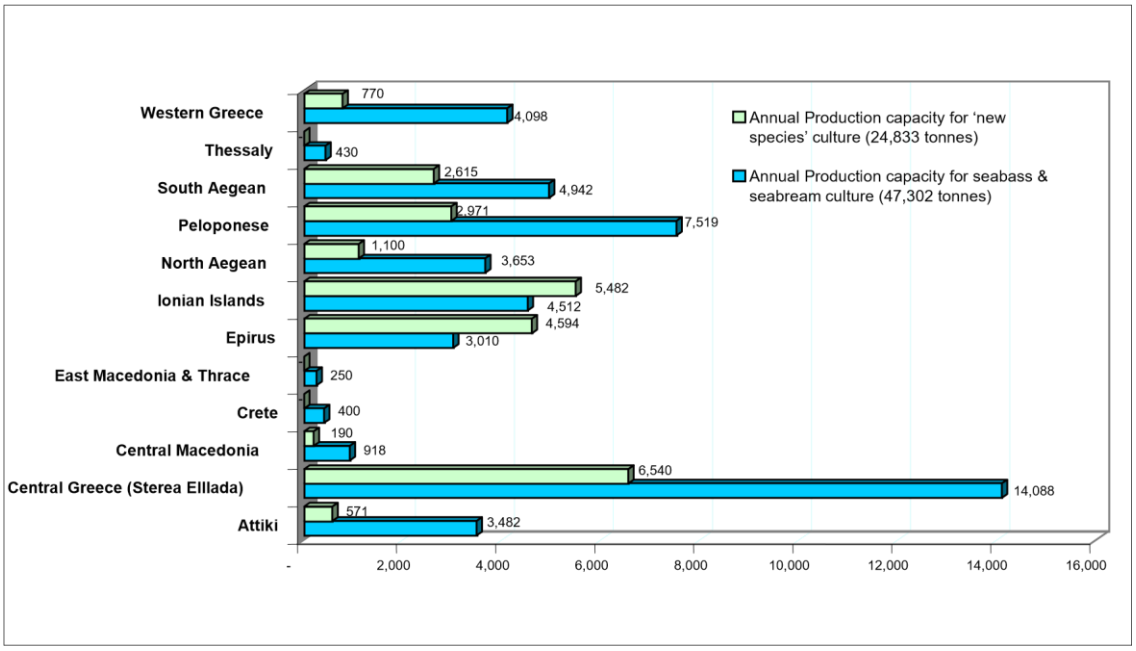
markets (i.e. Athens) and/or main distribution/ export centers (i.e. Patra), the majority of the farms are located in the region of Central Greece (Sterea Ellada) which numbers 95 farm-units, followed by Peloponnese, South Aegean and the western regions of Greece (Regions of: Ionian islands, Epirus, Western Greece). Figure 5 below depicts the regional distribution of the on-growing fish-farms in Greece. Accordingly, in Figure 6 is presented the annual production-capacity allowed for the culture of sea bass and sea bream as well as for the culture of 'new' species, according to the licenses granted by the Ministry of Agriculture by region.

Figure 5. Regional distribution of sea bass & sea bream on-growing fish-farm units in Greece.



Source: LAMANS Study of the market for aquaculture produced sea bass and sea bream species

Figure 6. Annual Production-capacity for the culture of marine species, by Region from the operating units in Greece.



Source: LAMANS Study of the market for aquaculture produced sea bass and sea bream species

1.5.1. Employment in the aquaculture sector in Greece

The following Table is summarizing the evolution of the employment in the aquaculture sector in Greece. The aquaculture sector in Greece and its significant development have resulted in remarkable results not only regarding the production of domestic fresh, cheap and high quality fish (especially sea bass and gilthead sea bream), but also the creation of a socio-economic structure that directly and indirectly involves thousands of employees, particularly in the fisheries-dependent areas of the country. In addition, mariculture is the only productive activity that has colonized uninhabited islands and rock-islands which are normally excluded from other investments. One of the main pillars of EU policies is the policy for employment. In each sectoral policy, contribution in the employment represents a non-negotiable component in terms of job creation and especially in less privileged regions. Aquaculture in certain regions and countries is an important increasing source of employment. In Greek Mariculture sector women consist an important percentage of the workforce located mainly in packaging stations in hatcheries, while by far smaller is their presence in the cage farms. Naturally increased percentage of women is employed in the administrative personnel positions. In particular in the packaging stations the percentage of women oscillates from 45 up to 50%,

while in the hatcheries their percentage is approximately 25%. Beyond (permanent or seasonal) workers in the marine aquaculture, a spectrum of professions and activities is developed due to the fact that the fish farms create indirect job positions (suppliers of material, shipping equipment, fuels, garages, catering and accommodation services, ship yards, factories of fish feeds, suppliers of pharmaceutical products, services etc). In 2002 they were estimated around 8.500 individuals, accordingly to Ministry of Rural Growth and Foods data. In 2009 this number was estimated to reach
10.000 individuals.

Table 7. Evolution of direct employment in the aquaculture sector in Greece. *Source: HELSTAT.*

				YEAR						
				2008	2009	2010	2011	2012	2013	2014
TOTAL	Total	Age	Total	2791	2508	3086	3671	3693	4447	4217
			15-34	962	1124	1194	1139	1139	1401	917
			35+	1829	1383	1892	2533	2555	3046	3300
	Men	Age	Total	2199	2280	2854	3104	2651	2965	2799
			15-34	826	1065	1021	947	823	605	612
			35+	1373	1215	1833	2157	1829	2360	2187
	Women	Age	Total	592	228	232	567	1042	1482	1418
			15-34	137	60	173	192	316	796	306
			35+	456	168	59	376	726	686	1112
GREEKS	Total	Age	Total	2791	2373	2776	2773	3123	4048	3824
			15-34	962	990	1097	894	938	1378	917
			35+	1829	1383	1679	1879	2185	2670	2907
	Men	Age	Total	2199	2145	2544	2205	2081	2603	2566
			15-34	826	930	924	702	622	582	612
			35+	1373	1215	1620	1503	1459	2021	1954
	Women	Age	Total	592	228	232	567	1042	1445	1259
			15-34	137	60	173	192	316	796	306
			35+	456	168	59	376	726	649	953
FOREIGNERS	Total	Age	Total	0	135	310	899	571	399	393
			15-34	0	135	97	245	201	23	0

		35+	0	0	213	654	370	376	393
Men	Age	Total	0	135	310	899	571	362	233
		15-34	0	135	97	245	201	23	0
		35+	0	0	213	654	370	339	233
Women	Age	Total	0	0	0	0	0	37	160
		15-34	0	0	0	0	0	0	0
		35+	0	0	0	0	0	37	160

1.6. The proposed investment opportunities

Investments for the intensive farming of the species sea bass, sea bream, sole, meagre, turbot are quite high. Despite the fact that this study is showing the great potential of these species, however, the required capital is in excess of 1 million Euros.

Therefore, we present below other opportunities that are less capital intensive and require a lot less investments for their realization. These include the rearing in the sea of mussels and the idea to create small facilities of sea bass and sea bream with ichthyotourism and fishtourism orientation.

Following consultations and discussions with prominent experts of the Aquaculture sector (Mrs. Ioanna Argyrou of NAYS Ltd), the Joint Ministerial Decision 31722/4-112011 (Approval of Special Framework on Planning and Sustainable Development on Aquaculture and of its Strategic Environmental Impact Study) allows licensing for small scale marine aquaculture units up to 15 tonnes per year if combined with tourist accommodation, or diving park in the framework of ichthyotourism or other agrotouristic activity. The condition in this case is that these companies operate by the same natural or legal entity or that there is an agreement among different companies.

1.7. Bivalve molluscs

Mussel farming in Greece is a relatively new industry and is focused on rearing the Mediterranean mussel *Mytilus galloprovincialis*. Mussels are filter-feeding animals that depend on natural primary productivity for their growth and development, competing for the capture of phytoplankton, microbes, and detritus in the water column. Currently, mussel culture systems are extensive in their nature worldwide. Farmers use ropes to provide a controlled substrate on which the mussels can settle and grow in a select, highly eutrophic site nearshore.

In Greece, the availability of such suitable places is limited, so the specific site and the occupied space play very important roles in the financial success of a mussel farm and its sustainability.

Development of the mussel culture sector in Greece occurred after the successful introduction of the ‘‘innovative’’ single longline floating technology during the mid 1980s (Theodorou et al. 2011). In contrast to the sea bass/bream industry—the major marine farming activity in Greece, with large

flexibility for site selection (Theodorou 2002)—there is a limit to the expected expansion of the mussel sector imposed by the small number of suitable estuaries or closed bays. Mussel farms currently occupy a sea surface of 3 ha on average (ranging mainly from 1–5 ha), producing up to 100 t/ha. The annual mussel production in Greece ranges from 25,000–40,000 t, with close to a maximum of 45,000–50,000 t projected for coming years.

The Mediterranean mussel farm industry in Greece is mainly an export-oriented activity based on the production of ''raw material'' for the processing and distribution networks of major consumer countries in Europe. However, structural problems in Greek mussel farming, such as poor marketing and lack of organized dispatch centers or purification plants, may put at risk the profitability of relatively small farms (Theodorou & Tzovenis, 2004). In addition, the pending new legislation for site reshuffling in ''Areas for Organized Aquaculture Development'' might increase production costs by imposing additional expenses to it (increased fees, monitoring intensification, and so on).

Farming of the Mediterranean mussel *Mytilus galloprovincialis* Lamarck 1819, is the premiere, almost exclusive shellfish aquaculture production sector in Greece. In general terms, the development of the Greek shellfish farming sector can be divided into 4 phases:

1. R & D phase (1950 to 1977) during which suspension mussel farming was established in Italy and France, and quickly expanded to Spain, United Kingdom, and Ireland. By 1980, it had expanded over almost the entire Mediterranean (Danioux et al. 2000). Early efforts to rear mussels in Greece were carried out by using poles, and were restricted in a few sites with high primary productivity, such as the Saronicos and the Thermaikos Gulf, close to the country's biggest markets of Athens and Salonica.

2. Pre-development phase (1985 to 1990) during which the first pilot longline floating farms were established, creating an opportunity for mass expansion of the activity in Greece. Although mussel rearing has developed rapidly since then, the full range of methods available and practiced elsewhere in Europe have not been made known on a larger scale. Almost all existing farms today use the Italian method of pergolari[3] hanging, either from fixed scaffolding frames or from floating longlines. ''Rope culture,'' practiced widely

[3] Pergolari: mussels tubed in cylindrical plastic nets—Italian style.

in Spain, has no application in Greek waters, although it permits a high degree of mechanization (Askew 1987).

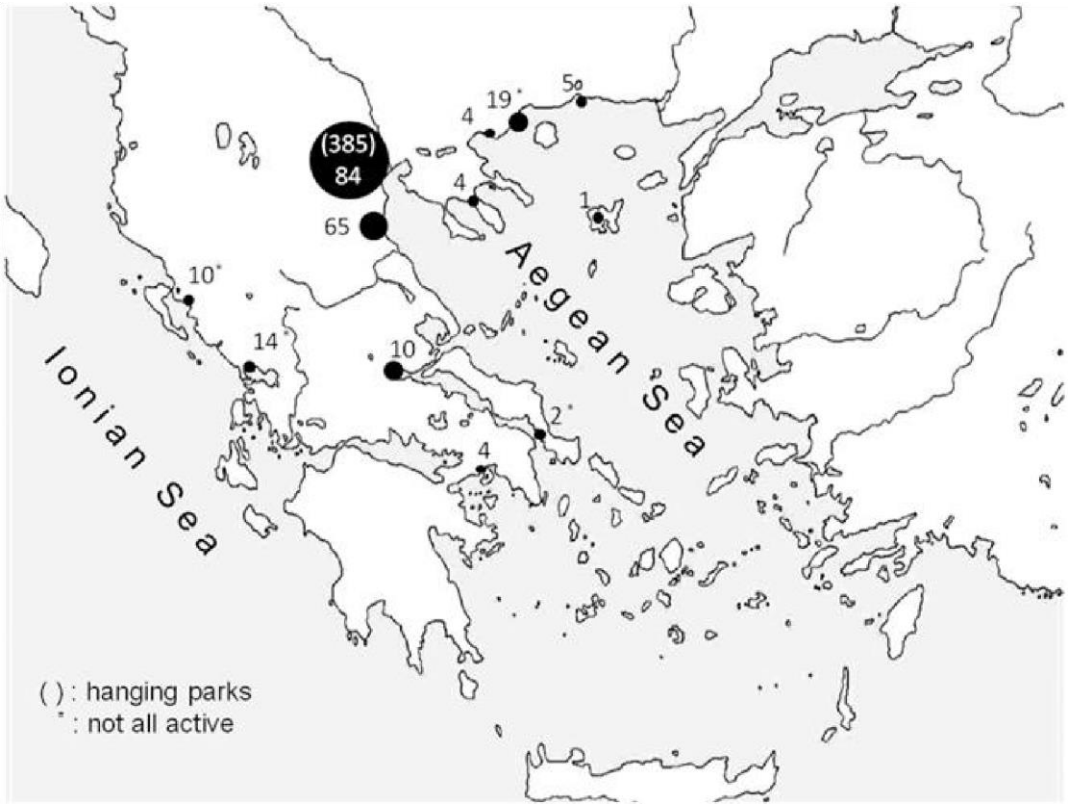
3. Development phase (1991 to 2000) during which research, public, and industrial priorities focused on production elevation that resulted in a rapid increase that soon reached current levels. Techniques were gradually set up to establish complete production systems (suspension culture), to perfect and to scale-up specialized craft (shifting from craft work to pontoons, from modified fishing boats to 10–15 m shellfish boats specialized for longline systems, applying mechanization with mechanical winches). This phase has been generally marked by financial support provided to the farmers, with subsidies and private loans granted by regional authorities and the European Union (Danioux et al. 2000).

4. Maturation phase (2001 to present) during which new aquaculture strategies have been applied to make offshore systems reliable, while lowering production costs (using bigger vessels, 15–20 m long, equipped with star wheels, loaders, mechanical French– type graders, and packing machines), and to achieve economies of scale. This includes the production concentration of large companies or producer organizations (organizations of definitive production structures configuring the profession, organizing the trade, and applying quality schemes and research programs).

1.7.1. Industry Distribution in Greece

In contrast to the rearing of euryhaline marine fin fish species in Greece (sea bass and sea bream), which were developed in areas within the mild climate of the Ionian Sea, and the central and south Aegean Sea, mussel farming has expanded mainly in the northern part of the Aegean Sea (Fig. 7). Ninety percent of farms lie in the wider area of the Thermaikos Gulf (Macedonia Region), representing about 80–90% of the annual national harvest (Galinou-Mitsoudi et al. 2006a, Galinou-Mitsoudi et al. 2006b). This is the result of the unique convergence of several large rivers, with currents that continuously move large volumes of freshwater, and thus provide excessive amounts of nutrients that ensure a desirable, high primary production (Theodorou et al., 2011).

Figure 7. Location of mussel farms in Greece.



Source: Theodorou et al., 2011.

Relatively new mussel farming sites, of lower carrying capacities, are Maliakos Gulf in the central west Aegean (Kakali et al. 2006, Theodorou et al. 2006a, Theodorou et al. 2006c, Beza et al. 2007, Tzovenis et al. 2007) and the Amvarkikos semiclosed embayment in midwest Greece (Ionian Sea). Small farming sites and shellfish grounds are also found in the Saronikos Gulf, East Attica, and Sagiada (northwestern Ionian Sea), and isolated efforts to rear limited quantities (50–100 t) of bivalve shellfish were reported in the Fokida (Gulf of Corinth), Limnos, and Lesvos islands (Theodorou et al., 2011).

1.7.2. Production Systems

In Greece, there are two production methods mainly in use for mussel farming: the traditional hanging parks, restricted in highly eutrophic shallow areas from 4–5.5 m in depth, and the single longline floating system, suitable for deeper waters (>5.5 m), which is the most popular and widely expanded rearing method.

1.7.2.1. Hanging Parks

The method of hanging parks has been applied in shallow waters (up to 6 m deep) as it uses wooden or metallic scaffolding, wedged on a soft bottom, to

hang from its non submerged (1–2m above sea level) mussel bunches. The latter are ropes, which provide space for mussels to attach and grow, that dangle just over the bottom. The overall device is made up of rectangular grids (15 x100 m) installed at a certain distance to each other (about 150 m) to allow for sufficient nutrition from the locally thriving phytoplankton (Alexandridis et al. 2008). Productivity per hectare of these systems is usually very high, ranging from 150–400 t live mussels. However, their application in Greece is restricted by the limited available space in suitable sites (shallow soft bottoms, desirable eutrophication levels, ease of access, protection from excessive seawater turbulence, location not in protected natural areas, and so on) (e.g., Karageorgis et al. 2005, Zanou et al. 2005, Alexandridis et al. 2006).

In Greece, a legislation change during 1994 incorporated bills on natural parks and coastal zone protection, and consequently removed the licenses of most of these facilities without involvement of the local authorities in the withdrawal of the facilities. Moreover, because these systems are very productive, and easy and cheap to construct, many farmers, and even unregistered newcomers, have extended these facilities. At times, this had led to serious losses as a result of suffocation or malnutrition of the settled spat (Kochras et al. 2000).

For some farms, the hanging park method is used complementary to their main longline system, supporting installation for the finishing of the product, for spat collection, and for biofoulant removal by lifting the mussel bunches out of the water and exposing them to the air for a certain time.

1.7.2.2. Single Floating Longline System

The single longline floating system is made up of a series of buoys that suspend a submerged rope (about 1.5 m below surface) from which long mussel bunches are hung (down to 20 m), with the whole construction anchored from its two ends with heavy loads. The longline floating system overcomes the limited availability of space restricting the hanging parks, by expanding the farming activity to deeper waters. This can result in a somewhat lower productivity, ranging from 80–120 t/ha. Typically, a number of parallel single longlines of 100–120 m in length constructed by polypropylene ropes are UV resistant (diameter, 22–28 mm), and they are set 10 m apart and suspended from buoys of 180–200 L, or secondhand plastic barrels. A pair of moorings (3 t each) is used to anchor the floating installation laterally from each longline set to a direction parallel to the direction of the

prevailing currents. The right anchor is site dependent (bottom substrate type, current direction), with an indicative ratio between sea depth and distance of anchor of 1:3.

In Greece, the installation of the longline system in the early phase of the sector, was done by placing the anchor off the borders of the licensed area, but recent regulation dictates that anchors should be deployed within the limits of the rented farming space. The current implementation of these rules poses a dilemma for the farmers forced to choose between either rearranging their farms (with the corresponding permanent decrease in capacity) or licensing the extra space needed to expand (with temporary loss of valuable production time by following the necessary administration paperwork, which takes more than a year).

1.7.3. Mussel Farming Business

Today, in Greece, there are about 218 officially licensed farms for mussel production occupying 375.5 ha (Theodorou et al., 2011). These farms follow the single floating longline technique, because the existing 305 hanging park farms, being placed within protected coastal areas, have had their licenses suspended until a legal formula can be found to legitimize their operation. Theodorou et al., (2011) found that a significant increase in licenses coincides with election or Government changes, which affect policies. Producing farms are plotted against the number of licenses, because it takes time for farms to implement their license. Several licenses remain inactive. Of note, several hanging park farms have expanded after their formal licensing or installed prior to licensing. Production rates per hectare differ between the two rearing systems, with hanging parks being more productive than longline systems. Hanging parks are more productive as a result of the excellent original placement of hanging parks in the most productive spot of the Thermaikos Gulf. After trial and error for the use of approximately 1 pergolari/m^2, the hanging parks achieved an annual productivity of up to 400 t/ha. Such installations represent very small licensed properties, originally 0.1– 0.2 ha, because they cannot stretch outward toward the open sea (Kochras et al. 2000, Alexandridis et al. 2008). Production system varies from year to year and from site to site, because it depends mainly on local annual primary production. Local annual primary production varies according to annual environmental fluctuations and the biogeochemical characteristics of each location, influencing food availability, spawning, and growth patterns.

1.7.3.1. Production Planning

Besides being the most popular rearing technique in Greece today, the single longline floating system is currently the only one formally licensed, so its production plan is presented in detail here. Nevertheless, the production plan of the hanging parks does not differ significantly, because both techniques follow the life cycle of the local mussel *M. galloprovincialis*. A fully deployed, floating, single longline mussel farm in Greece has an average production capacity of 100 t/ha/y (live product on a pergolari, biofoulants included) and covers 1 ha with 11 longlines of 100 m each, running in parallel, 10 m apart.

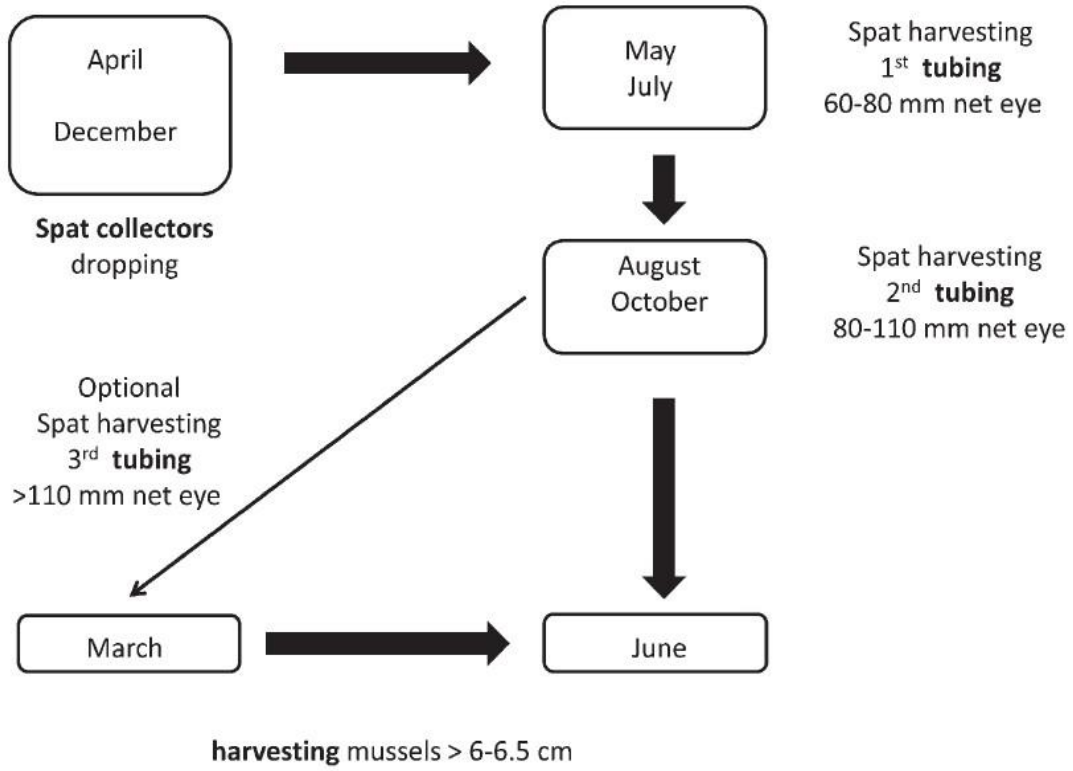
The operation cycle each year commences by collecting spat (Fig. 5). Spat collectors of 2–2.5mlong, usually made of common polypropylene ropes (diameter, 12–18 mm), are dropped in the water from December to March at a ratio of 1 collector per 2–3 pergolari scheduled to be prepared at the end of the spat collection period (Theodorou et al. 2006b, Fasoulas & Fantidou 2008). Spat settles normally when it reaches about 20 mm long or 0.8 g, on 1,800 pergolari/ha (Koumiotis 1998), and is ready for harvesting from the end of May until mid July.

The juveniles (>35 mm) are easily detached manually from the ropes, collected, and transferred to pergolari. These are plastic, cylindrical nets, 3–3.5mlong, with a net eye of 60–80mm attached on a polyethylene rope hung from the single line every 0.5 m (201/100mline or 5,400/ha). They are formed manually with the help of polyvinylchloride cylindrical tubes with a diameter ranging from 40–60mm. From August to October, these first batches of seed are graded, again manually, and juveniles are placed into larger pergolari, with net eyes of 80–120 mm, formed using wider tubes 70–90 mm in diameter. A third grading is necessary, if these pergolari get too heavy and risk the loss of many mussels or even the whole bunch. From December to March, new pergolari could be formed using larger holding tubes of 90–150 mm in diameter with a plastic net eye of 105–150 mm, providing more space for the animals. Each tubing increases the survival of the attached mussels, leading to a final 33%of the original seed.

In general, this strategy is used by all farmers and is modified at times to suit their local or temporary needs by using different tube sizes or net eyes. This depends on the quality and the condition of the seed stock. Mussels are ready for the market after a year, when they get about 6 cm long, usually in early summer. At this time, the pergolari weigh about 10–15 kg/m, more than double

the weight from their last tubing. The mussel quality at harvest, assessed by condition indices and chemical composition, varies seasonally, depending on the environmental conditions that prevailed during the growout period (Theodorou et al. 2007b).

Figure 8. Typical production model of Greek mussel farming.



Source: Theodorou et al., 2011.

1.8. The concept of agro - tourism

The concept of **agrotourism** is a direct expansion of ecotourism, which encourages visitors to experience agricultural life at first hand. Agrotourism is gathering strong support from small communities as rural people have realised the benefits of sustainable development brought about by similar forms of nature travel. Visitors have the opportunity to work in the fields alongside real farmers and wade knee-deep in the sea with fishermen hauling in their nets or with aquaculture activities. A category of agrotourism is fish tourism and ichthyotourism.

1.8.1. What is fish tourism?

Fish tourism is part of the wider context of marine ecotourism and may involve the embarkation of persons (who are not members of the crew) on fishing vessels for recreational-tourism purposes (fish tourism), as well as the accommodation, catering and general provision of special tourism services associated to fishing and aquaculture and related customs and traditions (ichthyotourism).

The core of this concept is the aim of appreciation and enjoyment of the natural marine environment in all of its many forms, along with any associated cultural features.

Fish tourism may be able to help revive fishing communities, and address low incomes, low levels of investment, high unemployment, out-migration, and so on. Moreover, fish tourism is thought to offer a special opportunity to achieve environmentally sound, sustainable development – development that will help to meet the needs of the present generation without damaging the resource base for future generations. It can also make a contribution to the objective of 'balanced spatial development' set out in the European Spatial Development Perspective (ESDP), by addressing regional disparities through sustainable use of the region's indigenous potential.

1.8.2. How can fish tourism aid coastal communities?

It is strongly believed that fish tourism can indeed bring economic benefits to peripheral areas of the EU Mediterranean area, but unless its development is properly planned and managed according to principles of sustainable development, such benefits will not last. Fish tourism that is not truly sustainable risks destroying its own resource base, perpetuating rather than breaking the cycle of renewal and disintegration that has plagued so many local areas along the Mediterranean coastline in recent decades. It is critical that communities throughout the whole of the EU Mediterranean area apply the same principles of good practice in formulating local solutions, because the coastal and marine resources upon which they depend are implicitly shared transnational resources.

Many EU Mediterranean coastal communities have their roots in professional sea fishing and traditional forms of tourism. There has been a tendency for such communities to develop a strong economic and cultural dependence on such activities, with the requirements of these traditional activities tending to dominate in spatial development terms. More recently, however, many coastal communities have been subject to severe pressure resulting from the

progressive reduction in fishing opportunities under the EU's Common Fisheries Policy, with the result that many fishing communities have been forced into a period of structural economic decline and social stress. Meanwhile, the conventional substitute of traditional seaside tourism has proved of diminishing value because of heavy international competition. The imperative within spatial planning in the peripheral communities of the EU Mediterranean area has therefore changed considerably in recent years. Instead of attempting to facilitate the further development of the commercial sea fishing industry and traditional forms of tourism, spatial planning is attempting to stimulate social and economic regeneration through a process of diversification.

Some communities are now turning to 'new' forms of tourism and the development of fish tourism represents an important route by which the quality (and in particular, environmental quality) of the tourism products provided by peripheral communities may be improved. It has the potential to re-deploy some of the infrastructure and resources formerly employed by the local sea fishing and tourism industries. However, there is a growing awareness that any such development must contribute to wider sustainability objectives.

Experience suggests that unless tourism activity of any kind is properly planned and managed, it risks compromising the economic, social and/or environmental components of the sustainability of an area and also, through its transport implications, the global environment. Genuinely sustainable fish tourism offers an opportunity to promote new development that brings local economic and social regeneration benefits, while also having a neutral or even positive impact on the fishery resources and the ecosystem.

Simply put, fish tourism is tourism that is based on enabling people to experience the natural and cultural environments associated with traditional fishing in a manner that is consistent with the principles of sustainable development. In the context of this document, the term 'fish tourism' is intended to denote activities that take place in the coastal zone, in the marine environment, or in both. The development of fish tourism may be perceived as an opportunity to help regenerate coastal communities that are experiencing economic hardship as a result of the decline of their traditional economic sectors, such as agriculture, professional fishing and seaside tourism. Fish tourism can also generate positive outcomes for the natural

environment, for example by raising funds that can be used for coastal zone protection, by providing economic alternatives to activities that degrade or deplete the fishery resources, and by more widely propagating eco-awareness and the principles of sustainable development. Yet experience has shown that if fish tourism is to play this role effectively, it must be developed within a planning framework that ensures that its practice is compatible with sustainability principles. Fish tourism involves bringing tourists close to nature: an activity that carries with it the risk of causing serious harm to the very things that fish tourism providers are helping tourists to experience. Fish tourism that is done improperly may do more harm than good.

Fish tourism is fundamentally about attempting to establish and maintain a symbiotic relationship between tourism, the marine environment and its resources within it (ie aquatic life) and the coastal cultural environment. This means conducting tourism that gives tourists a satisfying experience – one that they will pay for – while appreciating the intrinsic conservation value of the local natural and cultural environments on which fish tourism depends.

1.8.3. Are there any general regulations and policies concerning fish tourism?

A number of international and EU obligations and duties for planners of fish tourism exist. In particular, there are established national and international regulations and policies for the protection of the coastal and marine environment. These policies are implemented largely through the planning system, and are vital to maintaining the quality of the natural environment upon which fish tourism depends to attract tourists. They comprise international agreements/conventions and include World Conservation (IUCN) designations. At the world region level there are European regulations and directives, including the Habitat Directive. Agenda 21 and Local Agenda 21 are United Nations agreed policies. Chapter 17 of Agenda 2126 is concerned with protection of the oceans, all kinds of seas, including enclosed and semi-enclosed seas, and coastal areas and with the protection, rational use and development of their living resources.

1.8.4. Is there an example of best-practice in fish tourism ?

By far, the Italian model presents an ideal case of best practice in fish tourism. Pescaturismo is an integrated approach to fishtourism, focusing on the following activities which promote the fishing tradition and marine culture:

- Conducting boat excursions along the coastline (including spending overnight on board).
- Watching the professional fishing activity.
- Introduction to the traditional and classical fishing gear.
- Provision of lunch on board or at shore.
- Game fishing.
- Provision of information on the marine environment and the coastal biodiversity.

Ittiturismo provides additionally the following services:

- Staying at fishermen's' lodgings (if appropriately modified for such use).
- Testing and purchasing of local traditional fisheries foodstuffs (prepared with traditional recipes, home made).

The Pescaturismo initiative is managed by Lega Pesca which is a national association member of the Italian Union of Cooperatives and Associations. The structural role of Lega Pesca is to promote, supervise, represent and support the members of Pescaturismo (300 associations counting 20.000 members). Lega Pesca provides technical, financing, legal and managerial support.

1.8.5. Fish tourism in Greece

In Greece, the Ministry of Tourism has routed a series of actions of legislative nature for the completion, complementation or upgrade of the institutional framework, which are necessary for the development of the tourist sector and the successful implementation of the designed policies [4] . Relevant developments are the following:

- Law 4093/2012 and Law 4111/2013 and the Ministerial Decisions issued pursuant to those laws, regulate issues concerning the profession of tourist guides (amending Law 710/1977 on tourist guides regarding the opening-up of the profession).

[4] See: Annual Tourism Reporting for 2012 Greece (http://ec.europa.eu/enterprise/sectors/tourism/files/annual_reports/2013/greece_report_2012_en.pdf)

- Law 4002/2011, Law 4014/2011, Law 4070/2012 and Law 4093/2012 include the latest provisions regarding tourism accommodation and businesses, the environmental authorization of projects and activities in tourism as well as new forms of tourism investment, such as Areas of Integrated Tourism Development and tourism accommodation complexes (a combination of hotel establishments with special tourism infrastructure facilities and tourism dwellings).

The Ministry of Tourism faced the issue of mitigating seasonality by enriching and diversifying the Greek tourism product through the development of special forms of tourism (maritime tourism, diving tourism, winter tourism, rural tourism, gastronomic tourism, religious tourism, cultural tourism etc.). To achieve this objective the Ministry of Tourism:

i. Processed the necessary legal framework for the development of those special forms of tourism (for instance, Law 4049/2012 includes provisions regarding thermal springs and spa businesses, Law 4070/2012 defines the concept of fishing-tourism and regulates the exercise of the relevant activities). It also develops the necessary special tourism infrastructure (e.g. marinas, thalassotherapy centers, conference centers, ski centers etc.); enriching special tourism infrastructure facilities is promoted through Priority Axes of the Operational Programme "Competitiveness and Entrepreneurship". Moreover, the legislation enacted for construction or modernisation of tourism businesses that specialise in alternative forms of tourism is particularly favourable (Investment Law 3908/2011, NSRF 2007-2013 programmes).

ii. Promoted, through its communication strategy, the country's variety of resources that constitute the basis for the development of special forms of tourism.

iii. Organised ecotourism routes, trekking paths and information kiosks throughout Greece within the framework of the co-financed operational programmes and the Investment Law.

In Law 4070/2012 (Gov. Gazette 82/A/10.4.2012) "Regulations on electronic communications, transport, public projects and other provisions", Chapter Z' (Articles 174-184) institutionalizes the concept of fishing tourism and regulates issues concerning the exercise of such activities (fishing tourism).

The above Law 4070/2012, in combination with the Joint Ministerial Decision 31722/411-2011 (Approval of Special Framework on Planning and Sustainable Development on Aquaculture and of its Strategic Environmental Impact Study) allows licensing for small scale marine aquaculture units up to 15 tonnes per year if combined with tourist accommodation, or diving park in the framework of ichthyotourism or other agrotouristic activity. The condition in this case is that these companies operate by the same natural or legal entity or that there is an agreement among different companies.

2. Opportunities/marketing prospects (in Greece and internationally) of the aquaculture products

Fish is among the most traded food commodities worldwide. Fishery trade has expanded considerably in recent decades, as the fisheries sector operates in an increasingly globalized environment. The way fishery products are prepared, marketed and delivered to consumers has changed significantly, and commodities may well cross national boundaries several times before final consumption. Fish can be produced in one country, processed in a second and consumed in a third. Among the driving forces behind this globalized fisheries and aquaculture value chain are: dramatic decreases in transport and communication costs; outsourcing of processing to countries where comparatively low wages and production costs provide a competitive advantage; increasing consumption of fishery commodities; favourable trade liberalization policies; more efficient distribution and marketing; and continuing technological innovations, including improvements in processing, packaging and transportation.

Geopolitics has also played a decisive role in advancing and reinforcing these structural trends. The intermingling of these drivers of change has been multidirectional and complex, and the pace of transformation rapid. All these

factors have facilitated and increased the movement of production from local consumption to international markets. This change is manifested most clearly in wider geographical participation in trade. In 2012, about 200 countries reported exports of fish and fishery products.

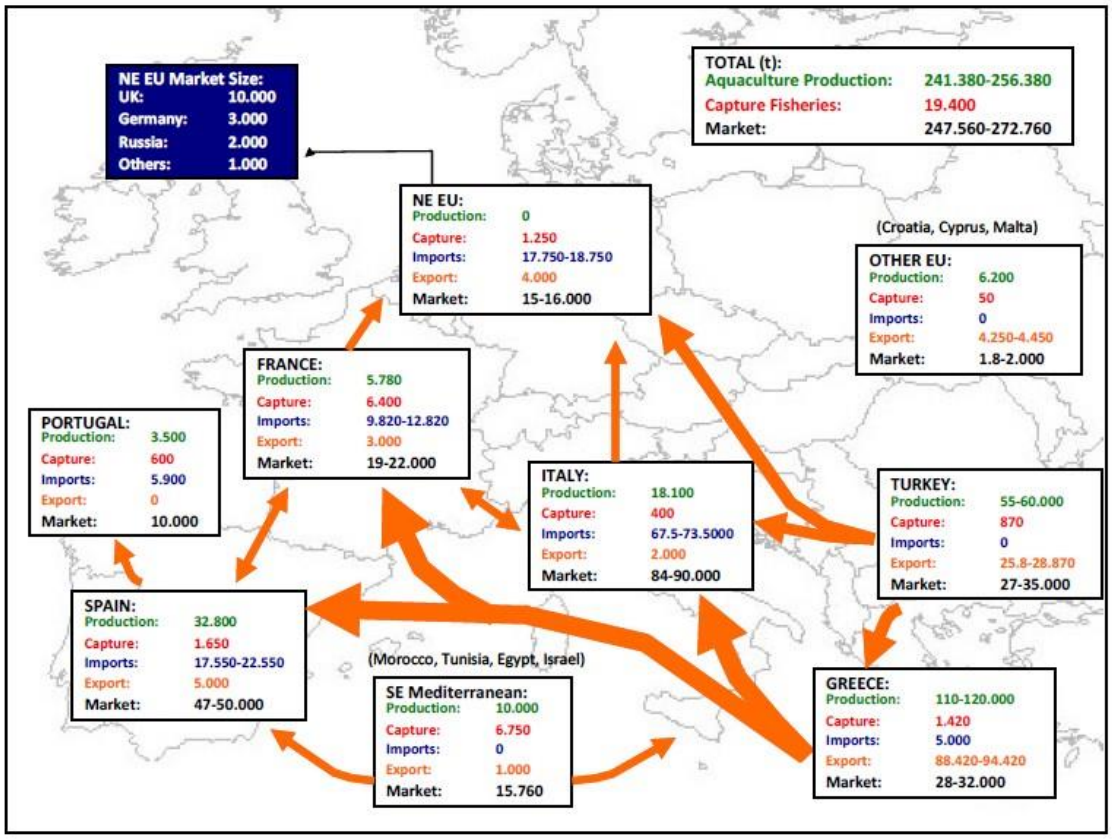
In general terms the consumers of aquaculture products can be divided into three general categories:

- traditional seafood consumers, usually of an older demographic and inhabitants of coastal zones with a tradition and familiarity with the consumption of seafood products;
- higher income consumers who can afford high-end fish products such as salmon, tuna, European seabass, gilthead sea bream, turbot, etc. and
- consumers who are more aware of the health benefits of seafood and seek to have a healthier lifestyle (younger, not necessarily familiar with seafood products, more environmentally aware).

Although the market for Mediterranean European sea bass and gilthead sea bream has expanded tremendously over the past twenty years, its main consuming in terms of quantity markets remain Italy, Spain and France. France is the single largest market for seafood in the EU, followed by Spain, Italy, UK and Germany (Barazi-Yeroulanos, 2010).

Greece has in recent years increased its imports of European sea bass and gilthead sea bream, namely from Turkey, but this quantity is destined for resale in other European markets and not for local consumption. Italy, France and Spain are net importers of bass and bream as their national production, though highly prized, is not large enough to cover domestic consumption. Some production from Italy and France is traded between these two countries as is the case with Spanish and French production. Greek and Turkish fish may sometimes be resold from Italy to countries in Northern Europe. Greek and Turkish fish sold in France is sometimes resold to the UK.

Figure 9. European sea bass and gilthead sea bream trade flows, 2007.



Source: Barazi-Yeroulanos, 2010.

2.1. Distribution and retailing of farmed fish

The character of the distribution and sale of fish in general and farmed fish in particular has changed over the last decade with traditional wholesalers and fishmongers being gradually replaced with large retail chains (i.e. supermarkets). There are of course differences between countries and in some countries, between regions, such as north and southern Italy, where traditional channels are still dominant. In part this shift has come about with changes in demographics and urbanization and in part as a result of supermarket chains realizing that they can increase their circulation by capitalizing on the trend for healthier, fresher foods. This has imposed a need for greater quality control and standardization on the part of suppliers and has facilitated the market penetration of farmed products as they are ideally suited to this in comparison to products of capture fisheries. The negative aspect of this development is the loss of relative negotiating power of producers Vis a Vis large retailers and the loss of the long term relationships and tradition involved in traditional channels of sales, distribution and consumption of fisheries and aquaculture products. Traditional wholesalers and fishmongers very often are experienced and knowledgeable about the product with an appreciation for the

idiosyncrasies of production and the particular characteristics of seafood. The depersonalization of the procurement procedure and the sales relationship has resulted in a more level, standardized playing field, at the cost of the complete commoditization of the product. The consumer has gained a guarantee of freshness, complete traceability and accountability as well as year-round availability. However, as the margin for the producer has been continuously reduced over the past ten years, this gain has not been passed on to the consumer.

In the Mediterranean as a whole however, there are still large differences in the distribution channels for seafood and farmed fish. Data submitted through the MedAquaMarket national country reports show a distinct difference between the large European markets for seafood with a predominance of supermarkets as the main or growing channel for farmed fish distribution and the smaller seafood markets where traditional channels are still dominant.

Table 8. Distribution channels for farmed fish in the Mediterranean.

	Supermarkets	Traditional retailers	Catering/ Foodservice	Multiple retail stores	Other
Albania	10%	50%	40%		
Croatia	50%	30%	20%		
Cyprus	20%	80%			
France	50%	20%	30%		
Greece	20%	80%			
Italy	80%	5%			
Israel	40%	60%			
Montenegro		30%	70%		
Morocco	100%				
Spain	32%	30%	8%	30%	
Turkey	3%	45%	2%	20%	17%

Source: MedAqua Market national country reports (in Barazi-Yeroulanos, 2010).

2.2. Distribution channels of seafood in Greece

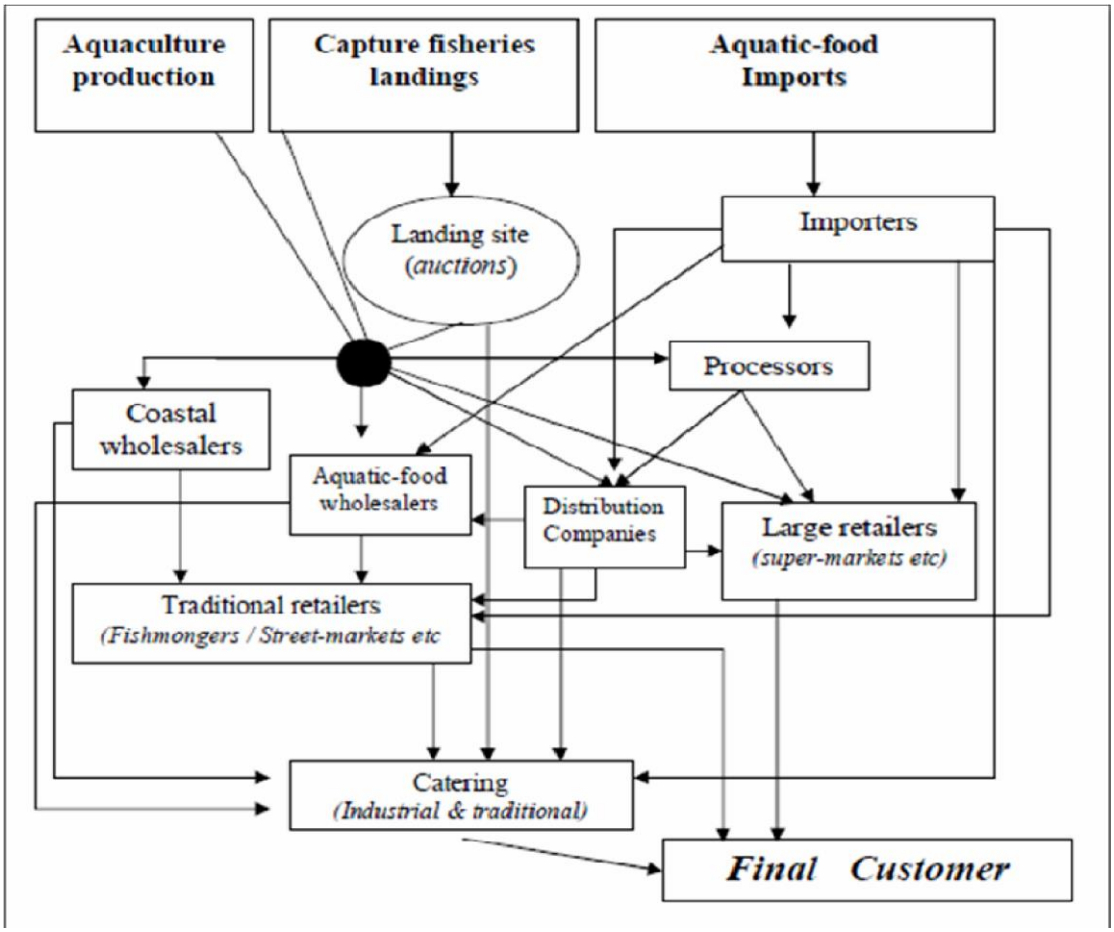
In the Greek market there are three main sources of supply of aquatic-food products, below which a distribution network stems out. The complexity of this distribution network is evidently illustrated in the Figure 10, through an expanded system of interconnected intermediaries form the initial stage to the final customer/consumer.

The importance of each intermediary within the Greek aquatic-food market chain is not systematically recorded, hence any evaluation of market characteristics, and trends within it, is problematic. In general, traditional retailers still account for a large part of the sales of fishery products, although the widening geographical distribution and coverage of large retailers (super/hypermarkets) has brought about major changes in the distribution network. By 2002, large retailing companies already accounted for 66 % of total retail sales, and over 62 percent of the retail sales of food products (Gira, 2002).

The dynamic entrance of large-retailers (super-markets) in the market of fresh fishery products, after the mid 1990s, based to a great extend to the supply of products of aquaculture, resulted in a significant increase of the sales of fishery products via that channel. In fact, within only three years (1995–1998), supermarkets managed to increase their share of the sales of fishery products from 5 % to 50 %, largely at the expense of the traditional retailers. Accordingly, based on recent company information, super-markets have increased their market share on farmed European sea bass and gilthead sea bream sales quite significantly over the last years, accounting for almost 20 % of the volumes traded in the national market.

Concerning the trade of farmed European sea bass and gilthead sea bream in export markets, large aquaculture companies in an attempt to better control distribution channels, and to reduce the number of intermediaries that exist from production to final retailer and ultimately the consumer, pursued a "forward integration" strategy. In certain export markets, such as France, Italy, Germany, and the UK, there are company representatives or even subsidiary companies, responsible for the trading and/or distribution of their products. These large companies often receive/purchase (at low prices, and recently below cost) products of smaller producers who lack the size and organization for trading their products in these markets. However, this vertical integration often goes only as far as a Trading Company, responsible for exporting and selling of the products mainly to wholesalers, and less to final retailers (super/ hypermarkets), although the latter seem to be gradually increasing their share, as the steady and large volume of orders allows them to bargain directly for lower prices.

Figure 10. Greece: Distribution network for seafood



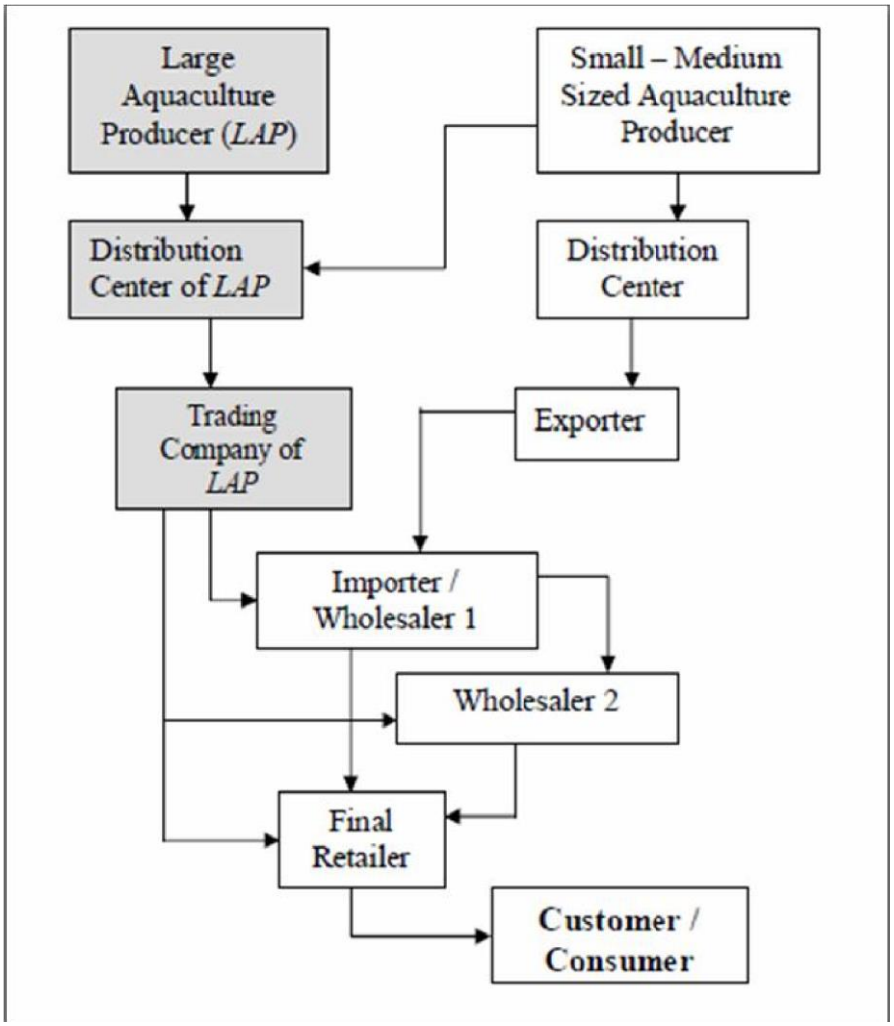
Source: Papageorgiou (2003), MedAquaMarket national country report.

Some major issues in the past biennium that continue to affect international trade in fishery products are:

- the volatility of commodity prices in general and its influence on producers and consumers;
- the distribution of margins and benefits throughout the fisheries value chain;
- the globalization of supply chains, with growing outsourcing of production;
- climate change, carbon emissions and their impacts on the fisheries sector;
- the role of the small-scale sector in fish production and trade;
- the growing concern of the general public and the retail sector about overfishing of certain fish stocks;
- the relationship between fisheries management requirements, allocation of fishing rights and the economic sustainability of the sector;
- the need to ensure that internationally traded fishery products from capture fisheries have been produced legally;

- the increase in farmed products in international trade and the impact on the domestic fisheries sector from a surge in imports of farmed products;
- the economic crises and the risk of increased import barriers and tariffs;
- the multilateral trade negotiations within the WTO, including the focus on fisheries subsidies;
- the need for competitiveness of fish and fishery products versus other food products;
- the introduction of private standards, including for environmental and social purposes, their endorsement by major retailers, and their possible effect on market access for developing countries;
- the more stringent rules for quality and safety of food products, including for imported products, in several countries;
- the perceived and real risks and benefits of fish consumption.

Figure 11 – Export network of the Greek aquaculture industry.



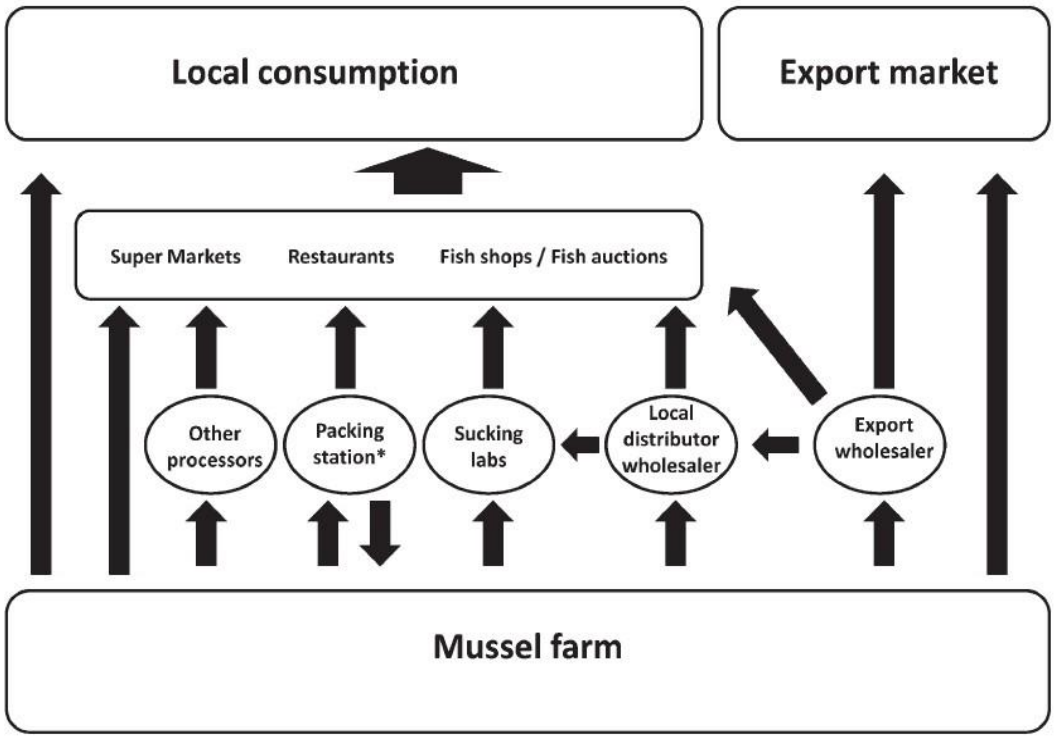
Source: Barazi-Yeroulanos, 2010.

As for the mussels, the following Figure 12 describes the market structure of Greek mussel farming. Despite the presence of a wide range of shellfish species in the Greek seas, there is an obvious lack of tradition among Greeks for consuming shellfish species (Batzios et al. 2004). Apparent consumption based on data from 1999 to 2001 showed that shellfish molluscs (mussels, oysters, clams, and so forth) were 0.70 kg/capita annually at a total of 14.33 kg seafood/person (Papoutsoglou 2002).

Most Greek consumers do not know how to cook bivalves and ignore their high nutritional value. Consumer reluctance was strengthened after poisoning incidents occurred during the 1950s, caused by shellfish harvested from polluted shipyard areas
(Theodorou 1998). People living close to the farming sites in northern Greece are more familiar with bivalve consumption. Galinou-Mitsoudi et al. (2007) reported on bivalve shellfish consumption in the city of Thessaloniki. Among

native species consumed in local restaurants, mussels (93.75%) were the most popular, with the remaining shellfish types being consumed in small percentages (warty venus *Venus verrucosa* Linnaeus 1758, 2.68%; flat oyster *Ostrea edulis* Linnaeus 1758, 1.79%; and scallops *Chlamys glabra* Linnaeus 1758, 1.79%). Selection criteria seemed to be based on the lower price of the farmed mussels in contrast to wild harvested species of limited availability.

Figure 12. Market structure of Greek mussel farming.



Source: Theodorou et al., 2011.

Because farmed mussels are usually consumed live or fresh, their distribution to southern Greece or the Greek islands cannot be effected by usual fresh product transport logistics (such as those used for fish), because of the uncommon temperature (6–12°C) and handling requirements (plastic net bags) that disproportionally raise the distribution cost, especially for small quantities. Alternatively, fresh bivalve shellfish are distributed by the farmers or the fishermen by their own means of transportation.

The competition for clients (restaurants, fishmongers, and so forth) among the different distributors depends on the availability and continuity of supply for wild-harvested species. Mussels in this context are sold in a complementary manner, because they are the basic product of the ‘‘special’’ niche market of bivalve shellfish. Market interaction between wild and cultured bivalves, based on detailed statistics for the wild shellfisheries, needs further investigation,

because recent reports on the latter show a considerable decline of catch (about 700 t in 2005 vs. 7,000 t in 1994 (Koutsoubas et al. 2007). This situation is clearly depicted in the local oyster sector state with negligible exports during the past decade and an annually import volume ranging from 20–35 t during the same period (Theodorou et al., 2011). Fresh bivalves also have competition from imported frozen and processed products, with the advantage of easy-to-use packaging at a reasonable price. In 2005, 3,496 t of mussels in various product forms, mainly of added value, were imported, with a total value of V12.3 million. The situation changed in 2007 as imports of live product (almost all imported from Italy and Spain) were 5 times higher and processed mussel products 5 times lower than in 2005. Overall figures were much lower, with live and processed mussels about half in terms of volume and less than one third in terms of value compared with 2005. Data were unavailable for mussels packed in air-tight packages, reaching 2.6 t in 2005.

In Greece, mussels are exported as raw material and imported as highly priced valueadded products of a smaller total volume. The negative balance between the exported and imported volumes of processed mussel products, despite the capacity of the local farming for it, implies that the Greek industry should move to more value-added products to compete with imports in the local market. Based on the trend of the farmed mussel market, it is evident that the local market is currently at a standstill. Products not exported are forwarded locally to a small number of restaurants, fishmongers, retail chains, or seafood auctions, with public consumption restricted to specialty seafood restaurants and local ‘‘tapas’’- like bars (see Fig 9).

In brief, the domestic mussel-selling business is obviously in need of better marketing approaches. Sales could be improved by educating Greek consumers on shellfish matters (Batzios et al. 2003) and investing in product promotion in the local market. Because the per-capita consumption of seafood products increased during the past decade (Papoutsoglou 2002, Batzios et al. 2003, Arvanitoyannis et al. 2004), bivalves could potentially have a better share of this consumer trend.

2.3. Distribution channels of seafood in Greece

The Panhellenic Exporters Association (PEA), collects data concerning the development of production, the degree of self-sufficiency, total imports and exports, namely the degree of externalization of the sector, both in terms of imports, and in terms of production, resulting in Balassa indices on

international competitiveness (compared to the corresponding products of the EU 28 and with the total Greek exports) and recording data of foreign competition (Archontis, 2015).

Moreover, PEA, analyzing the international and domestic factors influencing demand trends, records the evolution of import and export prices and identifies the main markets targeted and the most effective distribution channels.

Especially for the aquaculture industry, the survey data over the period considered (2004-2013), both show significant variations (depending on the type of seafood) in total production, important centralization (especially in business terms), despite the geographical dispersion of production units, a high degree of self-sufficiency to meet domestic demand, but also a high degree of openness and international competitiveness (Archontis, 2015).

In terms of analysis, data focus on sea bream and sea bass, which are the core products in terms of both production and extroversion.

Table 9. Sea bass evolution of production, imports, exports, apparent consumption and self sufficiency. Values in Thousands of Tonnes.

Year	Production	Imports	Exports	Consumption	Self-sufficiency (%)
	(1)	(2)	(3)	(4)=(1)+(2)-(3)	(5)=(1)/(4)
2004	33,00	1,122	11,958	22,164	148,9%
2005	35,00	0,769	12,713	23,055	151,8%
2006	45,00	1,762	18,194	28,568	157,5%
2007	48,00	4,425	28,196	24,229	198,1%
2008	50,00	4,288	28,036	26,252	190,5%
2009	45,00	3,125	29,543	18,582	242,2%
2010	45,00	1,843	36,899	9,945	452,5%
2011	45,00	0,705	35,352	10,353	434,7%
2012	41,50	0,497	31,636	10,361	400,6%
2013	48,00	0,063	29,459	18,604	258,0%
Mean value	42,00	0,143	27,024	15,120	277,8%

Source: PEA, HELSTAT, FEAP

Table 10. Sea bream evolution of production, imports, exports, apparent consumption and self sufficiency. Values in Thousands of Tonnes.

Year	Production	Imports	Exports	Consumption	Selfsufficiency (%)
	(1)	(2)	(3)	(4)=(1)+(2)-(3)	(5)=(1)/(4)
2004	49,00	0,299	16,544	32,754	149,6%
2005	50,00	0,324	17,875	32,449	154,1%
2006	66,00	0,895	23,911	42,984	153,5%
2007	79,00	1,511	34,150	46,360	170,4%
2008	94,00	1,223	48,263	46,960	200,2%
2009	90,00	0,675	50,517	40,157	224,1%
2010	74,00	0,793	48,205	26,588	278,3%
2011	63,00	0,372	40,494	22,879	275,4%
2012	72,00	0,748	43,888	28,861	249,5%
2013	75,00	0,090	47,399	27,691	270,8%
Mean value	71,00	0,242	38,896	32,346	219,5%

Source: PEA, HELSTAT, FEAP

Table 11. Degree of Extroversion and Competitiveness of sea bass and sea bream (2000-2014). Balassa index. (Quantity: Thousands of Tonnes)

	Sea bass *Dicentrarchus labrax*			Sea bream *Sparus aurata*		
Year	Imports	Exports	Balassa Index (= Exports-Imports / Exports + Imports)	Imports	Exports	Balassa Index (= Exports-Imports / Exports + Imports)
2000	0,153	12,380	0,98	0,408	19,018	0,97
2001	0,830	15,290	0,86	0,886	22,159	0,92
2002	0,926	13,278	0,85	0,268	19,285	0,97
2003	0,527	12,351	0,92	0,450	23,105	0,95
2004	1,122	11,958	0,86	0,299	16,544	0,96
2005	0,769	12,713	0,89	0,324	17,875	0,95
2006	1,762	18,194	0,85	0,895	23,911	0,92
2007	4,425	28,196	0,77	1,511	34,150	0,91
2008	4,288	28,036	0,77	1,223	48,263	0,95
2009	3,125	29,543	0,84	0,675	50,517	0,97
2010	1,843	36,899	0,91	0,793	48,205	0,97
2011	0,705	35,352	0,96	0,372	40,494	0,98
2012	0,497	31,636	0,96	0,748	43,888	0,96

2013	0,063	29,459	0,99	0,090	47,399	1,00
2014	0,143	27,024	0,99	0,242	38,896	0,99
Mean value	1,412	22,821	0,90	0,612	32,914	0,96

Source: Panhellenic Exporters Association (PEA)

The idea to determine a country's 'strong' sectors by analyzing the actual export flows was pioneered by Liesner (1958). Since the procedure was refined and popularized by Bela Balassa (1965, 1989) it is popularly known as the Balassa Index. Alternatively, as the actual export flows 'reveal' the country's strong sectors it is also known as Revealed Comparative Advantage.

The possibility of competitive pricing of the product in international markets confirms the clear export orientation, as illustrated further in the above Table. The majority of the production is exported, while the Index Balassa, is always in a positive field, indicating a positive and enhanced competitiveness leading to a high surplus in trade with other member states.

Indicative of the strength of the product is that Balassa index stands at 0.90 for sea bass and 0.96 for sea bream over time touching the absolute competitive price (+1).

The Balassa index measures the competitive advantage of a country.

$$\mathrm{RCA}_{ij} = \frac{\frac{x_{ij}}{X_i}}{\frac{x_{aj}}{X_a}}$$

Where:

xij denotes the export of products j from country i
Xi denotes the total export from country i xaj
denotes the total export of product j from reference
area.
Xa denotes the total export from reference area.

Specifically:
xij denotes the export of seabass or seabream j from Greece.
Xi denotes the total exports of seabass or seabream from Greece.

xaj denotes the export of seabass or seabream j from EU
28. Xa denotes the total exports of seabass or seabream
from EU 28.

Table 12. Balassa indexes for a number of agricultural products in Greece.

	xij / Xi		xaj / Xa		Index
Olive oil (HS: 150910) =	5,168%	/	0,912%	=	5,7
Olives (HS 200570) =	6,590%	/	0,264%	=	25,0
Cucumbers (HS: 070700) =	0,646%	/	0,229%	=	2,8
Industry tomatoes (HS 2002) =	1,455%	/	0,521%	=	2,8
Fresh tomatoes (HS 070200) =	0,367%	/	0,803%	=	0,5
Potatoes (HS 070190) =	0,095%	/	0,262%	=	0,4
Wine (HS: 2204) =	1,362%		4,422%	=	0,3
Feta cheese (HS: 04069032) =	5,668%	/	0,080%	=	70,9
Yoghurt (HS: 040310) =	2,432%		0,361%	=	6,7
Gruyere, Kaseri (HS: 04069085) =	0,158%	/	0,002%	=	79,0
Kefalotyri (HS: 04069035) =	0,045%	/	0,002%	=	22,5
Honey (HS: 040900) =	0,158%	/	0,132%	=	1,2
Sea bass (HS: 03028410) =	3,079%	/	0,059%	=	52,2
Sea bream (HS: 03028530) =	4,130%	/	0,065%	=	63,5
Other live plants (HS: 0602) =	0,237%	/	1,169%	=	0,2
Swine (HS: 0103) =	0,164%	/	0,672%	=	0,2
Poultry (HS: 0105) =	0,093%	/	0,414%	=	0,2

Source: Panhellenic Exporters Association (PEA)

From Table 12, it is evident that sea bass and sea bream ranks at the top positions of the agriculture commodities in Greece with export orientation. Aquaculture fish, is the second largest agricultural export after olive oil, and sometimes, comes first. The country exports almost 70-80% of its products and for some species Greece accounts for nearly half of global production. Currently the marine area dedicated to mariculture in

Greece is only 7,8Km^2, while only the Athens International airport covers an area of

17,5 Km^2.

3. Basic and/or innovative practices in aquaculture

Aquaculture made impressive progress during the past 30 years. Aquaculturists have developed or adapted many specific techniques to improve their operations - some drawn readily from other fields and some which have had to be devised by farmers and technicians themselves. They

range from simple field tricks like moistening soil and rolling it into an elongated shape to test whether there is enough clay in the soil to make watertight pond dykes -- through to advanced biotechnology such as gene transfer. As the sector has expanded to new regions, new species and to achieve control over more of the life cycle of farmed animals and plants, fish farmers have proven very innovative in devising solutions to the new problems they faced.

3.1. Disease prevention and management

Disease prevention and management are essential for the sustainability of the European aquaculture industry. The diversity of species and farming practices throughout Europe involves also a significant number of threats related to a large variety of pathogens that hamper production and require specific preventive and curative practices and tools ensuring a high level of biosecurity of aquaculture production and related seafood products. Among other disease-related threats, parasites and related infections can cause significant damages on farmed fish species and can result in poor growth performance, impaired welfare and death of farmed animals with significant consequences in terms of production and economic performance. Parasites can also affect the end users of aquaculture products and therefore their monitoring and eradication are essential for ensuring the safety of European consumers. The management of diseases is even more challenging in farmed aquatic mollusc where the absence of adaptive immune system further complicates the development of tools and methods allowing mitigating effects of diseases on production. Despite the initiatives that have been implemented to understand, explain and mitigate disease outbreaks affecting farmed molluscs, which seem to have multifactorial origins, the future of the European mollusc production sector is still challenged.

3.2. Hatchery technology and fry production

The rearing of larvae is generally carried out under controlled hatchery conditions and usually requires specific culture techniques which are normally different from conventional nursery and grow-out procedures, and especially with respect to husbandry techniques, feeding strategies, and microbial control. The main reason for this is that the developing larvae are usually very small, extremely fragile, and generally not physiologically fully developed. For example, their small size (ie. small mouth size), the uncompleted development of their perception organs (ie. eyes, chemoreceptors) and digestive system,

are limiting factors in proper feed selection and use during the early first-feeding or start-feeding period. Moreover, in species such as shrimp, these are not the only problems as the developing larvae also have to pass through different larval stages, eventually changing from a herbivorous filter feeding behaviour to a carnivorous hunting behaviour. It is perhaps not surprising therefore that larval nutrition, and in particular that of the sensitive first-feeding larvae, has become one of the major bottlenecks preventing the full commercialization of many farmed fish and shellfish species. This can also be illustrated by the following examples.

Aquaculture was originally restricted to the home range of each species, where fry (seed) could be caught from the wild and stocked in ponds. A study of how water temperatures, changes in day length and other factors affected the reproductive cycle of fish subsequently led to the ability to breed many species far from their native waters and where the natural conditions would not normally allow breeding. Manipulation of water temperatures and day length remains important in the successful hatchery production of many farmed species to this day. As hormones became identified and their action understood in higher vertebrates, fish farmers began to experiment too, with extracts of hormone producing organs in fish, and found that egg development and spawning could be promoted in many species by the injection of hormone extracts from pituitary gland. These techniques are used today in the production of fish like carp, salmon and bream. Oysters and other molluscs are brought to produce eggs by manipulating water temperatures and shrimp are made to develop their ovaries by removing a gland that produces an inhibitory hormone, sited in the eyestalk. Hormones are also used in processes like the sex-reversal of tilapia to produce all-male populations that give better production. There is a short period in the early life of the fish when their sex is not fully determined and feeding them with a hormone treated feed can push them to develop male characteristics.

Many fish are stripped of their eggs (females) and milt (males) in hatchery production and the fertilisation is carried out externally. Typically this is done in a bowl with the eggs and sperm being mixed with a feather. Shrimp that do not readily mate in captivity are artificially inseminated by extracting the sperm capsule from the male and attaching it to a female that has ripe ovaries to replicate the natural mating process.

Figure 13. Controlled hatchery techniques are essential for developing aquaculture.

a. Eggs stripped from an Atlantic salmon

b. Atlantic salmon larvae with yolk sac.

c. Atlantic salmon and gilthead sea bream larvae at first feeding.

d. Feeding fish larvae with *Artemia* nauplii.

3.2.1. Reliable supplies of feed

The young stages of many farmed animals need quite specific feeds to survive and many techniques have had to be developed to produce reliable supplies of feeds, both live and inert, to support hatchery operations. Particular species of microscopic algae are selected from the thousands that occur in the sea or freshwater and grown in tanks with just the right mixture of nutrients to make them flourish. These algae are then fed to the young fish or shrimp. Many cultured fish and shrimp species require live microscopic animals at certain stages of their development and the type of feed they need can be quite specific. Aquaculturists have found that in many cases, animals such as *Artemia* and rotifers can fill this need and have developed the techniques to rear these two to an advanced level. *Artemia* (brine shrimp) are tiny shrimp like creatures that grow in salty lakes in places like Utah, USA and Iran. When the salt content increases to a certain level the *Artemia* turn into an egg-like cyst and this can be stored dry for many years. When it is put back in water, a tiny *Artemia* hatches out and this has proven to be an ideal feed for the early stages of many fish and shrimp.

Because of the problems and costs faced in rearing live feeds however, techniques have also been developed to produce artificial feeds with the right density to float in the water, the right taste and feel to be attractive to the fry and the right nutritional content to give good growth and survival. Vitamins dissolve out of such feeds quite quickly and so methods have been developed to coat the vitamins or hide them inside minute 'microcapsules'.

In ponds, it is often hard to see how much the animals are eating - a fish farmer can not see how much his animals leave, like a cattle or chicken farmer can - and so techniques have had to be developed to make sure the fish or shrimp are well fed, but feed is not wasted. Some farmers use demand feeders where the fish learn to push a lever to get feed. Others place feed on trays and then pull up the tray to check what feed is left. In fish cages, farmers nowadays use close circuit TV to see what is happening underwater.

There are wide varieties of methods that can be used to process aquatic feeds. For examples, in early days the most common method to feed the fish was hand feeding of mixed, home-blended diets and trash fish. Then fish farmers started using cold forming of moist diets. Pelleting presses then became popular and a majority of the fish feed were processed using pellet mill technology. Today extrusion technology is the method of choice to process aqua feed because of the benefits it offers to fish farmers. Current aquatic feed manufacturing practices seem to fit into two simple categories; floating and sinking. Today 100 % floating feed is extruded and nearly 60 % sinking feed is extruded. Whereas, the rest of the 40 % sinking feed is still pelleted. This is just simply because extrusion cooking offers several benefits to the aquatic feed manufactures.

There are many aquatic species that are cultured today. Some of them prefer to eat the pellet on the bottom of the pound where as some of species like to come on the surface to take pellet and some are column feeders (taking the feed as it slowly sinks through the water). For examples catfish, carp and tilapia like floating feed where as shrimp and river crab require sinking feed. On the other hand salmon, trout, sea bass/sea bream, and cod like to eat the pellet when it is slowly sinking.

Extrusion allows buoyancy control to make floating, sinking or slow sinking feed by controlling the processing parameters on one extruder. To make the pellet float in fresh or sea water requires <480g/l bulk density. In order to make pellet sink fast requires >

640g/l bulk density for sea water at 20°C (three percent salinity) and > 600g/l for fresh water at 20°C. To make slow sinking pellet it requires 580-600g/l for sea water and 540560g/l for fresh water. At neutral buoyancy pellets should have 520-540g/l for sea water and 480-520g/l for fresh water. Extrusion cooking provides ultimate control of the density of the products and thus buoyancy properties are managed.

The main purpose of lipids (fats and oils) in feeds are as an energy source; to increase palatability; provide essential fatty acids; carrier for fat soluble vitamins; modified texture; density control and dust reduction. Fat level in fish diets can vary depending upon the species of the fish. Some fish, like salmon, need feed with up to 40 percent fat in the pellet. Extrusion processes allow feed manufacturers to produce high fat feed. With twin screw extruder a 20 % fat can be added during extrusion of feed. Where as in single screw it is limited to around 12 % fat addition during extrusion. Additional fat is added to the pellet using different coating systems (vacuum or atmospheric). Extruded feed can absorb more fat externally in the coating steps as compared to pelleted feed. Nowadays aquatic feed is processed to contain almost 50 % fat which is only possible by using extrusion technology.

Different shapes and sizes of aquatic feed can be produced using extrusion technology. Depending upon the size of the fish the pellet size can range from 0.6mm to 60mm. The size of the pellet is important for the fish from juvenile to adult. A very small fish is not going to eat 10mm pellet since the size of the pellet is bigger than the mouth.

3.3. Innovative technologies in Aquaculture

In order to establish sustainable growth of the aquaculture industry, farms must operate not only in ideal economic and environmental conditions but also in a socially and culturally responsible manner. Good practices in Aquaculture involve a variety of factors that contribute to the final goal: providing fish of high quality that fulfill the demanding criteria of the consumer while preserving the environment.

Therefore farming business should integrate and improve technically the current production systems for aquaculture, including biological and operational aspects, using new and cost-effective innovative technologies and practices to ensure the sector's sustainability and growth. This also includes improvement of the professional skills and competences of people working and being trained to work within the blue economy.

Developing methodologies can be a useful tool for monitoring the quality of the fish and the farming area in order to establish the good organoleptic features, the freshness and quality of a fish, as well as monitoring of dangerous substances for the consumer such as histamine, shellfish toxins or microbial load.

The importance of a diet rich in omega fatty-3 acids is now widely known, contributing to major health benefits such as heart health and neurological development. A usual estimation of the chemical composition of feed and fish is given by screening the following parameters: protein, fat, ash, moisture, amino acid and fatty acid content. This profile can give useful information for the quality and quantity of nutrition that has to be given to fish in order to ensure best quality results.

A freshly looking fish is always tempting to the consumer. It is of considerable interest to farming industries, to investigate quality changes of fishery products during farming, storage and distribution. There are several techniques that can assess the freshness of a fish, demonstrating that a product, meets certain clear, commonly understood and accepted standards or characteristics. The main quality parameters for freshness are aroma, flavor, texture and sensory response. Instrumental analysis can give a full profile of fish freshness. Texture and colorimetric analysis, pH, volatile substances and TVB-N measurements can be objective criteria for fish freshness.

Food-borne diseases have significant social and financial impacts. Therefore monitoring food safety is very a very important parameter in Aquaculture. Microbial load in food (Salmonella, E.coli, Listeria etc.), constitutes major public health risks and generate emerging disease problems. Monitoring the microbial load of fish with up-to-date techniques such as ELISA or qPCR, can ensure food safety for the consumer. At the same time, research should focus in identification and characterization of new toxic or microbial threats by supporting research on state-of-the-art tools for reference and surveillance. Monitoring of dangerous substances such as Shellfish toxins in shellfish farming or histamine levels in fish, is important for human health. The levels for detection are determined by the European community. Regular controls have to be performed to ensure public health. New methodologies such as HPLC or ELISA are accredited methodologies by international organisms for rapid and accurate quantification of these substances.

Monitoring of the aquaculture's health quality is also a very important parameter. An example is Viral nervous necrosis (VNN) is an infectious disease, caused by betanodaviruses, affecting more than 40 marine fish species, characterized by high morbidity and mortality. Because of its severe impact, robust diagnostic tools such as real-time reverse transcriptase-polymerase chain reaction (RT-qPCR) assays have been developed to detect and quantify betanoviruses and can be used for routine analysis. Using specific and sensitive diagnostic tools to identify infected fish in early stages of the disease, is very important because it might prevent outbreaks that will affect the whole population. Therefore proper therapy can be given to prevent lethal effects.

Quality control in Aquaculture must include dioxins, furans and polychlorinated biphenyls (PCBs) monitoring. These persistent organic pollutants are ubiquitous in nature and bioaccumulate in aquatic environment and eventually in the fat of fishery products or in plant tissue. Maximum limits for dioxins in foodstuffs are determined by the EC (Council Regulation 2375/01/EC amending Commission Regulation (EC) No 466/2001 setting maximum levels for certain contaminants in foodstuffs). Samples of water or fish oil are tested by high resolution gas chromatography with high resolution mass spectrometry.

Due to the need of species identification in Aquaculture for genetic improvement and it is necessary to have analytical methods for the discrimination between fish species, or even fish populations that might present better characteristics, e.g Specific growth rates, resistance to infections, or Feed Conversion Ratio. Molecular biology methods based on DNA analysis are more sensitive reliable and suitable for the analysis of fish QTL (Quantitative trait locus) or gene expression, that are indispensable tools for genetic improvement.

The introduction of Innovative technologies and the sustainability of Aquaculture can be accomplished taking full advantage of Academic Infrastructure for informing, training with the best available scientific knowledge. In some cases a well up-to-date equipped certified laboratory has to be consulted, but also a smaller properly organized laboratory station could be adequate for a variety of methodologies that can give an outline of the product's feeding value and a complete quality profile.

3.4. Alternative Materials for Aquafeeds

The continuous growth of the aquaculture industry has increased the demand of particular feed ingredients, such as fish-meal and fish-oil. Consequently, their price is increasing, as the production remains relatively stable throughout the years. Thus, emerges the need to substitute a portion of their inclusion in the aquafeeds, in order to keep the nutritional cost low and preserve the biodiversity. Protein and lipid deriving from plants, as well as from animal production by-products, can constitute as alternative sources for use by the aquaculture sector. Substitution levels must derive from experimentation, so they will not affect the health or welfare of the aquatic animals.

3.5. Recirculating aquacuture systems (RAS)

The implementation of recirculating aquaculture systems could relieve the environmental load caused by the aquaculture industry. Regardless of the installation cost, their impact is relatively low, since the water is filtered and be reused. Aquaculturists may benefit from larger stocking densities and better feed utilization. Such systems may be installed indoors and outdoors and be autonomous or part of an aquaponics system, which combines aquatic animal production with hydroponics. In this symbiotic environment, plants will utilize as nutrients the nitrates and nitrites, deriving from the nitrification bacteria activity on animal excretions, contributing even more to the decrease of the environmental impact.

3.6. Stress monitoring

Stress during the aquaculture practice may cause adverse economic effects for the commercial businesses. Monitoring of stress inducing factors, as well as their impact on the farmed aquatic animals, is needed, in order prevent further deterioration of their growth, health and welfare. While acute stress may be monitored through the determination of blood parameters, such as cortisol and glucose, chronic stress is more difficult to identify. Alterations in the concentrations of brain neurotransmitters, such as dopamine, serotonin and their metabolites, have been linked to chronic stressful conditions. Therefore their determination may successfully monitor stress levels in an aquaculture.

3.7. Future techniques

Many techniques important to the industry are in the health sector. Plating samples of water and tissue on agar plates to test for bacteria and fungi, the use of electron microscopy and DNA based 'probes' to check for viruses, the use of 'probiotics' or 'friendly' bacteria to keep water in good condition, to mention just a few. Then there are fields like cryogenics -- the freezing of eggs, sperm and embryos at ultra low temperatures for storage and use at a later date; the use of anaesthetics to calm fish down for live transport (also possible by lowering the temperature); treatments like dipping the shells of freshly caught shrimp in an anti-oxidation mixture to keep them fresh longer. The techniques useful to aquaculture are many and will continue to expand and improve, to help bring more cultured fish to the table.

4. SWOT ANALYSIS FOR THE EMERGENCE OF INTERVENTION AXES THROUGH THIS PROJECT IN AQUACULTURE

As the main purpose of this initiative is the introduction, acquaintance and support of the young generation to increase the competitiveness and economic performance of aquaculture activities, in order to develop the agro-food sector and the rectification of the Greek economy, we present here a SWOT analysis to highlight intervention priorities through this project in the aquaculture sector.

SWOT analysis of the Hellenic aquaculture

Strengths
- The geomorphology of the country's sea areas and large number of islands that allows developing marine aquaculture in favorable environmental conditions. The country has the longest coastline of the EU, which account for the largest percentage of the total population. - Proximity to major EU markets, due to the country's strategic position, with parallel increasing domestic consumption especially in the summer months due to tourism. - Availability of suitable marine areas, with growth potential in new locations for aquaculture development. - The existence of an ongoing aquaculture spatial planning, which will provide the necessary space for hosting aquaculture activities and will allow sustainable growth. - Increased environmental awareness and interest in installing fish protective devices and development of fishery resources (eg artificial reefs) and species protection activities and habitat management through bio-manipulation. - Aquatic ecosystems in Greece are characterized by particularly rich flora and fauna. - Existence of important Universities, Technological Institutions and Research Centers engaged in training and RTD in the aquaculture sector. - Know-how and experience developed by local companies in the application of modern methods of production and distribution of fish products. - Aquaculture is among the most important primary production sectors in Greece, especially in the sea and is one of the fastest developing sectors of economic activity of the country (it is among the six primary “rising stars” that could contribute to the

Greek economy's growth in a 5 to 10 year horizon according to McKinsey & Company[5]).

- Constantly increasing demand for aquaculture products.
- Vertical integration of aquaculture production units.
- The implementation of control systems and quality assurance applicable to the products of aquaculture units.
- The existence of spatial planning, which will return at improving control of aquaculture.
- The employment of a significant number of professionals and workers in related ancillary sectors and business development that support the sector in products - equipment & services.
- Strong EU interest and funding for the achievement of the current CFP targets.
- Proximity and trading relations with emerging markets
- Wide acceptance of local aquaculture products in the supermarkets & catering sector.
- Promotion of the healthy "Mediterranean diet" in which seafood – mainly in its fresh form- is a major constituent.

Weaknesses
- Absence of integrated coastal zone management and marine spatial planning for further business development and attraction of investments in the sector. - Due to the above, there is strong competition in the use of the coastal zone with other activities such as tourism or residential areas. - Time consuming and complicated licensing system[8]. - Lack of application of dynamic models that will allow the rational planning of commercial aquaculture parks (POAY) and regional knowledge for the carrying capacity of the environment for the exercise of intensive aquaculture. - The low level of differentiation of species and forms (types) of products (mainly 2 species sea bass and sea bream). - Low level of innovative practices utilization in the implementation of the production.

[5] See: http://www.mckinsey.com/locations/athens/greeceexecutivesummary_new/ [8] See OECD, 2014. Measurement and Reduction of Administrative Burdens in 13 sectors in Greece. Final Report Fisheries (http://www.oecd.org/gov/regulatorypolicy/Greece-Measuring-administrative-burdens-Fisheries.pdf)

- Remote and isolated islands from urban centers and lack of adequate intraregional connections that hamper logistics and the value chain, particularly for small and island aquaculture enterprises.
- Inefficient mechanisms to control product supply and price reductions.
- Fishery products without eco-labeling/certification and limited consumer information and promotion programs.
- Rather poor public perception of aquaculture products.
- A significant number of human activities which harm the marine environment (e.g. disposal of wastes in the sea and rivers from agricultural, livestock and urban centres). - The inadequacy of technical and social infrastructure, particularly in island fisheries areas.
- The unfair competition from countries outside the EU.
- Financial problems due to capital controls, lack of liquidity and low trust of Greek enterprises due to the Greek debt financial crisis.
- Major sector companies are under a debt crisis and pass into the hands of their creditors. Merging, restructuring and capitalization of outstanding loans still under development.
- Increased production costs due to dependence from imported goods (fishmeal, fish oil) affect the price of the product.
- Unsystematic and non-coordinated R & D efforts for the commercial exploitation of more species by the producers.

Opportunities

- Provision of employment opportunities throughout the year in island and coastal areas in maritime activities.
- The apparent increase in consumption of fishery products due to changing eating habits towards healthier diets.
- The development, restructuring and improvement of the aquaculture industry by defining and planning of the organized development areas of aquaculture (POAY). - The ability to support actions which contribute to protecting and improving the environment.
- The promotion of organic aquaculture and enhancement of environmentally friendly forms of aquaculture.

- The implementation of environment protection facilities in processing plants and marketing of fishery products.

- Diversification of the aquaculture industry with production of new species and new end products.
- Improvement of existing knowledge through the strengthening of innovation and Research and Technological Development (RTD).
- Organic and eco-labeling of final products.
- Aid for modernization of micro, small and medium units and actions of common interest, such as the creation of producer organizations (Regulation (EU) No 1379/2013[6]).
- Opportunities for funding from the Operational Programme Fisheries 2014-2020 for fishtourism and ichthyotourism activities as well as for Sustainable Development of Aquaculture.
- Licensing opportunities for planning small scale marine aquaculture units up to 15 tonnes per year combined with tourist accommodation, or diving park in the framework of ichthyotourism under Joint Ministerial Decision 31722/4-11-2011 – Approval of Special Framework on Planning and Sustainable Development on Aquaculture and of its Strategic Environmental Impact Study.

Threats
- The economic situation and the impact on the socio-economic fabric of the country especially in fisheries dependent areas. - Increased competition from the international markets. - Limited consumer's awareness and misinformation for the aquaculture products. - Long delays in the timely establishment and implementation of fixed and updated regulatory framework for the operation of the sector. - Environmental pressure in certain maritime areas, either because of tourism or other productive activities, or lack of long-term planning. - The dislocation risks of coastal areas and islands due to the decline of the fisheries sector. - The negative impact on the environment due to overfishing or violation of the

environmental conditions on aquaculture activities.

- The climate change and the apparent increase of the water level of the sea in lagoon areas, may induce changes in the systems and methods of

[6] See: http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2013:354:0001:0021:EN:PDF

aquaculture activity. Furthermore, the change in water levels of marine coastal areas may cause changes in ethology and breeding of various fish species, affecting the level of fish productivity of these areas. - The reduction of stocks for fish feed. - The effects of climate change (e.g. restriction of specific species productivity). - The economic situation. - Potential delays in efforts to restructure the public administration.

Source: Strategic Study of Environmental Impact Assessment of Operational Programme Maritime & Fisheries 2014-2020 and this study.

5. Business plan of two cases of fish farms (Small scale floating cages coupled with ichthyotourism & Bivalve aquaculture unit), including inter alia the kind and the cost of the installation, the funding opportunities, the needs in man months, the expected cost of production, the expected income in the first 5 years

5.1. Introduction: Costs of Production

In marine fish-farming the cost of the goods produced varies –sometimes quite significantly- from one farm-unit to another, depending on the size of the enterprise, its organizational level and structure, as well as its on-growing management tactics and practices.

Significant differences are also being observed in the cost structure between the vertically integrated companies and those, which only operate an on-growing unit. Moreover, differences may also be observed within the same farm-unit, from one year to another, depending on the time of the year that fry are introduced to the cages for ongrowing, and feeding regime and requirements of the farm's remaining stock.

Attempting to assess the evolution of the production cost-structure from the early years of the sectors development, based on past research and studies, it becomes apparent that significant changes have taken place within almost 15 years.

According to the literature as well as on information provided through interviews with people of the industry, the cost of production of sea bass and sea bream is being gradually reduced year after year, from 7 € to €10 € per kilo in 1989 to 3,72 € in 1998, and roughly around 3,48-4,36€ per kilo nowadays. While the latter Figures provide an indication of the reduction in the production cost, it is however difficult to make direct comparisons between the Figures provided by the different sources, as some do take into account *depreciation costs* and *other financial costs* and other do not. In general, the key determinants of the production-cost are

- Cost of fry (fingerlings)
- Feed costs
- Labour costs

If the enterprise does not own a hatchery it is forced to buy the necessary quantities of fry for on-growing. This cost ranges from 0.17 to 0.23 € per fingerling. In general, the cost of fry may account from 14.16% to 19.8% of the total production unit-cost. Fish feed makes up, by far, the largest part of the production cost, accounting from 40% to up to 47% of the total production unit-cost.

Estimating the production cost-structure, there are various factors that must be taken into account apart from the obvious production expenses such as the cost of fry, of feed, of labour etc. Following an in depth investigation on the matter, the categories which shape the production cost for the cultured sea bass and sea bream are:

- Feed. Fish feed account for the largest share of the cost of production. Two parameters determine its cost: Its price and Feed Conversion Ratio (FCR), the ratio at which feed is assimilated by the organisms and transformed into flesh ie: body-weight. The price of the feed depends largely on the quantity ordered, the place of deliverance (distance of farm) and –of course- the quality and type of the feed (extruded or pelleted). The greatest majority of the farm use, nowadays, extruded feed which incorporates more fat in it and yields better FCR. Extruded feed costs about 0.88€ per kilo (ranging from 0.85 – 0.91€), and as regards the FCR, there are numerous parameters which directly affect it, such as: the management of the farm, the stocking season, the 'heat-days' the fingerlings have been exposed, the mortality rate and finally, the size of the fish produced. For the size-grade of 300-450 gr, FCR ranges around 1,87. If however production targets for larger fish, due to the sexual maturation of the fish as size grows, FCR increases to 2,2 – 2,3 incurring a significant cost on the fish produced.
- Fry. Fry makes up a significant part of the production cots in aquaculture, being its most basic 'raw' material. Its cost depends directly on the quality required for the ultimate production of 1 kilo of marketable fish, which in turn relates to the final mortality ratio. For example, for the production of a product unit (360 gr fish), with an average mortality ratio of 20%, 3,571 fingerlings are required. In this respect, the vertical diversification of a company, by owning its own hatchery, creates a cost advantage since the on-growing unit of such a company does not have to buy its fingerlings form a third company.

This way, for farms with their own hatchery the cost of fry ranges from 0,50 to 0,61 €, while for the farms who have to buy the fry, production is burdened with 0,72 to 0,83 € per kilo of marketable fish (These figures refer to the cost for 3,752 fingerlings / kilo of final product)

- Labour. For the estimation of the labour cost an empirical index is being used to show the quantity of the fish produced per worker. With mean monthly wages ranging from 675 € to 734 €, a sound management may yield 30-35 tonnes per worker and may reach up to 60 tonnes per worker annually, under optimal circumstances –with the use of large cages and automated feeding. However, inefficient management in many farm units may lower the quantity of fish produced per worker, thus increasing the cost of labour, which generally accounts for 0,50 € to 0,53 € per kilo produced, while labour cost up to 0.62 € per kilo constitute an efficient management.

- Diving. The divers who check the cages, their moorings and held during the netchanges and the harvesting of the stock constitute a separate category since their salary is higher than that of the plain workers. In general, divers cost between 0,03 and 0,04 per kilo of product.

- Insurance. The cost of insurance ranges from 0.12 to 0.15 € per kilo produced.

- Medicines and vaccination. Sea bass often requires vaccination for reducing losses incurred from *vibrio* and *pasteurella,* and for this reason its cost ranges from 0,07 –0,09€, slightly in relation to the sea bream which costs from 0.02-
  0.03 €.

- Fuel & Energy. The cost in this category is directly related to the location of the farm-unit. Proximity to the shore, the existence of an easily accessible road, the remoteness of the site, and the boat requirements determine this cost category.
  In general, Fuel and Energy expenses add about 0.02 to 0.06 € per kilo of product.

- Repairs & Maintenance. In general, such costs range from 0.04 to 0.06€ per kilo produced

- Consumables. Including all petty costs (office consumables, clips for net mending etc), these add about 0.01€ per kilo of fish produced.

- **Other (sample analyses, special boat hiring etc).** Such expenses contribute to roughly about 0.01€ per kilo.
- **Depreciation.** Depreciation costs account for a significant part of the total cost of production, largely depending on the investments on fixed assets that each company makes. By large, depreciation costs add about 0.23-0.29€ per kilo produced.
- **Packaging.** The packaging of the fish after harvesting and sorting presents quite an important cost to the overall production costs, since a box of polystyrene for

6 kg of fish costs 0.59€. In total, packaging expenses add between 0.23 and

0.26€ per kilo. In this cost is included the labour cost of the workers of packaging unit and the cost for the transport of the fish to the packaging unit.

- **Management & Administration costs.** Including expenses for the personnel and operation of the accounting, sales, marketing departments etc, it varies greatly from one farm to another, and is directly proportional to the actual size of the company. In general these expenses burden the production cost with 0.15 to 0.29€ per kilo of fish produced.

Following the above, it becomes clear that for the reduction of the unit-cost, companies are pursuing economies of scale by increasing their production volumes. However, while this strategy does indeed reduce the unit cost of production, the unregulated supply has lead to the dramatic drop of the market price for these products.

Sea bream produced by vertically diversified companies with a hatchery costs from

3.48€ - 4.07€ per kilo, while for the companies who buy the fry, the cost rises to 3.70-

4.30€ per kilo. Similarily, sea bass costs from 3.53 € to 4.30 € per kilo to the companies owning a hatchery, and about 3.75 € to 4.36 € per kilo to the non-diversified ones (Table 13).

Table 13. Sea bass-sea bream product-cost-range (*fry produced vs fry purchased*).

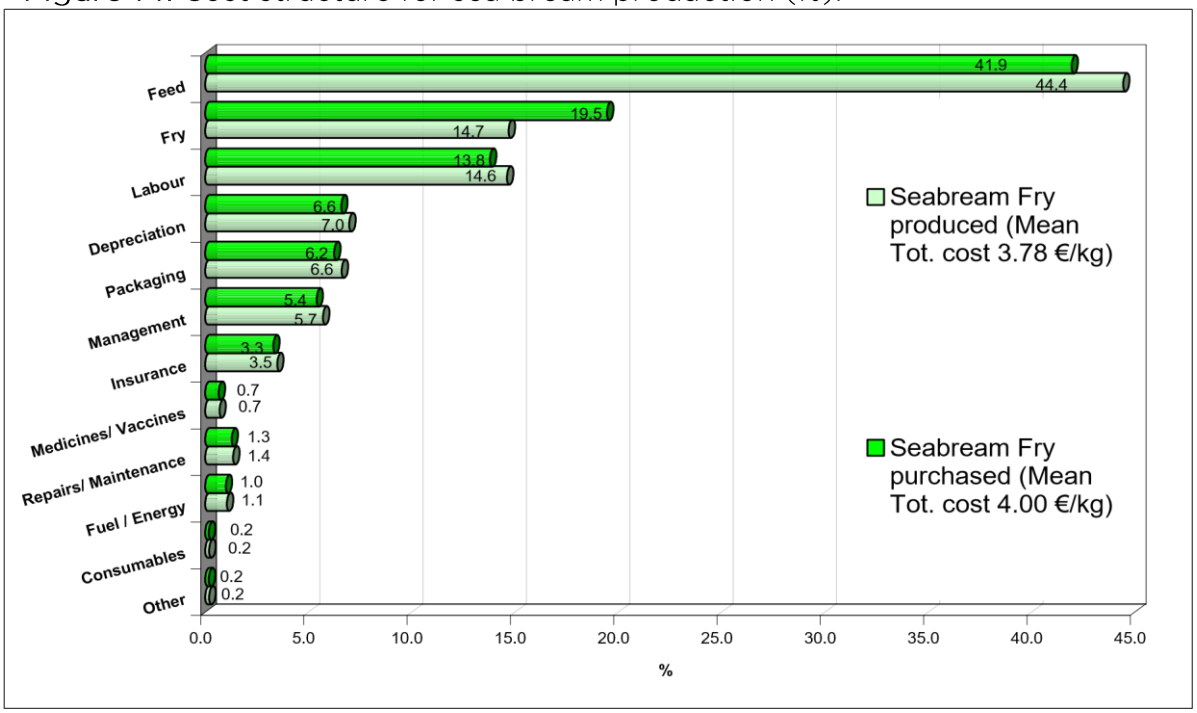
	Sea bream	Sea bass

	Fry produced		*Fry purchased*		*Fry produced*		*Fry purchased*	
Total Cost	Min €	Max €	Min €	Max €	Min €	Max €	Min €	Max €
€ / Kg	3.48	4.07	3.70	4.30	3.53	4.13	3.75	4.36

Source: LAMANS Management Services SA

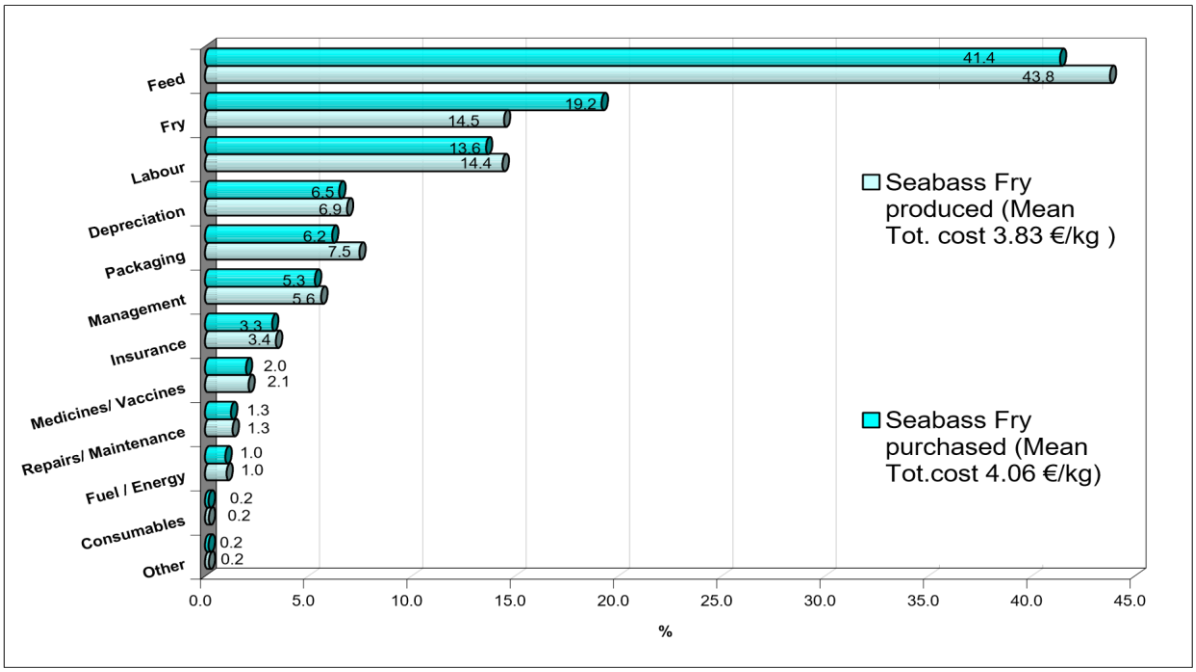
The following cost-structures per species are indicative. However, it is herein believed that these present a fairly accurate account of the various cost categories which burden the production of these species.

Figure 14. Cost structure for sea bream production (%).



Source: LAMANS Management Services SA

Figure 15. Cost structure for sea bass production (%).



Source: LAMANS Management Services SA

From the previous Figures it becomes apparent that the costs of fry, feed, labour, depreciation, packaging, and management, account for over 90% of the total production cost.

5.2. Business Plan 1: small scale floating cages coupled with ichthyotourism

5.2.1. GENERAL COMPANY INFORMATION

1. Company Name: XXXX
2. Activity Industry: Small marine aquaculture farm (15 t/year) with agrotouristic activities.
3. Object of operations: Rearing of Mediterranean marine species (sea bream, sea bass)
4. Established: 2016
5. Legal Status of Enterprise: Private company (IKE)

5.2.2. SUMMARY DATA BUSINESS PLAN

5.2.2.1. Brief description of the proposed business plan

The proposed business plan is for the creation of a small facility for the organic farming of marine Mediterranean fish species (for the moment sea bass and sea bream), combined with the provision of ichthyotourism, fishtourism and diving services.

The Joint Ministerial Decision 31722/4-11-2011 (Approval of Special Framework on Planning and Sustainable Development on Aquaculture and of its Strategic Environmental Impact Study) [7] allows licensing for small scale marine aquaculture units up to 15 tonnes per year if combined with tourist accommodation, or diving park in the framework of ichthyotourism or other agrotouristic activity. The condition in this case is that these companies operate by the same natural or legal entity or that there is an agreement among different companies.

Organically produced aquatic products are increasingly available to consumers and, in particular, sea bass and sea bream from certified farms in Greece have been exported and also channeled to large retail markets in Greece since 2008.

The organic aquaculture farm will be combined with the organization of alternative tourism activities (agrotourism, fishtourism, ichthyotourism, diving tourism, ecotourism etc), depending on the area and its local characteristics. Every area in Greece has unique nature and special characteristics that can be highlighted and attract tourists. This business plan proposal attempts to present this new concept that can be adopted in many areas of Greece.

The income of this type of business will not be solely from a wholesale or retail sales of the produced fish, but it will be combined with a number of parallel alternative tourism activities, depending on the local characteristics of each area and the skills and talent of the young investors.

5.2.3. PURPOSE & DESCRIPTION OF BUSINESS

(description of the purpose, the basic idea and phase which is now its implementation)

5.2.3.1. Organic aquaculture of sea bass and sea bream

Organic aquaculture is based on the principles of environmental sustainability, product quality and safety, as well as animal welfare. Current Regulation 710/2009/EC provides some detailed rules on organic production and a further implementation is expected by 2017 (COM(2014) 180 final). There are

[7] See: Chapter B, Article No. 5,b. Individual siting outside the Areas of Aquaculture Development (http://www.alieia.minagric.gr/sites/default/files/basicPageFiles/2-Ydat/11_2505B.pdf)

still several controversial issues on organic production of carnivorous fish species in intensive farming systems, mainly related to feed sources, animal welfare, disease prevention, environmental interactions, which require more knowledge to increase consumer confidence in organic aquaculture and to ensure its future development (FEAP, 2012, 2014).

The concept relies on the firm's capacity to produce and offer farm raised organic fish of superior quality that is upgrading the texture and taste to the wild stock, simply by simulating the nature's conditions into farming. For the moment in Greece, organic fish is produced by four major companies' NIREUS, Kefalonia Fisheries, Hellenic Aquaculture and Galaxidi, whose production is mostly exported (Paraskoulaki, 2015).

The life cycle of the organic fish is considered to start the day that the stock exits the hatchery for the open sea cages. Fish at this stage are at a weight of approximate 1 to 2 grams. The long lasting period of 18 or more months that are required to raise the fish from such weight to the market size of 0.4 kg or more, is the period that characterizes the fish production as organic.

- The unique features of organic fish is found on the following properties that separates the conventional to the organic production.
- Extended period of growing by minimal human disturbances.
- Nutrition by exclusive organic fish feed. Organic fish feed derives merely from fish meal and fish oil from eco-friendly sustainable sources and cereals from biological farming.
- Clean water environment. The organic growing unit will be located in a rural area with absolute lack of industrial waste, pesticides, herbicides or fertilizers remains.
- Fish density inside the cage is limited to lower than 10 kilograms per cubic meter of sea water.
- Free of chemotherapeutics. No other methods or industrial substances are used but self-healing.
- Warehousing of fish feed and other equipment are stored, used and cleaned separately.
- Cage nets are plain and colorless, free of any type of other protective dye.

5.2.3.2. Introduction to the concept of agrotourism and fishtourism

In Greece, there are many suitable places for practicing agrotourism and fish tourism in parallel with aquaculture activities. These forms of alternative tourism is when people tour things and places other than the usual tourist attractions. In this type of tourism, visitors often interact more with the locals and nature rather than simply looking at big buildings or historical sites. The local cultures, families and communities are emphasized over mainstream tourism. There are three main categories of this type of tourism: nature-based tourism, cultural tourism and adventure tourism. All three categories could interconnect, depending on the specific desires and abilities of the tourist.

This type of tourism, although so far is among the rarer forms of tourism, it becomes more and more popular. Many people desire the resort type of tourism, which is mainstreamed and often packaged in well-advertised bundles. Travelers typically will not ask for alternative tourism options when they are planning trips to other areas. The natural settings and everyday lives of the people who live in an area are what truly make up alternative touring, and the packages are easier to obtain because of their lower popularity.

Recognizing an alternative tourism package over a mainstream tourist opportunity simply involves reading the details of the trip. A company that offers golf tours in its alternative packages might have the wrong definition of this type of tourism. A true alternative touring package includes as few non-native elements as possible. After an alternative vacation, the vacationer should feel that he or she has experienced the true essence of the area, rather than seeing only the flashy, advertised eye-catchers.

Nature-based tourism is also referred to as ecotourism. This branch of alternative tourism takes individuals into the marine natural environment of the region. Packages include outdoor activities specific to the natural area such us diving, fishing, guided tour by a vessel, etc. A tourist who is interested in marine ecotourism will choose the activity level of the tour package; the activities will range from studying the natural marine flora and fauna to experiencing the various local outdoor activities practiced by the natives.

Cultural tourism is the ethnic and religious sector of alternative tourism. Individuals who are interested in cultural tourism will discover the rural, ethnic and religious practices of local residents. Wine and local cuisine tours are often included in these packages, as well as tours of the local music scene.

Tourists receive an in-depth look at how people live, work, play and interact with their natural environments.

Adventure tourism is popular in many areas of the world and sea regions. Physically active tourists might choose this form of alternative tourism when they are interested in more challenging physical activities. Sea diving and under water cave exploring are among the activities found in an adventure tourism package.

5.2.3.3. The concept of Local Available Resources (LAR)

It is a rather innovative method of analysing and exploring the local natural, social, cultural and economic environments, in an aim to identify the elements within it that have an intrinsic value, which can be exploited for the benefit of a person (worker), a company or venture, a sector, or a community at large. In effect, it is an elaborate scanning of the local environment and the existing and potentially available resources, in order to provide an holistic 'picture' of all the elements that are directly or indirectly related to a social and/or professional activity.

Resources differ from place to place and from subject to subject. By definition a Resource is something that a person interested may be able to see, to recognise, to give it a special "value or use"; to see an opportunity within it; to perceive it as something that can be used and exploited to the satisfaction of his/hers needs. A Resource, if properly approached and explored, may be transformed into a source of income.

The aspect of locality is also of fundamental importance to the notion of LAR, as it focuses the attention of the identification of the resources at local level, linking all elements (environmental, human, societal etc) into a tight framework. The design of diversification activities, for a person or a group of people, is placed under the wider context of locality, implying that all (or most) members of a community and all of its resources can be used and combined to have a more integral positive effect.

How can the concept of Local Available Resources be of benefit to an aquaculturist or fisher wishing to diversify his occupational activities?

In general, coastal fishers are a local resource, as is the profession of fishing with traditional means in a sense that there are people wishing to experience this activity at a price. However, for the full exploitation of this resource, all the complementing ones need to be identified and accordingly explored.

The first step towards the effective application of the LAR concept requires the recognition of a need, and subsequently the identification of a possible course towards the satisfaction of this need. In the case of an aquaculturist or a fisher wishing to enter the fish tourism business, the first step seems to have been taken, via the recognition of the need of the fisher to diversify his/hers occupational activities, and through the identification of fish tourism as a possible means to aid the fulfillment of this need.

The second step is an analytical breakdown of the resources available at local level that may, directly or indirectly, affect the diversification of the fisher towards fish tourism. This breakdown should categorise the resources and identify within each the possible positive effect towards the desired state. In brief, this may include:

Environmental Resources

- Fish and mussels stocks available
- Marine life present (ie seals, dolphins, whales, turtles, sharks, big fish etc)
- Coastal environment (coast morphology, coastal zone terrestrial and avian life

etc)

- Geological structures of interest

Historical & Cultural Resources

- Archaeological monuments and sites of possible interest
- Other historic monuments and sites of possible interest
- Local customs – traditions (local fairs, celebrations etc)
- Folk dance – local dancing groups
- Local cuisine and traditional recipes
- Other

Financial Resources

- Financial institutions (banks)

Administrative & Cooperative Resources

- Existence of a local Chamber of Commerce

- Local Authority Services
- Coast Guard station and Port-Authority
- Association and cooperatives of local fishermen
- Association of local hotel owners
- Tourist operators

General Infrastructure

- Proximity to major highways, ports and/ or airports
- Catering and Guest-housing (restaurants, hotels, rooms-to-let)
- Medical centre - hospital.

It is thus important for an aquaculturist/fisher to learn to 'read' the surroundings like a container of resources to be utilised and exploited for possible occupational prospects in order to diversify his/her activities. In that respect, there are numerous possibilities and combinations of activities for young people who wish to engage in the fisheries sector and diversify their occupational activities.

5.2.4. Objectives of enterprise (quantitative data)

The proposed Business plan is for a small aquaculture farm of 0.1 hectares area with an annual production capacity of 15 tonnes of organic marine Mediterranean fish per year. As the Greek legislation is setting a minimum of 1 hectare sea area (10.000m^2) for leasing, there is enough space to create a marine park with additional eco friendly activities. Special fish fry protection devices (Econet devices) will be installed in order to further enhance the sealife in the leased sea area through bio-manipulation (see www.ecoreefs.gr).

Fish can be sold on many different levels - wholesale, retail or "value added" (cooked using a variety of traditional ways depending on the area). This BP assumes that part of the fish will be sold to wholeasalers (ex farm) or through the Fertility electronic sales platform directly to consumers as well as to visitors and tourists either raw or cooked in the restaurant (fish tavern) of the company.

Moreover, the company will have additional revenues by providing a variety of services such as fishtourism excursions, diving and accommodation arrangements to visitors.

How should a fish tourism day be organised and what could be included?

A "typical" fish tourism day starts at the moment of the reservation, that is the moment of first contact with the client who asks detailed information about the service. It is important not to underestimate this moment, where the potential client is first presented with the service offered and enters the decision-making process for accepting or rejecting it.

Information concerning the service should include the type of vessel, the type of fishing gear used, the place of fishing, the kind of fish usually caught, the place and time of embarkation and departure, the place and time of arrival and disembarkation, any additional services provided or available on board (meals, drinks etc), the duration of the trip, any equipment provided (life-jackets, overalls etc) and finally the price charged.

The 'reception' procedure, during the embarkation of the clients, could include the offer of a coffee, tea, or juice the introduction of the crew and the captain to the clients, familiarisation with the vessel's compartments, the safety equipment and safety procedures, and finally a description of the gear and its use during fishing etc.

During the course of the journey to the fishing grounds, passengers may be given information concerning the navigation and sailing of the vessel and –under supervision- may be allowed to steer the vessels, chart the course, use the sonar for locating fish etc.

Once the fishing ground is reached, the captain and crew should allocate each passenger to a pre-specified post, with –previously explained- specific tasks (even if only 'demonstrative' fishing is practiced). The captain or a member of the crew should explain the various phases of the fishing operation, help the participants to perform their tasks and answer to any questions that may arise concerning the activity. Special care should be given on safety issues, and participants should be well supervised at all times.

Once the actual fishing phase is over, the next phase that of fish-sorting and fishpacking, starts. As with the previous phase, special instructions should be given to the participants, along with explanations on the species, their basic

ecology, and if so requested, traditional recipes with these species should be provided. The final phase of fishing is the sorting of the equipment, its daily cleaning and maintenance, and even in this phase passengers may be invited to participate.

Along with the actual fishing, the journey could –rather should- include a stop for relaxation sun and sea bathing, probably snorkelling etc. The daily trip could include a stop for a snack or a quick meal (depending on the vessel and the practicalities associated to it), while historical or ecological sites of interest along the coast should be visited if possible.

Upon return to the home-port, time should be spent with the passengers for reflection of the experiences gained. Arrangements could be made for the fish caught to be prepared for dinner, with traditional recipes at a local 'taverna' or restaurant, or even on board if this is possible. The fishtourists should be encouraged to take active part in the preparation of the dinner. The 'night' program could include folk dancing, singing, and other local habits and customs, while traditional products could be promoted at this stage through 'wine tasting', cooking with olive oil, etc

5.2.4.1. Ways of Financing

The fish farm can be funded from public funds through Regulation (EU) No 508/2014 of the European Parliament and of the Council of 15 May 2014, that established the European Maritime and Fisheries Fund (EMFF). The EMFF shall contribute to the achievement of the following objectives:

a) promoting competitive, environmentally sustainable, economically viable and socially responsible fisheries and aquaculture;
b) fostering the implementation of the Common Fisheries Policy (CFP);
c) promoting a balanced and inclusive territorial development of fisheries and aquaculture areas.

5.2.4.2. PROCEDURES FOR ESTABLISHMENT

(operating licenses, environmental constraints, required capital foundation etc.)

The cost of licenses and permits does not generally represent a very large component of total fixed costs; however, access to space and licenses represents a crucial limiting factor to aquaculture development for the moment. The Joint Ministerial Decision 31722/4-11-2011allows licensing for small scale marine aquaculture units up to 15 tonnes per year if combined with

tourist accommodation, or diving park in the framework of ichthyotourism or other agrotouristic activity. The condition in this case is that these companies operate by the same natural or legal entity or that there is an agreement among different companies.

5.2.4.3. COMPETITIVE ADVANTAGE

(whether the project includes innovation in production, or otherwise indicate anything new that will give it a competitive advantage)

The innovation in the proposed activity is the whole concept of combining aquaculture activities and fish tourism and alternative tourism. The legislation on fish tourism has been published only recently (Government Gazette No 97B'/20-1-2015) and describes the conditions, terms and procedure for conducting fishing tourism by professional fishermen.

Aquaculturists and Fishers aiming to diversify their occupational activities will need to collaborate and develop new skills and competencies for their successful entry to the sector of fish tourism. The relevant laws and regulations must be learned and comprehended while aspects of marketing (ecotourism marketing) and basic principles of management need to be understood and applied. Moreover, aspects concerning the sustainable exploitation of the resources will definitely be an issues of interest by the 'clients', who will need someone onboard not only to explain the basic aspects of this principle but also to operate the fishing vessel according to these.

5.2.5. MARKET

5.2.5.1. Market Segmentation

(Buying target audience and reasons)

The company's buying target audience will be tourists and as well as roadside and retail sales. In addition, sales will be promoted through the website of the company and collaboration with the FerTility platform (see below, chapter 5.3.8.2.).

5.2.5.2. Installation Site Analysis

Picking a successful site requires local knowledge of an area and existing uses, and an assessment of the area's production potential. What constitutes the right site will also depend on the species and phase of rearing. The following factors relate to whether shellfish will grow fast and survive:

• Speed of the current.

• Water temperature.

• Water salinity.

• Exposure to wave action.

• Sediment type.

• Water depth.

5.2.5.3. Competition

(Indicate the current situation, the possible reaction of competition in the appearance of the company, what is the expected future evolution, analysis based on Porter's competitiveness model).

The classic market competition model of Porter, 1980 envisages companies relying on three generic strategies to maintain competitive advantage; product differentiation, cost leadership (efficiency focus) and market segmentation (niche market focus). The first two relate to core competencies of the firm and are considered most important as they have broadest market scope. Cost leadership can be resolved into low cost and best cost strategies. The latter indicates provision of best value for relatively low cost in order to reduce the likelihood of price wars with other 'cost leaders'. Companies following differentiation strategies risk being copied by competitors and have greater incentive to innovate and improve. These notions clearly correspond with the categories of efficiency and innovation driven competition described above. 'Niche' focus on a narrow market segment often occurs when a company can afford neither a differentiation nor cost leadership strategy with wide market scope. It is often adopted by smaller companies and may be combined with cost leadership or differentiation within the niche. The collective focus of many small Greek firms on organic sea bass and sea bream production for to supply the EU market is a good example. However niches disappear and over-reliance on a single small specialist niche may be a risky strategy in the longer term. The costs incurred for value-added differentiation means that combining differentiation and cost (minimization) leadership strategies is rarely compatible at any market scale. Porter also observed that firms with intermediate market share are sometimes least profitable as they lack clear focus on a specific generic strategy.

5.2.5.4. MAIN FEATURES / EXPECTED EVOLUTION OF THE MARKET AND POSITION OF THE UNDERTAKING

(Existing and potential market estimate, the expected evolution in size, value, like other trends)

The Council of Europe defines organic production as being 'an overall system of farm management and food production that combines best environmental practices, a high level of biodiversity, the preservation of natural resources, the application of high animal welfare standards and a production method in line with the preference of certain consumers for products produced using natural substances and processes. Greece, France and Croatia are involved in organic production of sea bass and sea bream - 300 tonnes each in Croatia and France (respectively 6 and 9% of their total production) and 1,000 tonnes in Greece (<1%). Currently, 3 farms with organic certification produce in Greece for mostly domestic sales (FEAP annual report, 2014)[8]. Market issues, complicated bureaucracy are the main barriers for further development. Spain and Italy also have small production but no precise data available, also data for Turkey are unknown. The main reason for this very limited production is economic (prices too high and lack of consumers' awareness.

The current economic crisis has created the necessity to change and redefine the boundaries of existing business models world-widely and the tourism sector is no exception. It seems as if tourism enterprises agree that mass tourism and already existing models and forms of tourism do not longer constitute a solution to the crisis and have targeted mainly to customer satisfaction and interpreting customer behavioral intentions in order to respond to this new era that today's business environment has imposed on the tourism sector, combined with the economic crisis Greece is confronted by. The above are also combined with the tendency to develop new alternative forms of tourism in order to diminish the impact on both the environment and the host countries. Greece, one of the most vulnerable countries due to the economic crisis, tries to adapt these strategies in order to be relieved from this unfavorable situation.

Based on the above considerations and findings from existing studies in the literature, Nissim (2013) has been conducted a study in order to assess the effects of the current economic crisis on certain parameters affecting the

[8] Source: Claire Zubiaurre – EAS magazine Vol 38 – September 2013.

tourism industry, such as examining tourists' expenditures, revenues, changes of management styles on part of tourism businessmen, diversifications of tourism products, customers' reactions and needs. The study was addressed to 749 Greek potential tourists, 190 foreign tourists who have visited Greece and 32 tourism enterprises. Data were collected through a survey, based both on quantitative (Greek & Foreign tourists' questionnaires) and qualitative parameters (Tourism enterprises' interviews). The data gathered has been assessed and analyzed statistically using descriptive statistics, while interviews were carefully analyzed in order to present respondents' perceptions. Some of the key findings refer to: 1) the proportions of tourists' behavior influence towards the economic crisis and how such behavior has affected tourism enterprises due to the recession 2) tourists' perception of overall service quality and tourism enterprises' reactions in terms of service quality provision to ensure their customers' satisfaction 3) the positive correlation of tourists' behavioral intentions to alternative forms of tourism and the increase of competitiveness alternative tourism in its various forms can provide to tourism businesses. The findings are important from a theoretical perspective, by informing already existing knowledge in the area of tourism, while providing managers and policy makers with rich insight as to appropriate strategic moves and business models they should focus on, in order to create better conditions for the tourism industry's competitiveness in the Greek context in future.

5.2.5.5. SWOT ANALYSIS

Market issues continue to be a leading concern of the Mediterranean sea bass and bream industry. The market appears to be most influenced by the actions of the Greek industry, which accounts for around 34% of Mediterranean sea bass and 46% of sea bream (including Turkish production). Between 70 and 80% of Greek production is exported, mainly to other EU countries (Mendrinos & Bostock, 2009, Papageorgiou, 2009), and increases in supply are thought to have been responsible for a long period of (historically) low sea bream prices during 2007-09 which resulted in several company failures and consequent consolidation. There are signs that lessons have been learned although most emphasis has been on cooperation to restrain output (control of fry production by the leading companies) rather than development of the market, although there are indications that this is also receiving greater attention (Globefish 2009). Unlike salmon, which now has a wide range of

value-added products, most sea bass and sea bream are sold fresh and whole, mainly in Southern Europe. Sea bass in particular has become more popular as a restaurant dish, although the current global recession has impacted on this outlet. However, as processed whitefish, sea bass and bream are in a more competitive market which generally remains price sensitive. Substantial investment will therefore be required to differentiate and promote aquaculture produced sea bass and bream products if the market is to be substantially expanded in this direction. There is probably some scope for further cost reduction in the sector through consolidation, economies of scale, and improvements in production efficiency, which could also expand the market somewhat, if supported by timely marketing actions. The issue of shortage of sites does not feature substantially in this SWOT analysis. This could be due, especially in Greece, to current opportunities for expansion through the takeover of weaker competitors, but also due to recent efforts of the national administration to legally resolve the issues of site availability through improved spatial planning and minimisation of conflicts with other users. However, it is a major constraint in some areas as at best, permissions take between 1 and 2 years. Access to credit appears to be an increasing constraint, certainly for Greek farmers, due the high debt ratio and the liquidity problems they have faced over the last 6 years. In this context, feed and fry suppliers have also greatly reduced their credit period to 0-2 months, in contrast to the 12 or more months of the recent past. It should be noted that the extended credit period of the past seems to have been a contributory factor to continued increase in production without corresponding investment in marketing. (Mendrinos & Bostock 2009). There may also be significant differences in drivers for private and public companies. Larger companies quoted on the Athens stock market may have been driven by targets for revenue growth to increase share value rather than a focus on annual profits which tend to characterise private enterprises. Emerging diseases such the Viral Encephalopathy and Retinopathy caused by Nodavirus might result in significant future looses to the industry.

STRENGTHS	WEAKNESSES
• The geomorphology of the country's sea areas and large number of islands that allows developing marine aquaculture in favorable environmental conditions • High demand in Mediterranean market • Proximity to major EU markets, with parallel increasing domestic consumption especially in the summer months due to tourism. • Aquatic ecosystems in Greece are characterized by particularly rich flora and fauna. • The implementation of control systems and quality assurance applicable to the products of aquaculture units. • Strong EU interest and funding for the achievement of the current CFP targets. • Wide acceptance of local aquaculture products in the supermarkets & catering sector. • Promotion of the healthy "Mediterranean diet" in which seafood – mainly in its fresh form- is a major constituent.	• Licensing bureaucracy. • Credit limits from the banks. • Large number of small-subsidised operations in Greece with limited market access. • Absence of production controls or strategic planning by Greek authorities. • The low level of differentiation of species and forms (types) of products (mainly 2 species sea bass and sea bream). • Low consumer familiarity (esp. bream) in Northern Europe. • The unfair competition from countries outside the EU. • Absence of zoning for aquaculture • Lack of industry and market studies relating to potential export markets. • Absence of timely updated EU industry and market information. • Dependence on wholesale markets. • Limited portfolio of added value products. • Quality & cost of market information. • Transport logistics – distance from markets. • Planning constraints limit site availability.

OPPORTUNITIES	THREATS
• The apparent increase in consumption of fishery products due to changing eating habits towards healthier diets. • Increasing demand for farmed produce. • Existence of quality labels for organic and eco-labeling of final products. • Opportunities for funding from the Operational Programme Fisheries 2014-2020 for fishtourism and ichthyotourism activities as well as for Sustainable Development of Aquaculture. • Domestic (Greek) market expansion. • Export market potential. • New product development. • Accreditation to satisfy customer desires e.g. Agricultural University of Athens, Marine Stewardship Council (MSC), etc	• The economic situation and the impact on the socio-economic fabric of the country especially in fisheries dependent areas. • Increased competition from the international markets. • Limited consumer's awareness and misinformation for the aquaculture products. • Emerging diseases. • Possible emergence of new competitors. • Intense competition with substitutes (frozen, news items). • Great flexibility in price and demand for farmed fish affected by the varying availability of fresh fish. • Negative attitudes of consumers for aquaculture products. • The reduction of stocks for fish feed.

5.2.6. Products and Services

5.2.6.1. Description of Goods and / or Services

(characteristics of the products to be promoted on the market. Product categories, advantages, presentation, complementarity).

The farm will produce 15 tonnes of Mediterranean marine fish that will be ready for the market after about 17 months, when they will be about 350-400 gr.

5.2.7. Production Process

5.2.7.1. Description of the production process

(stages and organization of the production process or method of design and implementation of the service)

The annual capacity of the small scale fish farm unit will amount to 15 tonnes of Mediterranean marine fish.

According to international literature and experience from the rearing of these species that operate in other Mediterranean Countries, mortality throughout the rearing period is estimated to be around 15.99% for sea bream and sea bass.

To have a production flow throughout the year, it is scheduled to receive fry three times a year and in detail as below:

Periods of rearing – production of 15 tonnes

I. Marine Mediterranean fish species

January: fry stocking for 5 tonnes of Mediterranean marine fish. The production of 5 tonnes of market size fish is planned to be placed on the market in May of the second year (17 months rearing cycle).

II. Marine Mediterranean fish species

March: fry stocking for 5 tonnes of Mediterranean marine fish. The production of 5 tonnes of market size fish is planned to be placed on the market in July of the second year (17 months rearing cycle).

III. Marine Mediterranean fish species

June: fry stocking for 5 tonnes of Mediterranean marine fish. The production of 5 tonnes of market size fish is planned to be placed on the market in October of the second year (17 months rearing cycle).

Each on-growing period will be realized in 4 phases: (a) pre-fattening juveniles from weight of 2 g to the weight of 15 g, (b) on-growing from 15 g to 50 g, (c) on-growing from 50 to 180 g, and (d) on-growing from 180 to 380 g.

For the on-growing, the needed nets with mesh size 5-6 mm, 8-10 mm and 12-14 mm are needed, depending on the period of on-growing and farmed species.

Production program for Mediterranean marine fish

PRODUCTION OF 5 TONNES OF MEDITERRANEAN MARINE SPECIES

Production in nets of 5 – 6 mm (2g - 15g)

The unit is supplied annually during January, March and June 15,700 pieces of fry from Mediterranean marine fish of average weight of 2 g. The fry are placed in a rectangular cage of 7 by 7 M, 6 M depth nets with a mesh size of 5-6 mm. The volume is 294 cubic meters. So the initial stocking density is 0.11 kg / cubic meter.

The fry remains in this net until they reach an average weight of 15 g (2 months). Mortality during this period is considered the most critical and will be around 6%. Thus, at the end of this period the total biomass is 221 Kg. The final stocking density of this stage is 0.75 kg / cubic meter.

Production in nets of 5 – 6 mm (15 gr - 50 g)

The 15 g fingerlings remain in one rectangular cage of 7 by 7 M, 6 M depth equipped with a net of 6 M depth and with a mesh size of 5-6 mm. The volume is 294 cubic meters. So the initial stocking density is 0.75 kg / cubic meter.

The fingerlings remain in these nets until they reach an average weight of 50 g (about four months). Mortality during this period is in the order of 5%. Thus, at the end of this period the total biomass will be 701 Kg. Final stocking density at this stage is 2.38 kg / cubic meter.

Production in nets 8 – 10 mm (50g - 180g)

Then the fish of 50 g is transferred in two rectangular cages of 7 by 7 M, 8 M depth nets with mesh size 8 to 10 mm. The volume is 392 cubic meters. So the initial stocking density is 0.89 kg / cubic meter.

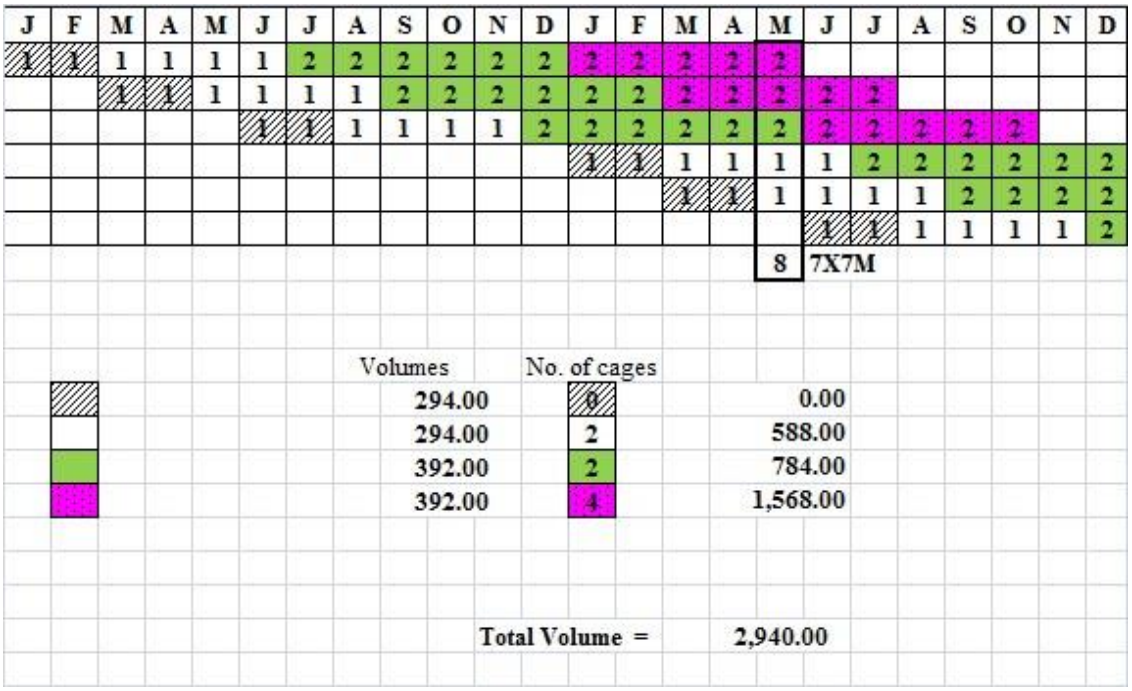
The fingerlings remain in this net until they reach an average weight of 180 g (about 6 months). Mortality during this period is around 4%. So at the end of this period the total biomass will be 2,423 Kg and the final stocking density at this stage is 3.09 Kg / cubic meter.

Production in nets 12 – 14 mm (180g - 380g)

Then the fish of 180 g remains in the same rectangular cages of 7 by 7 M, 8 M depth nets with mesh size 8 to 10 mm. The volume is 392 cubic meters. So the initial stocking density is 3.09 kg / cubic meter.

The fish remain in this nets until they reach an average weight of 380 gr (5 months). Maximum mortality during this period is estimated to be 2%. Thus, 13.190 pieces of Mediterranean marine fish will reach the average weight of 380 g and the total biomass will be 5,012 Kg. So the final stocking density at this stage is 6.4 kgr / cubic meter.

Figure 16. Production programme for 15 tonnes annually of Mediterranean marine fish species.



Source: Courtesy of NAYS Ltd

Number of necessary cages

According to the design of the marine farm, 492m^2 (0.05 hectares) are needed for the production of 15 tonnes of marine Mediterranean fish species. The infrastructure to be used is:

Production cages

" 8 plastic rectangular cages, 7x7M.

Management cages

" 4 plastic rectangular cages, 5x5M.

The total surface 492 square meters.

The total volume is 2,940 cubic meters.

Mooring system

The stabilization of the cages in the marine fish farm in the selected location is done using a special type of anchor and blocks of cement that will be deployed in an asteroid format. The cages will be connected with anchors, chains, galvanized wire etc.

Both the special type of mooring system as well as the side moorings will be placed as specified by the manufacturer.

Cage equipment and floating facilities

a. A provision is made for the needed nets and a limited number of spare nets to be equipped for the opportunity to change and wash the nets. Antipredatory nets are also foreseen.

b. Provision of diving equipment for two divers (uniforms, bottles, safety devices) with the filling machine for the bottles, in order to make possible daily underwater work such as maintenance and inspection of nets and moorings.

c. Provision of harvesting containers for the transport of fish from the floating sea cages to land.

d. Provision of a work boat with crane for personnel access and transport supplies unit.

5.2.7.2. Supply of raw materials

(list of suppliers, purchasing policy, market price, market arrangements)

A number of companies sell equipment for setting up an aquaculture farm. These are the following:

- DIOPAS SA (see: http://www.diopas.gr/) " Eleftherios Ad. Karamanis SA (see: http://www.caramanis.com/home.php?lang=el)
- HelNet s.a. (see: http://helnet.gr/en/)
- Mafilou marine (see: http://www.mafilou.com/en)
- Proteus s.a. (see: http://www.proteussa.com/)
- Stamatiou group (see: http://aquaculture.stamatiouplastic.gr/)

The cost of licenses and permits does not generally represent a very large component of total fixed costs; however, access to space and licenses represents a crucial limiting factor to aquaculture development (Commission of European Communities, Brussels 2009).

The investment costs associated with the farm are presented in Table 15.

5.2.7.3. Staff production

(Staffing needs by sector, skills, projected salaries)

For the company's needs will be employed:

1. An ichthyologist/diver with annual compensation 28.663 €
2. A fishworker with annual compensation 15.483,09 €

3. Three seasonal employees with total annual compensation 13.661,55 €

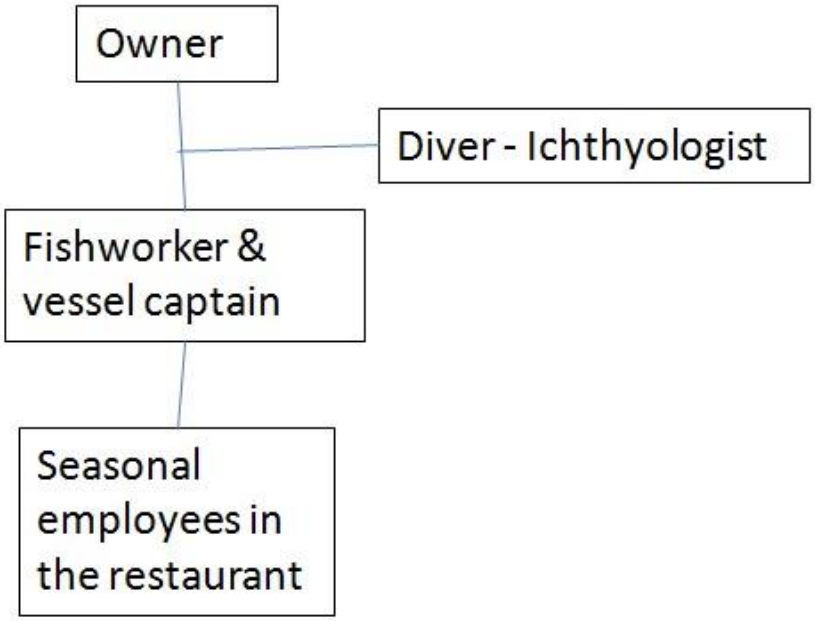
Spending on wages and the employer's cost of the company's workers are presented in the following Table 10. It is noted that estimated 1.5% annual wage maturity. Working time is considered the five-day week for 8-hour basis. These amounts represent annual wage compensation (14 salaries) and include employers' contributions. The owner must be a certified diver.

Table 14. Personnel costs for the operation of the fish farm. The owner will also work but does not appear on the Table.

Personnel Cost		2016	2017	2018	2019	2020	Total
Permanent staff							
Scientific Ichthyologist/diver	1	28,663.04					
Total	1	28,663.04		29,972.32 **29,972.32**	30,421.91 **30,421.91**	147,679.6 **147,679.6**	
Unskilled technicians Fishworkers	1	3,870.77	15,715.34	15,951.07		16,190.33	16,433.19	68,160.70
Total	1	3870.77	15715.34	15951.07		16190.33	16433.19	68160.70
Total Permanent	2	32,533.81	44,808.32	45,480.45		46,162.65	46,855.09	215,840.33
Seasonal (for 3 persons)	3	3,415.39					74,323.39
Total Seasonal	3	3,415.39		17,856.98 **17,856.98**	18,124.84 **18,124.84**		74,323.39
Total personnel costs		35,949.20	62,141.41	63,073.53		64,019.64	64,979.93	290,163.72

5.2.7.4. Organogram

The most common method of grouping functions is the per category functions such as sales promotion, financial management and production)



5.2.7.5. Analysis of production equipment / cost of procurement / settlement payment / public aid for the purchase

The following Table is summarizing the production equipment and its cost. The equipment will be purchased after a market research and 2-3 offers for each item. If public aid will be requested, the equipment must be new.

Table 15. Production equipment and cost for a small scale organic aquaculture farm of 15 tonnes per year offering fishtourism, ichthyotourism and diving services.

DESCRIPTION	COST (€)	23% VAT (€)	TOTAL (€)
EQUIPMENT OF FLOATING INSTALLATIONS			
Cages			
Rectangular plastic cages 7x7 m, pipe 250 mm	41.200,00	9.476,00	50.676,00
Rectangular plastic cages 5x5 m, pipe 250 mm	17.000,00	3.910,00	20.910,00
Nets			
Nets for rectangular cage 7x 7 m, mesh size 6 mm, depth 6 m	4.590,00	1.055,70	5.645,70
Nets for rectangular cage 7x 7 m, mesh size 10 mm, depth 8 m	6.450,00	1.483,50	7.933,50
Nets for rectangular cage 7x 7 m, mesh size 14 mm, depth 8 m	5.950,00	1.368,50	7.318,50

Nets for rectangular cage 5x 5 m, mesh size 6 mm, depth 3 m	4.200,00	966,00	5.166,00
Anti-bird nets with base for 7x7 m rectangular cage	1.520,00	349,60	1.869,60
Anti-bird nets with base for 5x5 m rectangular cage	560,00	128,80	688,80
Mooring system			
Econet devices	8.000,00	1.840,00	9.840,00
Mooring 1 in 1st year	55.000,00	12.650,00	67.650,00
TOTAL EQUIPMENT FLOATING INSTALLATIONS	144.470,00	33.228,10	177.698,10
TRANSPORTATION MEANS			
Plastic Boat 4 m length with outboard diesel eng. 15HP, 1 in 1st year & maintenance.	10,000.00	2,300.00	12,300.00
Floating platform 3m x 6m with outboard engine 25 HP	8,500.00	1,955.00	10,455.00
Car	22,000.00	5,060.00	27,060.00
TOTAL TRANSPORTATION MEANS	40,500.00	9,315.00	49,815.00

OTHER EQUIPMENT AND MACHINERY			
Fish handling equipment (eg vaccination machine, fish counter, fish landing nets, tanks e.t.c.)	2,000.00	460.00	2,460.00
Scientific equipment	500.00	115.00	615.00
Jacket for divers	900.00	207.00	1,107.00
Regulators	1,170.00	269.10	1,439.10
Octopus	510.00	117.30	627.30
Consoles of instruments	720.00	165.60	885.60
Bottles 15 ltr	2,400.00	552.00	2,952.00
Diving suits MEDAS 5mm	780.00	179.40	959.40
Compresser Mistral	2,300.00	529.00	2,829.00
Balance	175.00	40.25	215.25
IT Equipment	2,530.90	582.11	3,113.01

Furniture for fish tavern	8,000.00	1,840.00	9,840.00
Equipment for fish tavern	15,000.00	3,450.00	18,450.00
TOTAL EQUIPMENT AND MACHINERY	36,985.90	8,506.76	45,492.66
Buildings			
Traditional tavern (100m^2)	80,000.00	18,400.00	98,400.00
TOTAL BUILDINGS	80,000.00	18,400.00	98,400.00
GRAND TOTAL	301.425,00	69.327,75	370.752,75
TECHNICAL EXPENSES & CONTINGENCY (7% of eligible costs)	21.099,75	4.852,94	25.952,69
TOTAL INVESTMENT COST	322.524,75	74.180,69	396.705,44

5.2.8. Strategy in accordance with the marketing mix

(Pricing determination, price elasticity, arrangements, pricing in relation to competition and targets for customer satisfaction)

The demand for farmed fish is influenced by several factors, the most significant of which is the sale price of fish. For the sector's products demand has increased flexibility on price taking into account the existing possibility for easy replacement by other species of fish and seafood. Falling prices in recent years favored the demand for farmed fish by giving them a competitive advantage over substitute products. The demand for aquaculture products is directly dependent on the prevailing market of the catching sector fish products and as such, farmed fish are direct substitutes for wild caught fish. According to FAO, 53% of the world's fisheries are fully exploited, and 32% are overexploited, depleted, or recovering from depletion. This overexploitation combined with policies to reduce fishing effort, create a positive outlook for demand of farmed fish.

5.2.8.1. Strategy sales and distribution

(sales targets by product and by market segment, channel selection and distribution networks, collaborations, export targets).

The following Table is summarizing the sales targets of the company.

Table 16. Sales Revenues for a Mediterranean marine species farm of 15 tonnes capacity per year coupled with agrotouristic activities.

	2016	2017	2018	2019	2020	Total
Mediterranean marine species						
Quantity in Kgr	0	12,000	12,000	11,500	11,000	46,500
Price per kgr		13,00	13,20	13,39	13,59	13,29
Value (€)	0.00	156.000,00	158.340,00	154.018,64	149.532,01	617.890,65
Visitors	300	300	350	400	450.00	1,800
Fee per diver	23	23	23	23	23	23.00
Revenues from diving	6,900	6,900	8,050	9,200	10,350	41,400.00
Fishtourism Visitors	150	200	250	300	350.00	1,250
Fee per fishtourist	22.50	22.50	22.50	22.50	22.50	22.50
Revenues from fishtourism	3,375	4,500	5,625	6,750	7,875	28,125.00
Customers in Tavern		2,500	3,000	3,250	3,500	
Quantity in Kgr		3,000	3,000	3,500	4,000	13,500
Price per kgr		26	26	26	26	33.26
Additional seafood		8	8	8	8	
Revenues from Tavern	0	98,000	102,000	117,000	132,000	449,000.00
Total						
Quantity in Kgr	0	15,000	15,000	15,000	15,000	60,000
Value	10.275,00	265.400,00	274.015,00	286.968,64	299.757,01	1.136.415,65

5.2.8.2. Promotion and communication plan

The promotion and communication plan will include the creation of a web site as well as a connection with the FerTility platform for on-line sales that is currently under development through the FINISH initiative[9]. FerTility is a platform that provides a reliable solution for fish producers to connect with their customers. With FerTility the current isolation between fish & shellfish producers and the consumers and the difficulty to approach each other will no longer exist. Consumers will have the ability to select fish from an aqua farm or a supplier (fisherman) of his choice, while there will be selections for

[9] Future Internet Accelerator for Food, Perishables and Logistics. See: http://www.finish-project.eu/wp-content/uploads/2015/03/26_Upcom_FerTility.pdf

the form of the fish (whole, head-off, filleted, gilled and gutted, de-scaled and gutted, de-scaled, gilled and gutted, etc.). Then, after placing the order, he will get the order in a predefined area. Several possibilities will exist, based on the availability of the client (pick up from a predefined place, etc.). The FerTility platform is developed from the company UPCOM SA (www.upcom.eu), in collaboration with PLAGTON SA (http://www.plagtonsa.gr/) and NAYS Ltd (www.nays.gr). For more details see:
http://www.finish-project.eu/wpcontent/uploads/2015/11/Upcom_FerTility_Presentation.pdf

5.2.9. Financial analysis

The overall total investment cost amounts to € 322.524,75. The cost analysis is presented in Table 15 (cost per category). The description and the detailed budget of items that make up the investment fund is mentioned too. The proposed investment will be implemented from 1-2-2016 till 31-12-2017. It is noted that:

1. Technical support and contingencies are estimated at about 7% of the investment cost.
2. There is no provision for purchasing any technology.
3. Revised prices are estimated at 1.5%.
4. The current economic analysis concerns the period 2016-2020. Investment business will begin on February 1st, 2016 and will end on January 31, 2017. But by 2016 some facilities will be completed, thus in 2017, some financial figures (expenses- wage-cost raw materials) will be considered as totals.

5.2.9.1. Financing of the Investment

The investment is expected to benefit from the provisions of Regulation (EU) No 508/2014 of the European Parliament and of the Council of 15 May 2014, on the European Maritime and Fisheries Fund and repealing Council Regulations (EC) No 2328/2003, (EC) No 861/2006, (EC) No 1198/2006 and (EC) No 791/2007 and Regulation (EU) No 1255/2011 of the European Parliament and of the Council. The analysis of the investment cost of funding is indicated in Table 17.

Table 17. Financial plan for a Mediterranean marine species farm of 15 tonnes capacity per year coupled with agrotouristic activities.

Investment financing	%	Value (€)
Own funds	40%	129,009.90
Loans	15%	48,378.71
European Commission support	35%	112,883.66
Greek Public	10%	32,252.48
Total eligible costs	100%	322,524.75

Own contribution amounts to 40% of the production costs of the investment corresponding to 129,009.90 €. A long term loan of 48,378.71 Euros will be requested from a bank. The interest rate of the long term loan is 5% and its duration is for 10 years. Public expenditure is projected at 45% of the production costs of the investment corresponding to 145,136.14 €.

5.2.9.2. Company staff

As stated earlier, for the company's needs will be employed:

1. An ichthyologist/diver with annual compensation 28.663 €
2. A fishworker with annual compensation 15.483 €
3. Three seasonal employees with total annual compensation 13.661,55 €

5.2.9.3. General company expenses

The administrative and operational costs of the operation are reported in Table 18 and discussed below. Note that the calculated annual maturation is 1.5%.

Table 18. Administrative and operating expenses.

Time schedule

		Cost / year	2016	2017	2018	2019	2020	Total
								Price review 1,50%
Electricity		3.000,00	0	0,00	0,00	0,00	0,00	0,00
Telecommunications		2.000,00	3.000,00	3.045,00	3.090,68	3.137,04	3.184,09	15.456,80
Book keeping expenses		5.000,00	2.000,00	2.030,00	2.060,45	2.091,36	2.122,73	10.304,53
Various expenses		1.000,00	5.000,00	5.075,00	5.151,13	5.228,39	5.306,82	25.761,33
Depreciations			1.000,00	1.015,00	1.030,23	1.045,68	1.061,36	5.152,27
Management costs	**	0,20%	0,00	0,00	0,00	0,00	0,00	0,00
Bad debt expenses and losses	***	0,50%	20,55	530,80	548,03	573,94	599,51	2.272,83
Other Taxes, interest expenses	****	0,20%	51,38	1.327,00	1.370,08	1.434,84	1.498,79	5.682,08
Total Administrative & Operating expenses			20,55	530,80	548,03	573,94	599,51	2.272,83
			11.092,48	13.553,60	13.798,61	14.085,18	14.372,81	66.902,68

*** On sales

Administration Costs

The Administration costs include:

(1) miscellaneous office expenses of the enterprise (eg electricity, telephone) estimated annually at 5.000 €.

(2) expenses for book keeping, estimated annually at 5.000 €.

(3) other general business expenses (consumables, travel, stationery) estimated at 1.000 € per year.

Management Expenditure

The management expenses include the costs of contracts, loans, market interest etc. and is estimated at 0.2% of gross sales annually.

Bad debt expenses and losses

The bad debt expenses and losses relate to receivables and losses on the disposal and not the production of goods and estimated at 0.5% of gross sales annually.

Interest expenses / taxes

The interest and tax expenses include the road tax costs of transport of the business and any extraordinary contributions and estimated at 0.2% of gross sales annually.

5.2.9.4. Production cost

The production cost of the company includes the cost for the provision of organic fry as well as fish feed. The cost of producing the products of the plant is summarized for 2016-2020 in Table 19.

Table 19. Analysis of the production costs for a Mediterranean marine species farm of 15 tonnes capacity per year coupled with agrotouristic activities.

			Time Schedule							
			2016	2017	2018	2019	2020	TOTAL		
IN KGRs										
initial stock (biomass)	(Fry)								942,00	7.942,00
		2.000,00							2.000,00	2.000,00
		14.884,00								
Production (biomass increse/Quantity)			7.000,00	9.058,00	15.000,00	15.000,00	15.000,00	61.058,00		
Own use	(1)		0,00	0,00	0,00	0,00	0,00	0,00		
Sales	(2)		0,00	15.000,00	15.000,00	15.000,00	15.000,00	60.000,00		
Final stock (on-going production)			7.942,00	2.000,00	2.000,00	2.000,00	2.000,00	15.942,00		
Production Cost	in Euros									
Raw material			50.046,00	50.546,46	51.051,92	51.562,44	52.078,07	255.284,90		
Auxiliary materials & packaging			453,60	1.358,14	1.362,72	1.367,34	1.372,02	5.913,82		
Consumables			0,00	1.560,00	1.583,40	1.540,19	1.495,32	6.178,91		
Personnel cost			35.949,20	62.141,41	63.073,53	64.019,64	64.979,93	290.163,72		
Spare parts - Maintenance			1.214,05	2.840,05	2.898,90	2.957,75	2.957,75	12.868,49		
Insurance			0,00	3.007,87	3.105,50	3.252,31	3.397,25	12.762,93		
Depreciation			18.616,29	35.862,98	38.430,98	39.607,98	39.607,98	172.126,19		
Other costs			4.810,00	4.343,00	4.428,95	4.517,99	4.610,25	22.710,18		
Unforeseen Expenses (	2,00%	of production expenses)	2.221,78	3.233,20	3.318,72	3.376,51	3.409,97	15.560,18		
Total Production Cost										
Transferable cost										
Total Production Cost										
TOTAL									COST	0,00
			113.310,92	164.893,10	169.254,62	172.202,15	173.908,53	793.569,31	245.474,13	178.221,62
		770.397,17	0,00	113.310,92	32.729,88	23.762,88	23.054,71	23.172,15	172.910,32	173.791,09
			113.310,92	278.204,02	201.984,51	195.965,03	196.963,24	986.427,71		
Average value(3)		14,27	16,36	11,88		11,53	11,59			
Sales Cost	(2) x (3)	0,00	245.474,13	178.221,62		172.910,32	173.791,09	770.397,17		
Cost of own use	(1) x (3)		0,00	0,00	0,00	0,00	0,00	0,00		

a. Purchase of organic fry

Consumable livestock is considered the Mediterranean marine fish fry market as well as the organic fish feed. The purchase cost of fry is:

Organic fry: 0,26 € / piece[10]

The purchase cost for organic fish feed is 1.4 € / kgr.

The company will buy fry and fish feed at regular intervals every year. The purchase cost of raw material for the year 2016 are:

50,046 € (47.100 pieces of fry and 27 tonnes of fish feed).

b. Consumption of packaging materials

Because the fish produced are sent to a Packaging - Delivery Centre , the cost of packaging materials is estimated to 0,01 € / kgr.

Work Expenditure

Labor costs include salaries of the technical staff involved in the operation, and are analyzed in Table 18 (see above).

[10] See: Zacchino et al. (2014). http://orgprints.org/23940/1/23940%20rev%2013%20feb%20(2)_MM.pdf

Energy costs

Energy costs include all forms of fuel consumption. The cost of liquid fuel for moving vehicles is estimated at 250 € per month.

5.2.9.5. General Industrial Costs

a. Maintenance costs / repairs

Maintenance costs and repairs include the cost of the repair / maintenance of specialized installations and amount to 1.0% of their value. The detailed costs of maintenance / repair of special facilities are presented in the Table below and are the following:

Table 20. Cost of maintenance of fixed installations.

	2016	2017	2018	2019	2020
Total cost	1.214,05	2.840,05	2.898,90	2.957,75	2.957,75

b. Insurance costs

The insurance expenses include the insurance costs of livestock estimated at 1.00% of the insured value, which is averaged by the insurance company, to 15,02 € / kg production every year and totaled on average 2,552.59 € per year.

Table 21. Cost of insurance for an aquaculture farm of 15 tonnes per year.

Insurance costs		Time schedule					
		2016	2017	2018	2019	2020	Total
Value per kilo (average)	15,02 €/ kgr	0,00	17,69	18,27	19,13	19,98	
Insurance costs	1,00 %						
Insured amount	(Kgr)	7.942,00	17.000,00	17.000,00	17.000,00	17.000,00	75.942,00
Insured value	(€)	0,00	300.786,7	310.550,3	325.231,1	339.724,6	1.276.292,7
Insurance Costs	(€)	0,00	3.007,87	3.105,50	3.252,31	3.397,25	12.762,93

c. Depreciation and amortization expenses

Depreciation of fixed capital are presented in Table 22 and are calculated according to the following rates:

1. Floating installations	8%
2. Machinery	14%
3. Transportation means	20%
4. Other equipment	20%
5. Buildings	8%

Table 22. Depreciation of fixed assets for an aquaculture farm of 15 tonnes per year.

			Time schedule				
	coefficient		2016	2017	2018	2019	2020
16 Intangible Assets		(1)	0,00	0,00	0,00	0,00	0,00
Depreciation for the year	20%	(2)	0,00	0,00	0,00	0,00	0,00
Accumulated depreciation		(3)	0,00	0,00	0,00	0,00	0,00
Written-down value		(1) - (3)	0,00	0,00	0,00	0,00	0,00
11 Buildings-Installation Buildings		(1)	51.360,00	85.600,00	85.600,00	85.600,00	85.600,00
Depreciation for the year	8%	(2)	4.108,80	6.848,00	6.848,00	6.848,00	6.848,00
Accumulated depreciation		(3)	4.108,80	10.956,80	17.804,80	24.652,80	31.500,80
Written-down value		(1) - (3)	47.251,20	74.643,20	67.795,20	60.947,20	54.099,20
12 Machinery		(1)	154.582,90	154.582,90	154.582,90	154.582,90	154.582,90
Depreciation for the year	14%	(2)	10.820,80	21.641,61	21.641,61	21.641,61	21.641,61
Accumulated depreciation		(3)	10.820,80	32.462,41	54.104,02	75.745,62	97.387,23
Written-down value		(1) - (3)	143.762,10	122.120,49	100.478,89	78.837,28	57.195,67
13 Transportations Means		(1)	25.680,00	31.565,00	37.450,00	43.335,00	43.335,00
Depreciation for the year	20%	(2)	2.568,00	5.136,00	7.490,00	8.667,00	8.667,00
Accumulated depreciation		(3)	2.568,00	7.704,00	15.194,00	23.861,00	32.528,00
Written-down value		(1) - (3)	23.112,00	23.861,00	22.256,00	19.474,00	10.807,00
14 Other Equipment		(1)	11.186,85	12.256,85	12.256,85	12.256,85	12.256,85
Depreciation for the year	20%	(2)	1.118,69	2.237,37	2.451,37	2.451,37	2.451,37
Accumulated depreciation		(3)	1.118,69	3.356,06	5.807,43	8.258,80	10.710,17
Written-down value		(1) - (3)	10.068,17	8.900,80	6.449,43	3.998,06	1.546,69
Total cost			242.809,75	284.004,75	289.889,75	295.774,75	295.774,75
Depreciation for the year			18.616,29	35.862,98	38.430,98	39.607,98	39.607,98
Transfer to Production Cost			18.616,29	35.862,98	38.430,98	39.607,98	39.607,98
Reclassification to administrative costs			0,00	0,00	0,00	0,00	0,00

5.2.9.6. Results of Investment Sales Revenue

The revenues of the company will derive from a variety of activities that will combine organic aquaculture of Mediterranean marine fish as well as services (for diving, fishtourism and ichthyotourism) combined with the operation of a fish restaurant/ tavern.

The production capacity of the farm and sales revenues are presented in Table 23. These include:

1) Revenues from wholesales of organic Mediterranean marine fish.
2) Revenues from services (diving, fish tourirm)
3) Revenues from the seasonal operation (5 months/year) of a fish tavern.

Fish tourism activities will be organized in collaboration with local professional fishermen that the company will make an agreement to support the activity and to provide the customers through the organization of the activity through the internet.

Table 23. Sales revenues for a small scale organic aquaculture farm offering fishtourism, ichthyotourism and diving services.

Review prices (1.5%)	Time schedule					
	2016	2017	2018	2019	2020	Total

Analysis of sales and gross profit

Gross profit is calculated as follows: (Sales Revenue) - (cost of production).

We note that there is income from both farming and services. Gross profit of

5	Quantity in Kgr	0	12,000	12,000	11,500	11,000	46,
	Price per kgr		13.00	13.20	13.39	13.59	13
	Value (€)	0.00	156,000.00	158,340.00	154,018.64	149,532.01	617,890
8	Visitors	300	300	350	400	450.00	1,
	Fee per diver	23	23	23	23	23	23
	Revenues from diving	6,900	6,900	8,050	9,200	10,350	41,400
2							
	Fishtourism Visitors	150	200	250	300	350.00	1,
	Fee per fishtourist	22.50	22.50	22.50	22.50	22.50	22
	Revenues from fishtourism	3,375	4,500	5,625	6,750	7,875	28,125
5	Customers in Tavern		2,500	3,000	3,250	3,500	
	Quantity in Kgr		3,000	3,000	3,500	4,000	13,
	Price per kgr		26	26	26	26	33
	Additional seafood		8	8	8	8	
0	Revenues from Tavern	0	98,000	102,000	117,000	132,000	449,000
	Total Quantity in Kgr	0	15,000	15,000	15,000	15,000	60,
	TOTAL REVENUES	10,275.00	265,400.00	274,015.00	286,968.64	299,757.01	1,136,415

the enterprise for the period 2016-2020 are shown in Table 24, which shows that the gross profit percentage is increased gradually every year.

Table 24. Gross profit for a small scale organic aquaculture farm offering fishtourism, ichthyotourism and diving services.

Time schedule

	2016	2017	2018	2019	2020
Sales	10.275,00	265.400,00	274.015,00	286.968,64	299.757,01
Cost of Sales	0.00	245.474,13	178.221,62	172.910,32	173.791,09
Gross profit	10.275,00	19.925,87	95.793,38	114.058,32	125.965,92
Percent	100,00%	7,51%	34,96%	39,75%	42,02%

Account analysis and exploitation of results

The analysis and results for the period 2016-2020 is presented in Table 25. The calculation is based on sales revenue, operating expenses, and depreciation, other expenses and taxes.

Table 25. Income statement for a small scale organic aquaculture farm offering fishtourism, ichthyotourism and diving services.

	Time schedule 2016	2017	2018	2019	2020	Total
Turnover (Sales)	10.275,00	265.400,00	274.015,00	286.968,64	299.757,01	1.136.415,65
Income from own consumption	0,00	0,00	0,00	0,00	0,00	0,00
Cost of sales	0,00	245.474,13	178.221,62	172.910,32	173.791,09	770.397,17
Gross profit	*10.275,00*	*19.925,87*	*95.793,38*	*114.058,32*	*125.965,92*	*366.018,48*
minus						
Operating and Administrative expenses	11.092,48	13.553,60	13.798,61	14.085,18	14.372,81	66.902,68
Financial expenses	0,00	5.110,33	-2.738,75	2.177,44	1.973,45	6.522,48
Profit before depreciation	*-817,47*	*1.261,93*	*84.733,51*	*97.795,70*	*109.619,65*	*292.593,32*
Depreciation not included in production costs	0,00	0,00	0,00	0,00	0,00	0,00
Profit before tax	*-817,47*	*1.261,93*	*84.733,51*	*97.795,70*	*109.619,65*	*292.593,32*
Tax 37,0%	0,00	466,92	31.351,40	36.184,41	40.559,27	108.562,00
Profit after taxes	*-817,47*	*795,02*	*53.382,11*	*61.611,29*	*69.060,38*	184.031,33
		0%	19%	21%	23%	16%

CASH FLOW

The cash flow for the period 2016-2020 is depicted in **Table 26**. For its calculation it is considered the capital inflows (earnings before depreciation and taxes, own capital participation in the company's, long-term and short-term loans and the participation of the company to cover the capital) and capital outflows (taxes, interest on loans, income statement and the balance from previous years).

Table 26. Cash flow for a small scale organic aquaculture farm offering fishtourism, ichthyotourism and diving services.

	Time schedule					
Cash desk	`	0,00	981,32		226.880,32	354.529,62
Funds readily available	129.009,90					129.009,90
Grants	72.568,07	72.568,07				145.136,14
Long-term loans	0	48.379				48.378,71
Cash receipts from sales	8.220,00	239.887,50	273.153,50		298.478,17	1.105.412,44
Inflows	209.797,97	360.834,28	274.134,82	285.673,27	525.358,49	1.782.466,82
Salaries				**412.341,26**		
	35.949,20	62.141,41	63.073,53	64.019,64	64.979,93	290.163,72
Purchase A & B material	50.499,60	52.564,60	53.098,04	53.569,97	54.045,41	263.777,62
maintenance costs	1.214,05	2.840,05	2.898,90	2.957,75	2.957,75	12.868,49
Insurance costs	0,00	3.007,87	3.105,50	3.252,31	3.397,25	12.762,93
Other expenses	4.810,00	4.343,00	4.428,95	4.517,99	4.610,25	22.710,18
Selling & operating expenses	11.092,48	13.553,60	13.798,61	14.085,18	14.372,81	66.902,68
Investments	191.404,88	131.119,88	5.500,00	5.500,00	0,00	333.524,75
Taxes	0,00	0,00	466,92	31.351,40	36.184,41	68.002,73
Repayment of short-term loans (6% interest)	0,00	85.172,23	0,00	0,00	0,00	85.172,23
Interest on short-term loans	0,00	5.110,33	-5.110,33	0,00	0,00	0,00
Repayment of long term loans (5% interest)	0,00	0,00	3.835,12	4.029,28	4.233,26	12.097,66
Interest on long-term loans (5% interest)	0,00	0,00	2.371,59		1.973,45	6.522,48
Outputs	294.970,20	359.852,96	147.466,83	2.177,44	186.754,51	1.174.505,45
Override / (deficit) fund	-85.172,23	981,32	126.667,99	**185.460,95** 226.880,32	338.603,97	607.961,36
Obtain short-term loan	85.172,2	0,0	0,0	0,0	0,0	85.172,23
				226.880,32		
Remaining amount	0,00	981,32	126.667,99		338.603,97	693.133,59

	2016	2017	2018	2019	2020	Total
				126.667,99		

0.9 immediate payment / 0,1 on credit.

VALUE ADDED DATA

The basic elements of added value are presented in Table 27.

Table 27. Basic value added data for a small scale organic aquaculture farm offering fishtourism, ichthyotourism and diving services.

	Time schedule					
	2016	2017	2018	2019	2020	Total
Administrative and operating expenses	11,092.48	13,553.60	13,798.61	14,085.18	14,372.81	66,902.68
Finance	0.00	0.00	0.00	0.00	0.00	0.00
Depreciation	18,616.29	35,862.98	38,430.98	39,607.98	39,607.98	172,126.19
Total	29,708.76	49,416.58	52,229.59	53,693.16	53,980.79	239,028.87

Total Industrial Cost			113,310.92	164,893.10	169,254.62	172,202.15	173,908.53	793,569.31
% On industrial production costs			26%	30%	31%	31%	31%	30%

Table 28. Net Present value and Internal Rate of Return for a small scale organic aquaculture farm offering fishtourism, ichthyotourism and diving services.

Turnover			2018	2019	2020	2021			
Results before taxes			274.015,0	286.968,6	299.757,0	*313.246,1*			
	-817,47	1.261,93	84.733,51				97.795,70	109.619	
Investment	-	-					-		
Interest	191.404,90	131.119,95	-5.500,00				5.500,00	0,0	
Depreciation	0,00	5.110,33	-5.110,33				0,00	0,0	
	18.616,29	35.862,98	38.430,98				39.607,98	39.607,98	
	-	-							
	173.606,13	88.884,63	112.554,1				131.903,7	149.227	

Net Present Value	50,913.47

	(IRR till 2019)	(IRR till 2020)	(IRR till 2021)
Internal Rate of Return	-3%	16%	26%

Table 29. Predicted income statement.

	Time schedule					
	2016	2017	2018	2019	2020	Total
Turnover (Sales)	10.275,00	265.400,00	274.015,00	286.968,64	299.757,01	1.136.415,65
Income from own consumption	0,00	0,00	0,00	0,00	0,00	0,00
Cost of sales	0,00	245.474,13	178.221,62	172.910,32	173.791,09	770.397,17
Gross profit	*10.275,00*	*19.925,87*	*95.793,38*	*114.058,32*	*125.965,92*	*366.018,48*
minus						

Operating and Administrative expenses	11.092,48	13.553,60	13.798,61	14.085,18	14.372,81	66.902,68
Financial expenses	0,00	5.110,33	-2.738,75	2.177,44	1.973,45	6.522,48
Profit before depreciation	*-817,47*	*1.261,93*	*84.733,51*	*97.795,70*	*109.619,65*	*292.593,32*
Depreciation not included in production costs	0,00	0,00	0,00	0,00	0,00	0,00
Profit before tax	*-817,47*	*1.261,93*	*84.733,51*	*97.795,70*	*109.619,65*	*292.593,32*
Tax 37,0%	0,00	466,92	31.351,40	36.184,41	40.559,27	108.562,00
Profit after taxes	*-817,47*	*795,02*	*53.382,11*	*61.611,29*	*69.060,38*	184.031,33
		0%	19%	21%	23%	16%

5.2.10. Evaluation assessment of undertaking

(Count on the cash flow schedule)

The results of Table 26 (cash flow) as well as Table 28 with the indicators, suggest that the small scale organic aquaculture farm offering fishtourism, ichthyotourism and diving services is a profitable business. However, the positive results require some time as in most aquaculture activities and the investors must be patient as the best results will appear after the 4th year of operation. Cash flow analysis shows a particularly favorable flow (with the exception of the 1st year) as inflows are higher that outputs, especially if the whole operation will be subsidized from EU and National funds.

5.2.11. Final Business Plan Conclusions

(evaluation results, sustainability, maturity)

Organic fishfarming culture in Greece combined with services of fishtourism, ichthyotourism and diving is a novel approach and a completely new and pioneering activity, with returns depending on a combination of factors such as the location, the Local Available Resources, technical practices, skills of the entrepreneurs and appreciation of the higher quality.

In the proposed business plan, a major issue is the variation of the price between conventional and organic products. The big difference in price is indeed the reason that businesses are concerned about the size of their investment in the field of organic production as it is not yet certain that big productions can be absorbed by the markets.

Food safety and the continuous research of quality is of utmost importance to many European consumers. In recent years, after a series of food crises (mad cow disease, genetically modified food, chickens with dioxins, etc.) a large number of consumers have changed eating habits, demanding more and more certified products, natural and branded. In this context, the organic food sector has experienced strong growth, achieving further expansion of the commercial space. Organic aquaculture is at an early stage. Following the adoption of EC Regulation 710/09, which regulates organic aquaculture have been opened very interesting market prospects in Europe. This step may require even irrevocably at the legislative level, the importance of organic aquaculture, laying the foundations for sustainable development of the sector.

Organic production of fish in Greece currently represents a limited number of species such as sea bass and sea bream, which are grown organically, and is still characterized by small productions. Therefore, diversification towards agrotourism (fish tourism and ichthyotourism) makes the whole concept more robust and less vulnerable to unpredictable factors.

5.3. Business Plan 2: Bivalve aquaculture system

5.3.1. GENERAL COMPANY INFORMATION

1. Company Name: XXXX
2. Activity Industry: Marine aquaculture
3. Object of operations: Rearing of mussels (*Mytilus galloprovincialis*)
4. Established: 2016
5. Legal Status of Enterprise: Private company (IKE)

5.3.2. SUMMARY DATA BUSINESS PLAN

5.3.2.1. Brief description of the proposed business plan

The proposed business plan is for a mussel farming company. Mussel farming in Greece is a relatively new industry and is focused on rearing the Mediterranean mussel *Mytilus galloprovincialis*. Mussels are filter-feeding animals that depend on natural primary productivity for their growth and development, competing for the capture of phytoplankton, microbes, and

detritus in the water column. Currently, mussel culture systems are extensive in their nature worldwide. Farmers use ropes to provide a controlled substrate on which the mussels can settle and grow in a selected, highly eutrophic site nearshore.

In Greece, there are many suitable places for mussel farming, however, the specific site and the occupied space play very important roles in the financial success of a mussel farm and its sustainability.

5.3.3. PURPOSE & DESCRIPTION OF BUSINESS

(description of the purpose, the basic idea and phase which is now its implementation)

To evaluate the impact of mussel farm size on profitability, Theodorou et al. (2014) assessed a range of culturing operations (1–6 hectares[14] each) located in the same area

[14] 1 hectare is 10.000 m^2

(similar natural conditions and transportation costs) using similar technology and typical production methods.

Table 30. Investment cost for a range of sizes of Greek mussel farms (values in Euros).

	Farm size (ha)						
	1	1.5	2	3	4	5	6
Licenses and permits	10,000	12,000	15,000	20,000	25,000	30,000	30,000
Moorings	11,700	16,200	20,700	29,700	38,700	47,700	56,700
Ropes	8,711	12,807	20,051	25,093	36,433	40,324	49,667
Floats	5,775	8,663	17,325	17,325	28,875	28,875	34,650
Lighted buoys	4,500	4,500	4,500	4,500	4,500	4,500	4,500
Working vessel, 15 m	150,000	150,000	150,000	150,000	150,000	150,000	150,000
Working boat, 6 m	6,500	6,500	6,500	6,500	6,500	6,500	6,500
Outboard engine, 25 hp	4,500	4,500	4,500	4,500	4,500	4,500	4,500
Car	27,500	27,500	27,500	27,500	27,500	27,500	27,500
Land tools	24,000	24,000	24,000	24,000	24,000	24,000	24,000
Grading machine line	42,500	42,500	42,500	42,500	42,500	42,500	42,500
Total	295,686	309,169	332,576	351,618	388,508	406,399	430,517
EU/public subsidized 45%	133,059	139,126	149,659	158,228	174,828	182,879	193,732
Owner Contribution 55%	162,627	170,043	182,917	193,390	213,679	223,519	236,784

Source: Theodorou et al., 2014

The above Table shows that the investment cost for a mussel farm ranges between 295,686 Euros for a 1 hectare farm to 430,517 Euros for a 6 hectares farm. Most mussel farms in Greece currently occupy a sea surface of 3 ha on average (ranging mainly from 1–5 ha), producing up to 100 t/ha. The annual

mussel production in Greece ranges from 25,000–40,000 t, with close to a maximum of 45,000–50,000 t projected for the coming years.

Table 31. Annual income and profitability for a range of size of Greek mussel farms when not subsidized by EU/public (values in Euros).

	Farm size (ha)						
Annual income and profitability	**1**	**1.5**	**2**	**3**	**4**	**5**	**6**
Production yield, Y (t)	106	154	202	299	395	492	588
Sales price (€/t)			Total value product (TVP = $Py \times Y$)				
400	42,409	61,686	80,963	119,516	158,070	196,623	235,177
450	47,710	69,396	91,083	134,456	177,828	221,201	264,574
500	53,011	77,107	101,203	149,395	197,587	245,779	293,971
550	58,312	84,818	111,324	164,335	217,346	270,357	323,368
600	63,613	92,529	121,444	179,274	237,105	294,935	352,765
			Total fixed costs (TFC)				
	49,436	51,421	53,694	58,160	62,679	67,219	71,164
			Total variable cost (TVC)				
	30,001	38,375	47,072	65,094	85,328	103,320	121,006
			Total cost (TC = TVC + TFC)				
	79,437	89,796	100,766	123,254	148,007	170,539	192,171
			Pretax profit (π) = TVP – TC				
400	**–37,028**	**–28,110**	**–19,804**	**–3,738**	10,062	26,084	43,006
450	**–31,727**	**–20,399**	**–9,683**	11,202	29,821	50,662	72,403
500	**–26,426**	**–12,689**	437	26,141	49,580	75,240	101,801
550	**–21,125**	**–4,978**	10,557	41,081	69,338	99,818	131,198
600	**–15,824**	2,733	20,678	56,020	89,097	124,396	160,595
			Net profit (π) = TVP – TC (income tax 25%)				
400	**–37,028**	**–28,110**	**–19,804**	**–2,803**	7,547	19,563	32,255
450	**–31,727**	**–20,399**	**–7,263**	8,401	22,366	37,997	54,303
500	**–26,426**	**–9,517**	328	19,606	37,185	56,430	76,350
550	**–21,125**	**–3,734**	7,918	30,811	52,004	74,864	98,398
600	**–11,868**	2,049	15,508	42,015	66,823	93,297	120,446
			Net profit (π) (%)				
400	**–87**	**–46**	**–24**	**–2**	5	10	14
450	**–66**	**–29**	**–8**	6	13	17	21
500	**–50**	**–12**	0	13	19	23	26
550	**–36**	**–4**	7	19	24	28	30
600	**–19**	2	13	23	28	32	34

Bold type in the table body indicates negative results.

Source: Theodorou et al., 2014

The annual income and returns for each farm size (1 ha, 1.5 ha, 2 ha, 3 ha, 4 ha, 5 ha, and 6 ha) were estimated by examining the profit (p) of each farm under full production capacity (100% Y) using a range of ex-farm commodity market prices scenarios (Py), varying from 400–600 Euros/t for graded, packed products. Results of this effort, giving the profitability of each farm size without and with any EU/public subsidization, are presented in Tables 31 and 32, respectively.

In all cases, 4–6-ha farms were profitable, with net profit (p) margins ranging between 5% and 34%, and increasing up to 14%–39% if the assets were subsidized. Sale prices less than 400 V/t were not favorable for sizes smaller

than 3 ha if the investment was not subsidized, and 2 ha if funded. In all other cases, the net profits of mid-size farms of 3 ha ranged from 6%–23% if not subsidized, and between 7% and 24% for the subsidized option.

Table 32. Annual income and profitability for a range of size of Greek mussel farms when subsidized by EU (values in Euros).

Annual income and profitability	Farm size (ha)						
	1	1.5	2	3	4	5	6
Production yield, Y (t)	106	154	202	299	395	492	588
Sales price (€/t)			Total value product (TVP = $Py \times Y$)				
400	42,409	61,686	80,963	119,516	158,070	196,623	235,177
450	47,710	69,396	91,083	134,456	177,828	221,201	264,574
500	53,011	77,107	101,203	149,395	197,587	245,779	293,971
550	58,312	84,818	111,324	164,335	217,346	270,357	323,368
600	63,613	92,529	121,444	179,274	237,105	294,935	352,765
			Total fixed costs (TFC)				
	32,803	34,255	35,910	39,132	42,382	45,644	48,354
			Total variable cost (TVC)				
	30,001	38,375	47,072	65,094	85,328	103,320	121,006
			Total cost (TC = TVC + TFC)				
	62,805	72,630	82,983	104,226	127,711	148,964	169,361
			Pretax profit (π) = TVP – TC				
400	**–20,396**	**–10,944**	**–2,020**	15,291	30,359	47,659	65,816
450	**–15,095**	**–3,234**	8,100	30,230	50,118	72,237	95,213
500	**–9,794**	4,477	18,221	45,170	69,877	96,815	124,611
550	**–4,493**	12,188	28,341	60,109	89,635	121,393	154,008
600	809	19,898	38,461	75,049	109,394	145,971	183,405
			Net profit (π) = TVP – TC (income tax 25%)				
400	**–20,396**	**–10,944**	**–2,020**	11,468	22,769	35,744	49,362
450	**–15,095**	**–3,234**	6,075	22,673	37,588	54,178	71,410
500	**–9,794**	3,358	13,665	33,877	52,407	72,611	93,458
550	**–4,493**	9,141	21,256	45,082	67,227	91,045	115,506
600	606	14,924	28,846	56,287	82,046	109,478	137,554
			Net profit (π) (%)				
400	**–48**	**–18**	**–2**	10	14	18	21
450	**–32**	**—5**	7	17	21	24	27
500	**–18**	4	14	23	27	30	32
550	**–8**	11	19	27	31	34	36
600	1	16	24	31	35	37	39

Bold type in the table body indicates negative results.

Source: Theodorou et al., 2014

Profitability of 2-ha farms was between 7%–24% at sales prices greater than 450 V/t when subsidized, but was reduced to between 7% and 13% at a price range of 550–600 V/t and no subsidization. Profit did not exist for the 1-ha farm size. Even with EU/public subsidization, profit was limited at just 1% at a sale price of 600 V/t. Similarly, a 1.5-ha farm had losses when sales were less than 550 V/t, whereas losses for a financially subsidized farm existed at sales price less than 450 V/t. European Union/public subsidization enhances the viability of the smaller farms—hence, the profitability of the sector— by reducing the depreciation costs and thus the fixed costs of the operations.

Based on the above analysis of Theodorou et l., (2014), the proposed Business plan is for a mussel farm of 4 hectares with an annual production capacity of 400 tonnes per year.

5.3.4. Objectives of enterprise (quantitative data)

The proposed Business plan is for a mussel farm of 4 hectares with an annual production capacity of 400 tonnes per year.

Mussels can be sold on many different levels - wholesale, roadside, retail or "value added" (cooked or processed further). It cannot be stated often enough, however, that becoming a mussel grower does not in any way mean one is a mussel processor or marketer. This BP assumes that the market size mussels produced will be sold to a wholesale processor and shipper as well as retail sail at roadside. A grower may also be a processor and shipper, but the investment in processing equipment, refrigerated trucks, an inventory of packaging supplies, government certification for trucks and facility, National shipper and re-shipper licenses, personnel and fiscal management can be staggering and too often underestimated. Ill-planned marketing may lead to the quick demise of a mussel farm. At least in the beginning, it is advisable to focus on producing mussels with good yields and selling to a local processor or cooperative.

5.3.4.1. Ways of Financing

In Greece, contrary to agriculture or finfish mariculture (Theodorou et al. 2010a), mussel farming has limited insurance services or a loss reporting system, making it impossible to identify and rank the risks through usual methods.

Previous and latest surveys[11] indicate that, so far, the best option for financing is the creation of a financial reserve for the mussel farm to be in a position to cope with unforeseen adversities and survive financially until the next season. These practices may include personal or family bank savings and/or bank credit events.

The mussel farm can be funded from public funds through Regulation (EU) No 508/2014 of the European Parliament and of the Council of 15 May 2014, that established the European Maritime and Fisheries Fund (EMFF). The EMFF shall contribute to the achievement of the following objectives:

[11] See Theodorou et al. (2010), and Theodorou et al., 2015.

a) promoting competitive, environmentally sustainable, economically viable and socially responsible fisheries and aquaculture;
b) fostering the implementation of the Common Fisheries Policy (CFP);
c) promoting a balanced and inclusive territorial development of fisheries and aquaculture areas.

5.3.4.2. PROCEDURES FOR ESTABLISHMENT

(operating licenses, environmental constraints, required capital foundation etc.)

The cost of licenses and permits does not generally represent a very large component of total fixed costs; however, access to space and licenses represents a crucial limiting factor to aquaculture development for the moment. The design and creation of Organised Areas for Aquaculture Development (POAY) will significantly assist the licensing requirements (Argyrou et al., 2011).

5.3.4.3. COMPETITIVE ADVANTAGE

(whether the project includes innovation in production, or otherwise indicate anything new that will give it a competitive advantage)

Similarly, farms of 1–1.5 ha were totally local-market oriented because break-even prices were greater than 500 Euros/t (except the ideal case of a 1.5-ha farm operating at full capacity plus EU/public subsidization). This finding suggests that farms smaller than 2 ha have greater production costs per hectare at all product forms (pergolari, cleaned pergolari, or graded packs), because capital investment per hectare is too large for the expected outcome.

Even with EU subsidization, yields of at least 80% are required to have a marginal profit (Table 32) in the export market.

5.3.5. MARKET

5.3.5.1. Market Segmentation

(Buying target audience and reasons)

The Mediterranean mussel farm industry in Greece is mainly an export-oriented activity based on the production of ‘‘raw material’’ for the processing and distribution networks of major consumer countries in Europe. However, structural problems in Greek mussel farming, such as poor marketing and lack of organized dispatch centers or purification plants, may put at risk the profitability of relatively small farms (Theodorou & Tzovenis, 2004).

The company's buying target audience will be wholesalers as well as roadside and retail sales. In addition, sales will be promoted through the website of the company and collaboration with the FerTility platform (see below, chapter 5.3.8.2.).

5.3.5.2. Installation Site Analysis

Picking a successful site requires local knowledge of an area and existing uses, and an assessment of the area's production potential. What constitutes the right site will also depend on the species and phase of rearing. The following factors relate to whether shellfish will grow fast and survive:

- Speed of the current
- Phytoplankton and other food abundance
- Water temperature
- Water salinity
- Exposure to wave action
- Sediment type
- Water depth
- Predators

Other factors that influence the potential success of a site and the most suitable method of culture are access, security, water classification (approved/restricted areas).

5.3.5.3. Competition

(Indicate the current situation, the possible reaction of competition in the appearance of the company, what is the expected future evolution, analysis based on Porter's competitiveness model).

The classic market competition model of Porter, 1980 envisages companies relying on three generic strategies to maintain competitive advantage; product differentiation, cost leadership (efficiency focus) and market segmentation (niche market focus). The first two relate to core competencies of the firm and are considered most important as they have broadest market scope. Cost leadership can be resolved into low cost and best cost strategies.

The latter indicates provision of best value for relatively low cost in order to reduce the likelihood of price wars with other 'cost leaders'. Companies following differentiation strategies risk being copied by competitors and have greater incentive to innovate and improve. These notions clearly correspond with the categories of efficiency and innovation driven competition described above. 'Niche' focus on a narrow market segment often occurs when a company can afford neither a differentiation nor cost leadership strategy with wide market scope. It is often adopted by smaller companies and may be combined with cost leadership or differentiation within the niche. The collective focus of many small Greek firms on mussel production for to supply the EU market is a good example. However niches disappear and overreliance on a single small specialist niche may be a risky strategy in the longer term. The costs incurred for value-added differentiation means that combining differentiation and cost (minimization) leadership strategies is rarely compatible at any market scale. Porter also observed that firms with intermediate market share are sometimes least profitable as they lack clear focus on a specific generic strategy.

5.3.5.4. MAIN FEATURES / EXPECTED EVOLUTION OF THE MARKET AND POSITION OF THE UNDERTAKING

(Existing and potential market estimate, the expected evolution in size, value, like other trends)

The mussel sector has seen a significant growth in Greece over the past 15 years. Current production is about 35-40.000 tonnes depending on environmental conditions and represents a near 50% increase on 2000 production. This represents around 6.5% of cultured European mussel production. There is therefore substantial scope for increasing production without significantly impacting on total market supply, but pricing will need to be increasingly competitive if higher volumes are to be sold on the market. The Greek market for mussels is understood to be between 10,500 and 12,000 tonnes per year, with annual per capita consumption less than 1.2 kg, compared with 2kg in France and 4-5kg in Belgium. The Greek market thus has considerable further potential for growth. About 70%–80% of Greek mussel production is exported (Theodorou et al. 2011), so domestic Greek consumption is approximately 20-30% of the national mussel production, the rest being exported mainly to Italy and France and to a lesser extent to Spain.

Mussels enter a market where the consumers evaluate the products not only according to the price but also to several safety/quality and marketing aspects[12]. Live retail sales are static, typically only of interest to the traditional consumer familiar with preparation of live product, whilst vacuum packed sales are increasing, key attributes being convenience, shelf life, and versatility, and are the most likely to attract new consumers. It is this latter market segment that offers the best immediate prospects for the Greek product. Strong recent growth in the retail sector has however been driven by price promotions resulting in reduced unit prices and this is likely to continue.

The vast majority of mussel cultures in Greece (> 70%) are located in Thermaikos Gulf (NW Aegean Sea), in the Prefectures of Thessaloniki, Pieria and Imathia, where at least 2,500 people are employed, excluding processing units (e.g. mussel shucking units). There are 6 relevant co-operatives and 2 major Associations (SEMYO and Association of Pieria). The area occupied is totally about 27,700 acres and accounts for at least 80% of the total Greek production. Mussel production has risen, making Greece an increasingly important supplier of live mussels, especially to the nearby Italian market. Greek farmers increased their exports of live mussels to Italy by almost 50%, giving them at least a 35% share of Italy's live mussel market. That is second only to Spain, which has a 55% market share, according to the Food and Agricultural Organization.

With regard to production capacity, growth is most likely to come from existing sites either those in hand with larger producers or through consolidation of smaller sites into more economically viable clusters. With regard to new sites, the best ones are mostly already leased and planning constraints, as evidenced by the marine spatial plans of POAY already in existence, suggest significant barriers to new development especially for sites of any significant scale. Offshore development is unlikely in the short term given planning uncertainties, higher costs, greater risks, and the greater scale needed for viability, such scale also posing challenges for marketing of the much greater volumes involved. Thus lack of sites is not considered a constraint to growth at the present time.

[12] See Batzios et al., 2004 (http://www.researchgate.net/publication/226249321_Greek_Consumer's_Image_of_the_Cultured_Mussel_Market).

The production capacity of existing plans in POAY sites is considered to be at least double present levels and possibly up to 3 times greater in some areas. Whether such capacity can be exploited depends on a host of factors including market demand, gains in production efficiency, site suitability, carrying capacity, and no worsening with regard to water quality and regulatory issues.

Further gains in market volume will depend to a great extent on improved competitiveness. Greece to date has been a relatively high cost producer given the slower growth rate compared with elsewhere and the form of production, rope culture being more costly than bottom culture. The cost of production for rope grown mussels in Greece ranges between 327-749 Euros per tonne depending on the size of the farm[13] and it is competitive compared to North Europe. For example, in Scotland[14] production cost is estimated to be in the region of 856-999 Euros/tonne before finance for a relatively large scale (500t) operation with significant investment in workboat and onshore facilities, the main costs being labour and depreciation. There is scope to reduce such costs as savings are possible through economies of scale with regard to workboats and on shore facilities. This can be achieved by increased production within individual companies and/or through the processing of product on behalf of other growers, facilitated in geographically compact areas. Overall, however, it is likely that costs of production in Greece will remain similar unless Producer Organization schemes will achieve better economies of scale.

With regards to finance and investment, high capital costs, extended working capital requirements due to the annual production cycle, relatively poor investment criteria, the risks and uncertainties associated with production, the nature of the farming process, and the lack of stock insurance, act as major barriers to new entrants, especially those seeking to enter the business at a significant scale. The availability of EMFF grants for capital expenditure will be critical to the further development of the industry, given the capital intensive nature of the business and the negative viability of business plans without it. Loan finance is likely to remain difficult to procure given the lack

[13] See: Theodorou et al., 2014.

[14] See: David Scott, Douglas McLeod, James Young, Janet Brown, Anton Immink and John Bostock, 2010. A study of the prospects and opportunities for shellfish farming in Scotland (http://www.gov.scot/resource/doc/295194/0118352.pdf).

of suitable assets that can be offered as security and the long lasting financial crisis in Greece.

The future prospects of the industry are therefore considered most likely to be in the hands of existing growers. Only they have the experience, facilities, market access and incentive to take the industry forward. Further development will however be very much the province of well established larger growers with proven business models and strong track records. Such growers will seek to optimise their operations within their own geographical spheres of operation, either through consolidation or via contract harvesting and marketing arrangements as seen in Thermaikos Gulf.

The prognosis for smaller growers without the benefit of such arrangements is poor other than for limited local and wholesale sales, unless they can somehow emulate the Thermaikos Gulf model. As well as the basic considerations of market prospects, production capacity, competitiveness and investment potential, is the overriding issue of regulation. This impacts the industry in two main ways, site availability and water quality issues. As already discussed, site availability, although of crucial importance, it is considered unlikely to be a constraint on production in the short to medium term, although it will be vitally important for the industry to play a full part in the changes to the marine planning process arising as a result of the POAY planning. With regards to water quality issues, notably classification, depuration, biotoxins, and designation of shellfish growing waters, there continue to be major concerns within the industry regarding the interpretation and implementation of legislation by regulators. Whilst such issues are mostly an irritation rather than an overriding constraint, they should nevertheless remain at the top of the agenda with a view to achieving a balance that is acceptable to both industry and regulators, and in particular to iron out any anomalies between Greece and other countries, both in the EU and elsewhere.

Perhaps the greatest challenge the industry faces is to improve the productivity of existing sites. For successful growers on favourable sites with reasonably consistent yields from year to year this challenge has to a large extent already been met. But for a significant number of other growers, regardless of size, the uncertainties of the production process continue to be a major issue, whether due to irregular spatfall, predation losses, inexperience, labour problems, or water quality issues. The prospects for the industry thus depend to a great extent on how individual growers are able to overcome

such uncertainties. It is likely that production will become concentrated in those areas with the best overall characteristics for viability, and in this respect it is likely that Northern Greece will continue to dominate production at least in the short to medium term.

The overall prospects for mussel farming are considered to be cautiously optimistic, with ample capacity for growth from existing sites, and potentially also new sites subject to better recognition of shellfish farming in the evolving planning process. Development of such capacity will have to go hand in hand with market development, where despite the positive outlook for seafood consumption generally, carefully targeted efforts will be needed to continue to secure premium outlets in line with the cost base and particular attributes of Greek rope grown mussels.

As production grows, further price erosion is likely, and an equivalent response in the reduction of the cost base through consolidation, economies of scale, and adoption of new production technologies will be essential. At the same time, improvements to the regulatory environment particularly with respect to water quality issues will remain a top priority.

5.3.5.5. SWOT ANALYSIS

The shellfish sector has a much greater focus on environmental issues[15]. Much of this is positive as the industry seeks to promote its green production credentials. However, environmental variability and long-term climate change represent potential threats. Market issues have not been of high concern for the shellfish sector, although this may be changing with recent falls in price for mussels. The predominant product is live, so competition from third countries is modest, mostly in value-added products where distance from market is less of an issue. There is growing appreciation in some parts of the mussel industry that expansion of output should be possible with further investment in value added product and marketing efforts that capitalise on the product's health and environmental benefits. The issue of site availability is significant, and reflected in the SWOT analysis. New developments are limited to areas designated as shellfish waters under EC Directive 79/293/EEC, and in many areas there are restrictions due to navigational or

[15] See also European Aquaculture Competitiveness: Limitations and Possible Strategies (2009). http://www.europarl.europa.eu/RegData/etudes/etudes/join/2009/431569/IPOLPECH_ET(2009)431569_EN.pdf

visual impact considerations, or guidelines concerning allowable distance from finfish farms. Shellfish farming is not without environmental and ecological impacts although these are considered relatively benign compared with intensive fish production. Most shellfish farming is highly fragmented; carried out by owner-operator businesses, often at artisanal scale. However the size of some farms, especially in the mussel sector, is growing, and the emergence of larger businesses with some consolidation is possible, particularly with developments in deeper-water mussel long-line technology. Alternatively several cooperatives have emerged, especially for processing and marketing shellfish products.

STRENGTHS	WEAKNESSES
Market factors • A delicacy and positive image by a certain consumer share especially in Northern Greece. • Health benefits of eating shellfish. • Increasing consumption of seafood, "green" product. • Market diversification – via EU 28 & beyond . *Other factors* • National policies commitment to aquaculture. • Good water quality. • Good potential sites. • Availability of EMFF funds. • Strong Greek science base (individuals & Institutions).	*Environmental factors* • Industry uniquely vulnerable to environmental factors beyond its control (spatfall, growth, fouling, predation, water quality, biotoxins, harmful algal blooms). • Management of microbiological contamination. • Toxin testing methodology and overall management of biotoxin events. *Market factors* • Industry is production led rather than market led. • Dependence on wholesale markets. • Limited portfolio of added value products. • Quality & cost of market information. • Limited access to market intelligence (e.g. prices in European markets). • Limited efforts to fully identify growth opportunities (volume &/or price). *Production factors* • Small scale of industry and constituent businesses limits scale economies. • Limited uptake of novel production technology (mussels). • Lack of hatchery supply of mussel seeded ropes. *Finance* • Limited availability of capital (investment & working). • Poor understanding of the sector by banks/financiers.

	• Farm assets (excluding land) typically not acceptable as security by lenders. *R&D* • Lack of applied research. • Limited research funding. *Other factors* • Industry representation difficult due to small size of industry & lack of funding. • Limited industry engagement with trainers despite opportunity. • Transport logistics – distance from markets. • Planning constraints limit site availability.
OPPORTUNITIES *Market factors* • Domestic (Greek) market expansion. • Export market potential. • New product development. • Increased market share if production cost reduced. • Accreditation to satisfy customer desires e.g. Agricultural University of Athens, Marine Stewardship Council (MSC), etc • Improved generic promotion (but who pays ?). • Better use of B grade mussels. " Chance to "sell the story" re. sustainability, carbon sequestration, biodiversity etc. *Production factors* • Higher growth & lower production costs than competitors. • Large scale operations may offer scope for economies of scale and reduced production costs. • New production technologies e.g. continuous mussel culture. • Climate change: e.g. increased temperatures may improve growth. *Other factors* • Better planning policy to improve site availability. • Better water quality assessment to aid harvesting. • River Basin Management Plans	THREATS *Market factors* • Failure of market for Greek produce to expand as expected (lack of added value products; cheaper imports). *Production factors* " Predation e.g. crabs. *Environmental factors* • Deteriorating water quality esp. diffuse pollution. • Production problems e.g. tubeworm fouling. *Regulation* • Increasing burden of regulation. • Planning process and cost. • Complexity of regulations regarding depuration of shellfish. *Other factors* • Competition from other industries / suppliers of other mussel species e.g. from Chile.

should lead to better control of diffuse pollution. " Better communication between industry and regulators.	

5.3.6. Products and Services

5.3.6.1. Description of Goods and / or Services

(characteristics of the products to be promoted on the market. Product categories, advantages, presentation, complementarity).

The farm will produce mussels that will be ready for the market after a year, when they will get about 6 cm long, usually in early summer.

5.3.7. Production Process

5.3.7.1. Description of the production process

(stages and organization of the production process or method of design and implementation of the service)

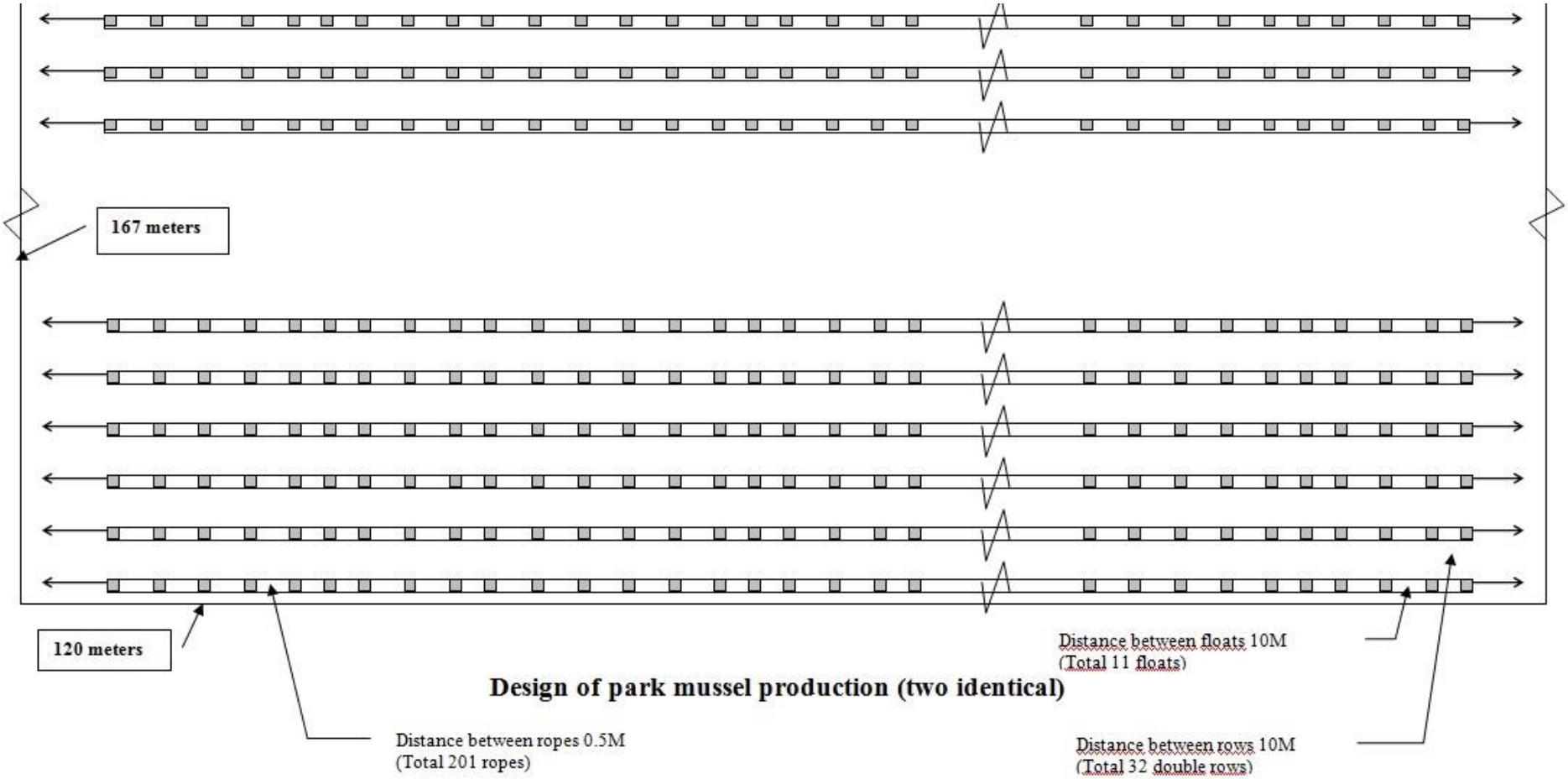
The operation cycle each year commences by collecting spat (Fig. 8). Spat collectors of 2–2.5mlong, usually made of common polypropylene ropes (diameter, 12–18 mm), are dropped in the water from December to March at a ratio of 1 collector per 2–3 pergolari scheduled to be prepared at the end of the spat collection period. Spat settles normally when it reaches about 20 mm long or 0.8 g, on 1,800 pergolari/ha, and is ready for harvesting from the end of May until mid July.

The juveniles (>35 mm) are easily detached manually from the ropes, collected, and transferred to pergolari. These are plastic, cylindrical nets, 3–3.5mlong, with a net eye of 60–80mm attached on a polyethylene rope hung from the single line every 0.5 m (201/100mline or 5,400/ha). They are formed manually with the help of polyvinylchloride cylindrical tubes with a diameter ranging from 40–60mm. From August to October, these first batches of seed are graded, again manually, and juveniles are placed into larger pergolari, with net eyes of 80–120 mm, formed using wider tubes 70–90 mm in diameter.

A third grading is necessary, if these pergolari get too heavy and risk the loss of many mussels or even the whole bunch. From December to March, new pergolari could be formed using larger holding tubes of 90–150 mm in diameter with a plastic net eye of 105–150 mm, providing more space for the animals. Each tubing increases the survival of the attached mussels, leading

to a final 33%of the original seed. In general, this strategy is used by all farmers and is modified at times to suit their local or temporary needs by using different tube sizes or net eyes. This depends on the quality and the condition of the seed stock. Mussels are ready for the market after a year, when they get about 6 cm long, usually in early summer. At this time, the pergolari weigh about 10–15 kg/m, more than double the weight from their last tubing. The mussel quality at harvest, assessed by condition indices and chemical composition, varies seasonally, depending on the environmental conditions that prevailed during the grow-out period.

Figure 17. Design of a 2 hectares mussel park.



Source: Courtesy of NAYS Ltd

5.3.7.2. Supply of raw materials

(list of suppliers, purchasing policy, market price, market arrangements)

A number of companies sell equipment for setting up a mussel farm. These are the following:

- DIOPAS SA (see: http://www.diopas.gr/) " Eleftherios Ad. Karamanis SA (see: http://www.caramanis.com/home.php?lang=el)
- HelNet s.a. (see: http://helnet.gr/en/)
- Mafilou marine (see: http://www.mafilou.com/en)
- Stamatiou group (see: http://aquaculture.stamatiouplastic.gr/)

The cost of licenses and permits does not generally represent a very large component of total fixed costs; however, access to space and licenses represents a crucial limiting factor to aquaculture development (Commission of European Communities, Brussels 2009).

The investment costs associated with different farm sizes are presented in Table 26. The largest investment component is the working vessel (150,000 Euros), which must be at least 15 m long to have enough space to support the adaptation of the modern French–type grading machines (42,500 Euros). Such a boat is assumed to be necessary for any size of farm, because the work tends to be mechanized to reduce labor. The car (27,500 Euros) and the 6-m working boat with a 25-hp engine (6,500 Euros + 4,500 Euros = 11,000 Euros) are also common for such farm sizes. The primary difference in the investment cost is a result of the licensing cost and the increasing cost of floating installations (moorings, ropes, floats, marker buoys), which is determined by farm size.

The total cost of a new installation or the modernization of an existing installation is eligible for funding of up to 45% of the investment by government–EU funds, provided the equipment is new (Operational Program of Fisheries 1994 to 2000, 2000 to 2006, 2007 to 2011). Theodorou et al. (2014) reported that the total investment costs per hectare decrease when the farm is larger, mainly as a result of the economies of size associated with the investment cost of the boat and the grading equipment.

Operational costs are typically estimated on an annual basis and are expressed in 2 distinct categories: variable costs and fixed (overhead) costs. Variable costs are those that vary directly with the level of the production, whereas fixed costs are often referred as ‘‘overhead’’ costs and typically do not change with the level of production addressed by this analysis (Adams et al. 2001).

Variable Costs

The largest variable cost, regardless of farm size, is the labor cost, because mussel farming is labor intensive (Loste 1995, Danioux et al. 2000). Energy costs refer to the fuel consumed during the production process, including transportation. Consumables refers to plastic nets for the pergolari, ropes for longlines, plastic net bags, and so on.
Other expenses refer to any unexpected variable costs during the production period.

Fixed Costs

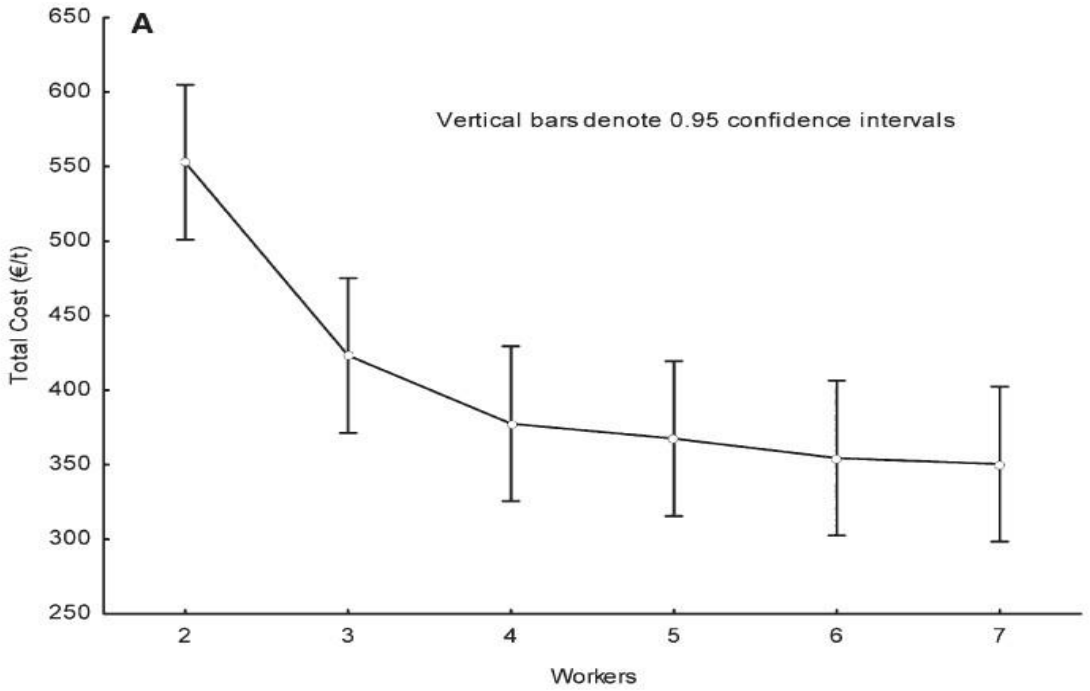
The annual fee for leasing the sea site of the farm is about 1,000 Euros/ha. Insurance is applied only to the car, because insurance for vessels used in mussel farming is not compulsory (Theodorou et al. 2011). Annual depreciation of the initial investment cost (spread over 8 y) is also taken into account and contributes a major share to overhead costs. Total costs increase as farm size increases. When EU/public subsidization exists, the total cost is significantly lower, giving a competitive advantage to subsidized farms.

5.3.7.3. Staff production

(Staffing needs by sector, skills, projected salaries)

Mussel farming is a seasonal and labor-intensive activity. Labor is a major component of the production cost (Theodorou et al. 2011). The variation of the level of wages might be an important risk factor, as in other industries; however, in the current study, it was not significant because of the very low range occurring in the Greek agricultural sector at the time of the study. Nevertheless, labor management had a significant impact on the total labor cost in relation to the farm size. Theodorou et al. (2011) demonstrated that the total cost per ton of harvested product decreased with increasing working-labor units (from 2–7 individuals), with the size of the farms playing a smaller role (Fig. 18).

Figure 18. Effect of the working crew size on the total cost (TC).



Source: Theodorou et al., 2014.

Furthermore, because the labor-intensive period is actually restricted seasonally to about 4 months overall, full-time employment could be replaced by seasonal employment or by outsourcing this activity to a professional working crew that services multiple farms in the area. However, legal obstacles would need to be removed for seasonal employment to be used, as is done in terrestrial farming.

For the company's needs will be employed:

4. An ichthyologist with annual compensation 21.497,28 €

5. A fishworker with annual compensation 15.483,09 €
6. Six seasonal employees with total annual compensation 13.661,55 €

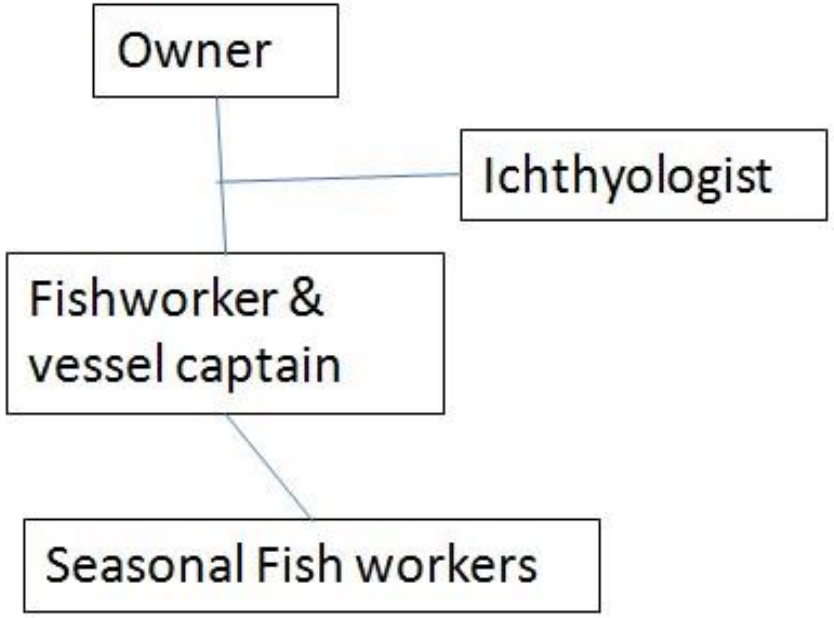
Spending on wages and the employer's cost of the company's workers are presented in the following Table 33. It is noted that estimated 1.5% annual wage maturity. Working time is considered the five-day week for 8-hour basis. These amounts represent annual wage compensation (14 salaries) and include employers' contributions.

Table 33. Personnel costs for the operation of the mussel farm. The owner will also work but does not appear on the Table.

Personnel Cost		2016	2017	2018	2019	2020	Total
Permanent staff							
Scientific Ichthyologist	1	21,497.28					
Total	1	21,497.28	22,479.24	22,816.43	110,759.72		
			22,479.24	**22,816.43**	**110,759.72**		
Unskilled technicians Fishworkers	1	3,870.77	15,715.34	15,951.07	16,190.33	16,433.19	68,160.70
Total	1	3870.77	15715.34	15951.07	16190.33	16433.19	68160.70
Total Permanent	2	25,368.05	37,535.08	38,098.10	38,669.57	39,249.62	178,920.42
Seasonal (for 6 persons)		2.00	2	2	2	2	
	6	13,661.55					70,387.95
Total Seasonal	6	13,661.55	14,285.59	14,499.87			70,387.95
			14,285.59	**14,499.87**			
Total personnel costs		39,029.60	51,401.55	52,172.57	52,955.16	53,749.49	249,308.37

5.3.7.4. Organogram

The most common method of grouping functions is the per category functions such as sales promotion, financial management and production)



5.3.7.5. Analysis of production equipment / cost of procurement / settlement payment / public aid for the purchase

The following Table is summarizing the production equipment and its cost. The equipment will be purchased after a market research and 2-3 offers for each item. If public aid will be requested, the equipment must be new.

Table 34. Production equipment and cost for a mussel farm of 400 tonnes per year.

DESCRIPTION	COST (€)	23% VAT (€)	TOTAL (€)
EQUIPMENT OF FLOATING INSTALLATIONS			
Long Lines			
Ropes Φ24 (Kgr)	8,395.00	*1,930.85*	*10,325.85*
Floats for long lines			
Barrels (200 kgr)	8,000.00	*1,840.00*	*9,840.00*
Ropes Φ14 (kgr)	1,665.00	*382.95*	*2,047.95*
Ropes Φ8 (kgr)	550.50	*126.62*	*677.12*
Mooring system			
Construction of 2 m^3 blocks, artificial reefs type	36,000.00	*8,280.00*	*44,280.00*
Transportation and installation of blocks	30,000.00	*6,900.00*	*36,900.00*
Ropes Φ26 (kgρ)	11,010.00	*2,532.30*	*13,542.30*
Mooring system connections	20,000.00	*4,600.00*	*24,600.00*
Light marking and delineation	6,504.00	*1,495.92*	*7,999.92*
Mussel nets Φ80 (meters)	971.04	*223.34*	*1,194.38*
Mussel nets Φ105 (meters)	1,942.08	*446.68*	*2,388.76*
Mussel nets Φ120 (meters)	3,883.36	*893.17*	*4,776.53*
Ropes Φ4 for pergolari (kgr)	400.40	*92.09*	*492.49*
Ropes Φ14 for seed collection (kgr)	5,767.50	*1,326.53*	*7,094.03*

TOTAL EQUIPMENT FLOATING INSTALLATIONS	135,088.88	*31,070.44*	*166,159.32*
TRANSPORTATION MEANS			
Working Boat 5,65 M	3,800.00	*874.00*	*4,674.00*
Outboard engine	4,500.00	*1,035.00*	*5,535.00*
Working vessel 15 M	100,000.00	*23,000.00*	*123,000.00*
Working vessel engines	50,000.00	*11,500.00*	*61,500.00*
Various mechanical equipment for 15 m working vessel	65,003.49	14,950.80	79,954.29
Car	22,000.00	*5,060.00*	*27,060.00*
TOTAL TRANSPORTATION MEANS	220,300.00	50,669.00	270,969.00

OTHER EQUIPMENT AND MACHINERY			
Conveyor belt for loading of mussels from the sea on board	3,700.00	*851.00*	*4,551.00*
Conveyor belt for loading of mussels from the boat ashore	9,300.00	*2,139.00*	*11,439.00*
Machine for washing mussels	20,500.00	*4,715.00*	*25,215.00*
Water Pump for cleaning mussels	1,400.00	*322.00*	*1,722.00*
Engine power strip	5,800.00	*1,334.00*	*7,134.00*
Conveyor belt for screening mussels	3,700.00	*851.00*	*4,551.00*
Volumetric machine	4,900.00	*1,127.00*	*6,027.00*

Environmental Monitoring System	20,000.00	*4,600.00*	*24,600.00*
IT equipment	2,530.90	*582.11*	*3,113.01*
TOTAL EQUIPMENT AND MACHINERY	71,830.90	*16,521.11*	*88,352.01*
GRAND TOTAL	427,219.78	*98,260.55*	*525,480.33*
Seed supply	12,448.00	*2,863.04*	*15,311.04*
TECHNICAL EXPENSES & CONTINGENCY (7% of eligible costs)	29,905.38	*6,878.24*	*36,783.62*
TOTAL INVESTMENT COST	469,573.16	*108,001.83*	*577,574.99*

5.3.8. Strategy in accordance with the marketing mix

(Pricing determination, price elasticity, arrangements, pricing in relation to competition and targets for customer satisfaction)

Wholesale prices in Greece vary between 40 to 60 cents of Euro per kgr.

5.3.8.1. Strategy sales and distribution

(sales targets by product and by market segment, channel selection and distribution networks, collaborations, export targets).

The following Table is summarizing the sales targets of the company.

Table 35. Sales Revenues

	2016	**2017**	**2018**	**2019**	**2020**	**Total**

Mussels

Quantities in Kgr	0	400,000	400,000	400,000	400,000	1,600,000
Price per Kgr	0.55	0.56	0.58	0.59	0.61	0.59
Total value	0.00	225,500.00	231,137.50	236,915.94	242,838.84	936,392.27

5.3.8.2. Promotion and communication plan

(plan targets per segment, implementation strategy, schedule, cost)

The promotion and communication plan will include the creation of a web site as well as a connection with the FerTility platform for on-line sales that is currently under development through the FINISH initiative[16]. FerTility is a platform that provides a reliable solution for fish producers to connect with their customers. With FerTility the current isolation between fish & shellfish producers and the consumers and the difficulty to approach each other will no longer exist. Consumers will have the ability to select fish from an aqua farm or a supplier (fisherman) of his choice, while there will be selections for the form of the fish (whole, head-off, filleted, gilled and gutted, de-scaled and gutted, de-scaled, gilled and gutted, etc.). Then, after placing the order, he will get the order in a predefined area. Several possibilities will exist, based on the availability of the client (pick up from a predefined place, etc.). The FerTility platform is developed from the company UPCOM SA (www.upcom.eu), in collaboration with PLAGTON SA (http://www.plagtonsa.gr/) and

[16] Future Internet Accelerator for Food, Perishables and Logistics. See: http://www.finish-project.eu/wp-content/uploads/2015/03/26_Upcom_FerTility.pdf

NAYS Ltd (www.nays.gr). For more details see: http://www.finish-project.eu/wpcontent/uploads/2015/11/Upcom_FerTility_Presentation.pdf

5.3.9. Financial analysis

The overall total investment cost amounts to € 469,573.16. The cost analysis is presented in Table 34 (cost per category). The description and the detailed budget of items that make up the investment fund is mentioned too. The proposed investment will be implemented from 1-2-2016 till 31-1-2018. It is noted that:

1. Technical support and contingencies are estimated at about 7% of the investment cost.
2. There is no provision for purchasing any technology.
3. Revised prices are estimated at 1.5%.
4. The current economic analysis concerns the period 2016-2020. Investment business will begin on February 1st, 2016 and will end on January 31, 2018. But by 2016 some facilities will be completed, thus in 2017, some financial figures (expenses- wage-cost raw materials) will be considered as totals.

5.3.9.1. Financing of the Investment

The investment is expected to benefit from the provisions of Regulation (EU) No 508/2014 of the European Parliament and of the Council of 15 May 2014, on the European Maritime and Fisheries Fund and repealing Council Regulations (EC) No 2328/2003, (EC) No 861/2006, (EC) No 1198/2006 and (EC) No 791/2007 and Regulation (EU) No 1255/2011 of the European Parliament and of the Council. The analysis of the investment cost of funding is indicated in Table 36.

Table 36. Financial plan of the mussel farm company.

Investment financing	%	Value (€)

Own funds	55%	258,265.24
Loans	0%	0.00
European Commission support	35%	164,350.61
Greek Public	10%	46,957.32
Total eligible costs	100%	469,573.16

Own contribution amounts to 55% of the production costs of the investment corresponding to 258,265.24 €.

Public expenditure is projected at 45% of the production costs of the investment corresponding to 211,307.92 €.

5.3.9.2. Company staff

As stated earlier, for the company's needs will be employed:

1. An ichthyologist with annual compensation 21.497,28 €
2. A fishworker with annual compensation 15.483,09 €
3. Six seasonal employees with total annual compensation 13.661,55 €

5.3.9.3. General company expenses

The administrative and operational costs of the operation are reported in Table 37 and discussed below. Note that the calculated annual maturation is 1.5%.

Table 37. Administrative and operating expenses.

		Cost / year	Time schedule 2016	2017	2018	2019	2020	Total
Price review	1.50%							
			0.00	0.00	0.00	0.00	0.00	0.00
Electricity		2,000.00	2,000.00	2,030.00	2,060.45	2,091.36	2,122.73	10,304.53
Telecommunications		2,000.00	2,000.00	2,030.00	2,060.45	2,091.36	2,122.73	10,304.53
Book keeping expenses		5,000.00	5,000.00	5,075.00	5,151.13	5,228.39	5,306.82	25,761.33
Various expenses		1,000.00	1,000.00	1,015.00	1,030.23	1,045.68	1,061.36	5,152.27
Depreciations			0.00	0.00	0.00	0.00	0.00	0.00
Management costs	**	0.2%	0.00	451.00	462.28	473.83	485.68	1,872.78
Bad debt expenses and losses	***	0.5%	0.00	1,127.50	1,155.69	1,184.58	1,214.19	4,681.96
Other Taxes, interest expenses	****	0.2%	0.00	451.00	462.28	473.83	485.68	1,872.78
Total Administrative & Operating expenses			10,000.00	12,179.50	12,382.49	12,589.03	12,799.19	59,950.20

*** On sales

Administration Costs

The Administration costs include:

(1) miscellaneous office expenses of the enterprise (eg electricity, telephone) estimated annually at 4.000 €.

(2) expenses for bookkeeping, estimated annually at 5.000 €.

(3) other general business expenses (consumables, travel, stationery) estimated at 1.000 € per year.

Management Expenditure

The management expenses include the costs of contracts, loans, market interest etc. and is estimated at 0.2% of gross sales annually.

Bad debt expenses and losses

The bad debt expenses and losses relate to receivables and losses on the disposal and not the production of goods and estimated at 0.5% of gross sales annually.

Interest expenses / taxes

The interest and tax expenses include the road tax costs of transport of the business and any extraordinary contributions and estimated at 0.2% of gross sales annually.

5.3.9.4. Production cost

The company predicts that the first year's cost of mussel juveniles will be considered a work in progress and therefore the cost will be transferred to the following year. The cost of producing the products of the plant is summarized for 2016-2020 in Table 38.

Table 38. Analysis of the production costs for a mussel farm of 400 tonnes capacity per year.

					Time Schedule					
					2016	2017	2018	2019	2020	TOTAL
IN KGRs										
initial stock (biomass)		(Fry)			31,120.00	131,120.00	131,120.00	131,120.00	131,120.00	**555,600.00**
Production (biomass increse/Quantity)					100,000.00	400,000.00	400,000.00	400,000.00	400,000.00	**1,700,000.00**
Own use	(1)				0.00	0.00	0.00	0.00	0.00	**0.00**
Sales	(2)				0.00	400,000.00	400,000.00	400,000.00	400,000.00	**1,600,000.00**
Final stock (on-going production)					131,120.00	131,120.00	131,120.00	131,120.00	131,120.00	**655,600.00**
Production Cost	in Euros									
Raw material		(Γόνος)	0.00	0.17	12,448.00	0.00	0.00	0.00	0.00	**12,448.00**
Auxiliary materials & packaging					0.00	24,000.00	24,000.00	24,000.00	24,000.00	**96,000.00**
Consumables					0.00	2,255.00	2,311.38	2,369.16	2,428.39	**9,363.92**
Personnel cost					39,029.60	51,401.55	52,172.57	52,955.16	53,749.49	**249,308.37**
Spare parts - Maintenance					1,220.39	4,453.55	4,512.40	4,571.25	4,571.25	**19,328.84**
Insurance					0.00	2,994.19	3,069.04	3,145.77	3,224.41	**12,433.42**
Depreciation					22,239.58	50,381.42	81,575.33	82,752.33	82,752.33	**319,700.98**
Other costs					4,990.00	7,527.00	7,826.48	8,139.00	8,465.19	**36,947.66**
Unforeseen Expenses	(2.00%	of production expenses)			1,598.55	2,860.25	3,509.34	3,558.65	3,583.82	**15,110.62**
Total Production Cost					**81,526.12**	**145,872.97**	**178,976.54**	**181,491.32**	**182,774.88**	**770,641.83**
Transferable cost					**0.00**	**81,526.12**	**56,139.04**	**58,044.05**	**59,135.18**	**59,721.43**
Total Production Cost					**81,526.12**	**227,399.09**	**235,115.58**	**239,535.37**	**241,910.06**	**1,025,486.22**
Average value	(3)				0.62	0.43	0.44	0.45	0.46	
Sales Cost	(2) x (3)				0.00	171,260.05	177,071.53	180,400.19	182,188.63	**710,920.39**
Cost of own use	(1) x (3)				0.00	0.00	0.00	0.00	0.00	**0.00**
TOTAL COST					**0.00**	**171,260.05**	**177,071.53**	**180,400.19**	**182,188.63**	**710,920.39**

a. Purchase of mussel fry

Consumable livestock is considered the mussels fry market. The purchase cost of fry is:

Mussel: 0,40 € / kg

The company will buy mussel spat only the first year of business. Then the fry will be collected by the company with special collectors.

The purchase cost of raw material for the year 2016 are:

12.448 € (31,120 kgr)

b. Consumption of packaging materials

Because the mussels produced are sent to a Packaging - Shell Delivery Centre , the cost of packaging materials is estimated to 0,01 € / kgr.

Work Expenditure

Labour costs include salaries of the technical staff involved in the operation, and are analyzed in Table 33 (see above).

Energy costs

Energy costs include all forms of fuel consumption. The cost of liquid fuel for moving vehicles is estimated at 250 € per month.

5.3.9.5. General Industrial Costs

a. Maintenance costs / repairs

Maintenance costs and repairs include the cost of the repair / maintenance of specialized installations and amount to 1.0% of their value. The detailed costs of maintenance / repair of special facilities are presented in the Table below and are the following:
Table 39. C ıintenance of fixed installations.

	2016	2017	2018	2019	2020
Total cost	1,220.39	4,453.55	4,512.40	4,571.25	4,571.25

b. Insurance costs

The insurance expenses include the insurance costs of livestock estimated at 1.00% of the insured value, which is averaged by the insurance company, to 0,49 € / kg production every year and totaled on average 3,185, 72 € per year.

Table 40. Cost of insurance for a mussel farm of 400 tonnes per year.

Insurance costs		Time schedule					
		2016	2017	2018	2019	2020	Total
Value per kilo (average)	0,47 €/ kgr	0.00	0.56	0.58	0.59	0.61	
Insurance costs	1,00 %						
Insured amount	(Kgr)	131,120	531,120	531,120	531,120	531,120	2,255,600
Insured value	(€)	0.00	299,418.90	306,904.37	314,576.98	322,441.41	1,243,341.66
Insurance Costs	(€)	0,00	2,994.19	3,069.04	3,145.77	3,224.41	12,433.42

c. Depreciation and amortization expenses

Depreciation of fixed capital are presented in Table 41 and are calculated according to the following rates:

1. Floating installations 2. Machinery	8% 14%
3. Transportation means 4. Other equipment	20% 20%

Table 41. Depreciation of fixed assets for a mussel farm of 400 tonnes per year.

Table 3- Depreciation of Fixed Assets

				Time schedule				
		coefficient		2016	2017	2018	2019	2020

16	Intangible Assets			(1)	0.00	0.00	0.00	0.00	0.00
	Depreciation for the year	20%		(2)	0.00	0.00	0.00	0.00	0.00
	Accumulated depreciation			(3)	0.00	0.00	0.00	0.00	0.00
	Written-down value			(1) - (3)	0.00	0.00	0.00	0.00	0.00
11	Buildings-Installation Buildings			(1)	0.00	0.00	0.00	0.00	0.00
	Depreciation for the year	8%		(2)	0.00	0.00	0.00	0.00	0.00
	Accumulated depreciation			(3)	0.00	0.00	0.00	0.00	0.00
	Written-down value			(1) - (3)	0.00	0.00	0.00	0.00	0.00
12	Machinery			(1)	72,272.55	144,545.10	144,545.10	144,545.10	144,545.10
	Depreciation for the year	14%		(2)	5,059.08	16,020.42	20,236.31	20,236.31	20,236.31
	Accumulated depreciation			(3)	5,059.08	21,079.49	41,315.81	61,552.12	81,788.44
	Written-down value			(1) - (3)	67,213.47	123,465.61	103,229.29	82,992.98	62,756.66
13	Transportations Means			(1)	133,375.50	223,951.00	229,836.00	235,721.00	235,721.00
	Depreciation for the year	20%		(2)	13,337.55	26,675.10	45,967.20	47,144.20	47,144.20
	Accumulated depreciation			(3)	13,337.55	40,012.65	85,979.85	133,124.05	180,268.25
	Written-down value			(1) - (3)	120,037.95	183,938.35	143,856.15	102,596.95	55,452.75
14	Other Equipment			(1)	38,429.53	76,859.06	76,859.06	76,859.06	76,859.06
	Depreciation for the year	20%		(2)	3,842.95	7,685.91	15,371.81	15,371.81	15,371.81
	Accumulated depreciation			(3)	3,842.95	11,528.86	26,900.67	42,272.48	57,644.30
	Written-down value			(1) - (3)	34,586.58	65,330.20	49,958.39	34,586.58	19,214.77
	Total cost				244,077.58	445,355.16	451,240.16	457,125.16	457,125.16
	Depreciation for the year				22,239.58	50,381.42	81,575.33	82,752.33	82,752.33
Transfer to Production Cost					22,239.58	50,381.42	81,575.33	82,752.33	82,752.33

Reclassification to administrative costs					0.00	0.00	0.00	0.00	0.00

5.3.9.6. Results of Investment

Sales Revenue

Revenues from sales are calculated based on the annual production of the unit and the corresponding selling price of products of the unit which is estimated at:

" Mussels 0,55 €/kgr

The production capacity of the plant and sales revenue are presented in Table 42.

Table 42. Sales revenues for a mussel farm of 400 tonnes per year.

Review prices → 2.5%	Time schedule					
	2016	2017	2018	2019	2020	Total
Mussels						
Quantity in Kgr	0	400,000	400,000	400,000	400,000	**1,600,000**
Price per kgr	0.55	0.56	0.58	0.59	0.61	**0.59**
Value (€)	0.00	225,500.00	231,137.50	236,915.94	242,838.84	**936,392.27**
Total						
Quantity in Kgr	**0**	**400,000**	**400,000**	**400,000**	**400,000**	**1,600,000**
Value	**0.00**	**225,500.00**	**231,137.50**	**236,915.94**	**242,838.84**	**936,392.27**

Analysis of sales and gross profit

Gross profit is calculated as follows: (Sales Revenue) - (cost of production).

We note that there is no income from other activities of the company (e.g. services). Gross profit of the enterprise for the period 2016-2020 are shown in Table 43, which shows that the gross profit percentage is increased gradually every year.

Table 43. Gross profit for a mussel farm of 400 tonnes per year production capacity.

Time schedule

	2016	2017	2018	2019	2020
Sales	0.00	225,500.00	231,137.50	236,915.94	242,838.84
Cost of Sales	0.00	171,225.14	183,353.98	188,268.84	190,448.87
Gross profit	0.00	54,274.86	47,783.52	48,647.09	52,389.96
Percent	0.00%	24.07%	20.67%	20.53%	21.57%

Account analysis and exploitation of results

The analysis and results for the period 2016-2020 is presented in Table 44. The calculation is based on sales revenue, operating expenses, and depreciation, other expenses and taxes.

Table 44. Income statement for a mussel farm of 400 tonnes per year production capacity.

ime schedul e

	2016	2017	2018	2019	2020	Total	%
Turnover (Sales)	0.00	225,500.00	231,137.50	236,915.94	242,838.84	936,392.27	100.00
Income from own consumption	0.00	0.00	0.00	0.00	0.00	0.00	
Cost of sales	0.00	171,260.05	177,071.53	180,400.19	182,188.63	710,920.39	0.76
Gross profit	*0.00*	*54,239.95*	*54,065.97*	*56,515.75*	*60,650.21*	*225,471.88*	0.24
minus							

Operating and Administrative expenses					10,000.00	12,179.50	12,382.49	12,589.03	12,799.19	59,950.20	0.06
Financial expenses					0.00	0.00	0.00	0.00	0.00	0.00	
Profit before depreciation					*-10,000.00*	*42,060.45*	*41,683.48*	*43,926.72*	*47,851.03*	*165,521.68*	0.18
Depreciation not included in production costs					0.00	0.00	0.00	0.00	0.00	0.00	
Profit before tax					*-10,000.00*	*42,060.45*	*41,683.48*	*43,926.72*	*47,851.03*	*165,521.68*	0.18
Tax		37.0%			0.00	15,562.37	15,422.89	16,252.89	17,704.88	64,943.02	0.07
Profit after taxes					*-10,000.00*	*26,498.09*	*26,260.59*	*27,673.83*	*30,146.15*	100,578.66	0.11
						12%	11%	12%	12%	11%	

CASH FLOW

The cash flow for the period 2016-2020 is depicted in Table 45. For its calculation it is considered the capital inflows (earnings before depreciation and taxes, own capital participation in the company's, long-term and short-term loans and the participation of the company to cover the capital) and capital outflows (taxes, interest on loans, income statement and the balance from previous years).

Table 45. Cash flow for a mussel farm of 400 tonnes per year production capacity.

Time schedule

	2016	2017	2019	2018	2020	Total
			194,136.25		0.	

Cash desk	0.00	24,946.65		66,899.22		325,782.08	
Funds readily available	258,265.24						258,265.
Grants	105,653.96	105,653.96					211,307.
Long-term loans	0	0					
Cash receipts from sales *	0.00	202,950.00				242,246.55	912,108.
Inflows	363,919.20	333,550.61	230,573.75	236,338.09		568,028.63	1,381,681.
			297,472.97	430,474.34			
Salaries	39,029.60	51,401.55		52,172.57	52,955.16	53,749.49	249,308.
Purchase A & B material	12,448.00	2,255.00		2,311.38	2,369.16	2,428.39	21,811.
maintenance costs	1,220.39	4,453.55		4,512.40	4,571.25	4,571.25	19,328.
Insurance costs	0.00	2,994.19		3,069.04	3,145.77	3,224.41	12,433.
Other expenses	4,990.00	7,527.00		7,826.48	8,139.00	8,465.19	36,947.
Selling & operating expenses	10,000.00	12,179.50		12,382.49	12,589.03	12,799.19	59,950.
Investments	271,284.56	185,840.60		5,500.00	5,500.00	0.00	468,125.
Taxes	0.00	0.00		15,562.37	15,422.89	16,252.89	47,238.
Repayment of short-term loans	0.00	0.00		0.00	0.00	0.00	

Interest on short-term loans	0.00	0.00		0.00	0.00	0.00		0.
Repayment of long term loans	0.00	0.00		0.00	0.00	0.00		
Interest on long-term loans	0.00	0.00				0.00		
Outputs	338,972.55	266,651.39	0.00 **103,336.72**	0.00 **104,692.26**		101,490.80	915,143.	
Override / (deficit) fund	24,946.65	66,899.22		194,136.25	325,782.08	466,537.83	466,537.	
Obtain short-term loan	0.0	0.0				0		
Remaining amount	24,946.65	66,899.22	0 **194,136.25**	0 **325,782.08**		466,537.83	466,537.	

0.
0.
0.
0.
0.

* 0.9 immediate payment ./0,1 on credit

VALUE ADDED DATA

The basic elements of added value are presented in Table 46.

Table 46. Basic value added data for a mussel farm of 400 tonnes per year production capacity.

	Time schedule	

	2016	2017	2018	2019	2020	Total
Administrative and operating expenses	10,000.00 0.00	12,179.50 0.00	12,382.49 0.00	12,589.03 0.00	12,799.19 0.00	59,950.20 0.00
Finance						
Depreciation						
Total	22,239.58	50,381.42	81,575.33	82,752.33	82,752.33	319,700.98
	32,239.58	**62,560.92**	**93,957.81**	**95,341.35**	**95,551.51**	**379,651.18**
Total Industrial Cost	81,526.12	145,872.97	178,976.54	181,491.32	182,774.88	770,641.83
% On industrial production costs	40%	43%	52%	53%	52%	49%

Table 47. Budget general operating expenses.

Cost Elements	1st year	2nd year	3rd year	4th year	5th year
Equipment	271,284.56	185,840.60	5,500.00	5,500.00	
Payroll	39,029.60	51,401.55	52,172.57	52,955.16	53,749.49
Rent (sea area lease)	4,240.00	4,452.00	4,674.60	4,908.33	5,153.75
Various operating expenses	10,000.00 3,000	12,179.50 3,000	12,382.49 3,000	12,589.03 3,000 3,145.77	12,799.19 3,000 3,224.41
Publicity costs	0.00	2,994.19	3,069.04	3,230.67	3,311.44
Insurance	750.00	3,075.00	3,151.88	15,422.89	16,252.89
Transportation costs	0.00	0.00	15,562.37		
Various taxes	328,304.16	262,942.84	99,512.95	100,751.85	97,491.17
Interest					
TOTAL					

Table 48. Net Present value and Internal Rate of Return for a mussel farm of 400 tonnes per year production capacity.

	2016							
Turnover	0.00			2019	2020	2021		
				236,915.94	242,838.84	*253,766.58*		
Results before taxes	-10,000.00	42,060.45	41,683.48		43,926.72		47,851.03	*50,004.32*
Investment	-271,284.56	-185,840.60	-5,500.00		-5,500.00		0.00	*0.00*
Interest	0.00	0.00	0.00	0.00			0.00	*0.00*
Depreciation	22,239.58	50,381.42	81,575.33		82,752.33		82,752.33	*82,752.33*
	-259,044.98	-93,398.73	117,758.81	121,179.05			130,603.35	*132,756.65*

Net Present Value	-48,493.42

	(IRR till 2019)	(IRR till 2020)	(IRR till 2021)
Internal Rate of Return	-16%	2%	12%

Table 49. Predicted income statement.

	2016	2017	2018	2019	2020
Turnover	0.00	225,500.00	231,137.50	236,915.94	242,838.84
– Sales Cost	0.00	171,260.05	177,071.53	180,400.19	182,188.63
Gross profit	0.00	54,239.95	54,065.97	56,515.75	60,650.21
– Personnel cost	39,029.60	51,401.55	52,172.57	52,955.16	53,749.49
	10,000.00	12,179.50	12,382.49	12,589.03	12,799.19

– Various operating expenses	4,240.00	4,452.00	4,674.60	4,908.33	5,153.75
– Leasing sea area	-	42,060.45	41,683.48	43,926.72	47,851.03
– Publicity	10,000.00				
Earnings before interest, tax		42,060.45	41,683.48	43,926.72	47,851.03
– Interest payable	- 10,000.00	15,562.37	15,422.89	16,252.89	17,704.88
Net Profit before taxes	0.00 - 10,000.00	26,498.09	26,260.59	27,673.83	30,146.15
– Taxes					
Net Profit					

5.3.10. Evaluation assessment of undertaking

(Count on the cash flow schedule)

The results of Table 45 (cash flow) as well as Table 48 with the indicators, suggest that the mussel farm is a profitable business. However, the positive results require some time as in most aquaculture activities and the investors must be patient as the best results will appear after the 5th year of operation. Cash flow analysis shows a particularly favorable flow as inflows are higher that outputs, especially if the whole operation will be subsidized from EU and National funds.

5.3.11. Final Business Plan Conclusions

(evaluation results, sustainability, maturity)

Mussel culture in Greece is an extensive farming activity, with returns depending on a combination of factors such as natural productivity, technical practices, production cost, and pricing.

In the proposed business plan, a major issue is the critical role of space availability. Mussel farm operations in Greece are dictated through a licensing system and this procedure could be a major risk factor for entry in the sector. It was highlighted that farm size is critical to the financial viability of the producers, because profitability is too limited for smaller farms (up to 3 ha) as a result of the

high production costs per hectare. Labor by working crews of at least 5 workers could improve farming productivity even for smaller farms.

The business plan also highlighted the importance of EU and Government support for the startup and consequent viability and sustainability of the farms through the relief of depreciation costs. The future of the industry might lay in producers getting organized in larger schemes that promote production industrialization and farming scale-up that, in their turn, reduces average production costs and aids value-added processing.

6. Discussion Section

6.1. Summary consideration of capacity and prospects in agriculture and food sector

Aquaculture continues to be the fastest growing animal food-producing sector and to outpace population growth. The overall growth in aquaculture production remains relatively strong owing to the increasing demand for food fish among most producing countries. World food fish aquaculture production expanded at an average annual rate of 6.2 percent in the period 2000–2012, more slowly than in the periods 1980–1990 (10.8 %) and 1990–2000 (9.5 %). Between 1980 and 2012, world aquaculture production volume increased at an average rate of 8.6 % per year. World food fish aquaculture production more than doubled from 32.4 million tonnes in 2000 to 66.6 million tonnes in 2012.

Aquaculture development is imbalanced and its production distribution is uneven, with Asia accounting for about 88 % of world aquaculture production by volume. In the past decade, the aquaculture sector remained relatively stagnant in the EU when it was one of the fastest growing food sectors in the world. This situation is a paradox as the EU is the world largest seafood consumer and is obliged to import 70% of the seafood sold in its market. The world's appetite for fish is steadily growing. Finfish and shellfish currently make up one-sixth of the animal protein people consume globally. As the global wild fish catch peaked in the 1990s, aquaculture—or fish farming—has grown rapidly to meet world fish demand, more than doubling production between 2000 and 2012. New research shows that aquaculture production will need to more than double again between now and 2050 to meet the demands of a growing population.

With the global wild fish catch stagnant and the human population increasing, aquaculture is here to stay. The world, therefore, needs to get its growth right—and ensure that fish farming contributes to a sustainable food future.

6.2. Accessibility and attractiveness (or discouragement) as youth employment opportunity, for youth new to farming and those with experience.

Aquaculture seems to be an attractive activity for youth employment not only because it can be oriented towards novel methodologies (eg organic farming) combined with the organization of alternative tourism activities (agrotourism, fishtourism, ichthyotourism, diving tourism, ecotourism etc), depending on the area and its local characteristics. Every area in Greece has unique nature and special characteristics that can be highlighted and attract tourists. This study highlighted a business plan proposal in an attempt to present this new concept that can be adopted in many areas in Greece.

Through time, the EU member States aquaculture sector have benefited from funding and subsidies from the European Commission in order to promote its development, and ensure a sustainable and viable sector, in competition with other aquaculture products of the world. Several programming periods have marked the EU history of the aquaculture sector, which have provided several funding opportunities to the sector. The new programming period 2014-2020 offers numerous opportunities for funding for fishtourism and ichthyotourism activities as well as for Sustainable Development of Aquaculture. Regulation (EU) No 508/2014 of the European Parliament and of the Council of 15 May 2014, that established the European Maritime and Fisheries Fund (EMFF) shall contribute to the achievement of the following objectives:

a) promoting competitive, environmentally sustainable, economically viable and socially responsible fisheries and aquaculture;
b) fostering the implementation of the Common Fisheries Policy (CFP);
c) promoting a balanced and inclusive territorial development of fisheries and aquaculture areas.

Specifically, Article 52 of Regulation 508/2014 is encouraging new aquaculture farmers practicing sustainable aquaculture. In order to foster entrepreneurship in aquaculture, the EMFF may support the setting-up of sustainable aquaculture enterprises by new aquaculture farmers. Support shall be granted to aquaculture farmers entering the sector provided that they:

(a) possess adequate professional skills and competence;
(b) set up for the first time an aquaculture micro or small enterprise, as managers of that enterprise; and
(c) submit a business plan for the development of their aquaculture activities.

Financial support depends on the area of Greece and may reach up to 45%[17]. Therefore, it seems that youth employment opportunities with EU support exist and are available for both, youth new to farming and those with experience.

The total budget of the Operational Programme for Fisheries and Maritime Affairs

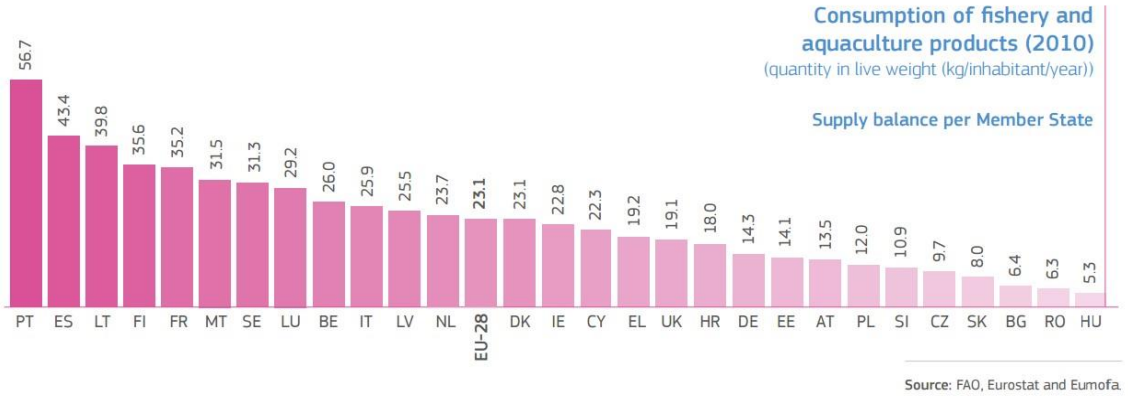
2014-2020 amounts to € 523,3 mil., of which 74.3% will be covered by EU funding and 25.7% from national financing.

6.3. Consumer habits and growth potential, as well as export potential

Fish forms an important part of the diet of much of the population in Greece as well as in Europe but, while the consumption of fish per capita has remained stable in most Western European countries, the past decade has seen a decline in Central and Eastern Europe. Worldwide, 18.9 kg of fish or seafood is consumed per person per year, as compared to a European Union average of 23.1 kg. Consumption varies from 5.3 kg per person in Hungary to 56.7 kg in Portugal. Greece's consumption is below the EU average of 23.1 kg per person at 19.2 kg. Three quarters of EU fish or seafood consumption is from wild fisheries with a quarter coming from aquaculture.

Before the financial crisis, the per capita fish consumption in Greece was around 25 kg per annum (slightly more than the EU average) and of these 2.1 kg were sea bass and sea bream. This means that the overall annual fish consumption in Greece was around 250 000 tonnes for a population of around 10 million, and that aquaculture contributed less than 10 percent.

[17] By the time that this report is written, the Hellenic OP Fisheries 2014-2020 has not published any specific measures and the % of subsidy per region is still not known.



For the immediate future, a moderate rise in fish consumption is expected in Western Europe, but scope exists for a significant increase in Central and Eastern Europe. This increase will probably be slow due to the combination of economic and structural problems that have contributed to low disposable incomes for most countries in these areas.

Therefore, there is scope for further increase of fish consumption in Greece as well as Europe.

The dynamic entrance of large-retailers (super-markets) in the market of fresh fishery products, after the mid 1990s, based to a great extend to the supply of products of aquaculture, resulted in a significant increase of the sales of fishery products via that channel. In fact, within only three years (1995–1998), supermarkets managed to increase their share of the sales of fishery products from 5 % to 50 %, largely at the expense of the traditional retailers. Accordingly, based on recent company information, super-markets have increased their market share on farmed European seabass and gilthead seabream sales quite significantly over the last years, accounting for almost 20 % of the volumes traded in the national market.

The export potential of the suggested business plans is very high. Organic sea bass and sea bream are highly appreciated in some niche markets and the same applies for high quality of bivalve molluscs. Nowadays, the majority of these products are exported.

6.4. Regional considerations

Regional considerations are important for the proposed aquaculture businesses.

The vast majority of mussel cultures in Greece (> 70%) are located in Thermaikos Gulf (NW Aegean Sea), in the Prefectures of Thessaloniki, Pieria and Imathia, where at least 2,500 people are employed, excluding processing units (e.g. mussel shucking units).

The reason for this is that mussels are filter feeder organisms and thus their growth rate is very much dependent on the availability of microalgae and in general more eutrophic waters. Areas like Amvrakikos Guf or areas nearby rivers have a competitive advantage compared to oligotrophic areas.

As for aquaculture and fish tourism activities, the Joint Ministerial Decision 31722/411-2011 (Approval of Special Framework on Planning and Sustainable Development on Aquaculture and of its Strategic Environmental Impact Study) allows licensing for small scale marine aquaculture units up to 15 tonnes per year if combined with tourist accommodation, or diving park in the framework of ichthyotourism or other agrotouristic activity. The condition in this case is that these companies operate by the same natural or legal entity or that there is an agreement among different companies.

The concept of Local Available Resources can benefit young people to diversify an aquaculture activity in cooperation with local fishermen. The proposed business plan for purposes to reduce the initial capital investment did not propose to buy a professional vessel and license. However, this is an option that interested entrepreneurs should consider. Instead, the proposed BP described a cooperation with local fishermen. The BP highlighted the importance for an aquaculturist/fisher to learn to 'read' the surroundings like a container of resources to be utilised and exploited for possible occupational prospects.

6.5. Stakeholder analysis

For the implementation of this study the researchers consulted a number of stakeholders that have a deep knowledge of the regulatory framework of aquaculture in Greece, organic farmer producers, fish feed specialists and mussel producers. In addition, a number of novel projects and ideas have been incorporated into the proposed Business Plans and include novel Fish Fry Recruitment devises
(ECONET)[18] as well as e-commerce applications (FerTility platform – see chapter

[18] See: www.ecoreefs.gr

6.8).

6.6. Synergies with other sectors and sectoral studies to the best of the researcher's ability

This study demonstrated the possibility to combine aquaculture with fish tourism and ichthyotourism which belong to the broader concept of agrotourism and ecotourism. This is further analyzed in the next chapter. To the knowledge of the researchers, there are no synergies of aquaculture with other sectors. However, there is in the future a potential synergy between aquaculture and the cultivation of vegetables through aquaponics.

Aquaponics is the combination of Aquaculture (raising aquatic animals such as snails, fish, crayfish or prawns in tanks) and Hydroponics (growing plants in water or soilless environment), in a carefully designed, hyper-productive closed-loop system and symbiotic environment. In the aquaculture, effluents accumulate in the water, increasing toxicity for the fish. This water is led to a hydroponic system where the byproducts from the aquaculture are filtered out by the plants as vital nutrients, after which the cleansed water is recirculated back to the fish pond. The process is easy to understand, simple to learn and to operate successfully. The process can be coined as high-performance agriculture. Some predict Aquaponics will be the future of Organic farming. The output is pure, clean, natural and 100% organic. The process is sustainable, doable at a localized level, compact, easily manageable with limited means and can give output for daily use of a 5 member family on a small scale. Aquaponics can be set up in any climate, any season, and any location and in any environment. It can be done indoors, backyard, building rooftop, terrace, balcony space, kitchen garden, large window space and corridors, even with less than an hour daily involvement.

The research team however, believes that this technology still needs improvement and the rearing species are fresh water species which is not the first choice to the Greek consumers. Although, it was not considered for further analysis in the scope of this Study, in theory, it is a concept that deserves further study and standardisation.

6.7. Specifically, each study should provide some implications for agro tourism (note that tourism is another vital sector for youth employment, and opportunities to link agro-food to this sector should be identified)

This study demonstrated the possibility for the creation of a small facility for the organic farming of marine Mediterranean fish species (for the moment sea bass and sea bream), combined with the provision of ichthyotourism, fishtourism and diving services.

In Greece, there are many suitable places for practicing agrotourism and fish tourism in parallel with aquaculture activities. These forms of alternative tourism is when people tour things and places other than the usual tourist attractions. In this type of tourism, visitors often interact more with the locals and nature rather than simply looking at big buildings or historical sites. The local cultures, families and communities are emphasized over mainstream tourism. There are three main categories of this type of tourism: nature-based tourism, cultural tourism and adventure tourism. All three categories could interconnect, depending on the specific desires and abilities of the tourist.

It is thus important for an aquaculturist/fisher to learn to 'read' the surroundings like a container of resources to be utilised and exploited for possible occupational prospects in order to diversify his/her activities. In that respect, there are numerous possibilities and combinations of activities for young people who wish to engage in the fisheries sector and diversify their occupational activities.

6.8. Implications for e-commerce

With over a billion users worldwide, the Internet is one of history's great success stories. However, today's Internet was designed in the 1970s, for purposes that bear little resemblance to current and future usage scenarios. Many challenges in the areas of technology, business, society and governance will have to be overcome if the future development of the Internet is to sustain the networked society of tomorrow.

To face these challenges, in 2011, the European Commission launched the Future Internet Public-Private Partnership Programme (FI-PPP). The main goal is to advance a shared vision for harmonized European technology platforms and their implementation, as well as the integration and harmonization of the relevant policy, legal, political and regulatory frameworks. As set forth in the Digital Agenda for Europe, these are considered to be prerequisites to build an inclusive knowledge society.

The FI-PPP is a European programme for Internet innovation. It is aimed at accelerating the development and adoption of Future Internet technologies in Europe, advancing the European market for smart infrastructures and increasing the effectiveness of business processes through the Internet.

It follows an industry-driven, user-oriented approach that combines R&D on network and communication technologies, devices, software, service and media technologies; and their experimentation and validation in real application contexts. It brings together the demand and supply sides, and it involves users early into the research lifecycle. The platform technologies will be used and validated by many actors, in particular by small and medium-sized companies and public administrations.

Thus, the effectiveness of business processes and infrastructures supporting applications in areas such as transport, health or energy can be increased; leading to the creation of innovative business models that strengthen the competitive position of the European industry in sectors such as telecommunication, mobile devices, software and services, and content provision and media.

The supply of fresh food products to healthily feed Europe is of vital importance. But food products and other perishables such as fisheries and aquaculture impose very challenging demands on the management of its supply chains. Due to high perishability, quality conditions have to be controlled from farm to fork. On the other hand, transparent documentation of supply chains is a complicated and time consuming procedure. Furthermore, supply chains have to deal with unpredictable variations in quality and quantity of supply. Therefore planning, control, and processing systems consequently need to be extremely flexible, while simultaneously enabling early warning and preventative control. EU is now funding solutions addressing this problems and successfully bringing them into the market.

In that framework, FerTility is a platform that provides a reliable solution for fish producers to connect with their customers.[19] With FerTility the current isolation between fish & shellfish producers and the consumers and the difficulty to approach each other will no longer exist. Consumers will have the ability to select fish or shellfish (mussels) from an aqua farm or a supplier (fisherman) of his choice, while there will be selections for the form of the fish (whole, head-off, filleted, gilled and gutted, de-scaled and gutted, de-

[19] See: http://www.finish-project.eu/wp-content/uploads/2015/03/26_Upcom_FerTility.pdf

scaled, gilled and gutted, etc.). Then, after placing the order, he will get the order in a predefined area. Several possibilities will exist, based on the availability of the client (pick up from a predefined place, etc.)[20].

The proposed business plans predict e-commerce sales through the FerTility platform.

6.9. Analysis of Imports and opportunities for Greek-produced substitutes

Greek seafood imports range between 40-65.000 tonnes per year and include fresh, chilled, frozen, frozen fillets, salted, dried, smoked, canned and shellfish (shrimps, mussels) from various countries. Market sources indicate that Greek consumption patterns for frozen seafood will continue to expand. Most frozen seafood is already covered by imports with the percentage of imported frozen seafood relative to total consumption estimated to be 55-65%. Frozen seafood can be expected to continue to take a larger share of the Greek seafood market as more people recognize its quality and economical price, and as small servings or semi-prepared products become more available.

Imports of fresh sea bass and sea bream are mainly from Turkey and are re-exported to Europe. There are no major opportunities for Greek-produced substitutes as Greek aquaculture is promoted in Greece as a fresh product of high quality. Mussels should also be promoted as a fresh high quality feed so the marketing of this product should increase its share to the Greek consumers as well.

6.10. Prerequisites to entrepreneurial success (critical success factors)

Commercial fish and shellfish farming can be profitable, but it also can be expensive. Commercial fish farming is generally more complicated than the potential producer first believes. The producer must be a combination business and sales person, as well as a biologist, lawyer, manager, and (possibly most of all) a hard worker. Time and work spent in planning is profitable, and the greatest profit or reward may be the decision not to go into fish farming: it definitely is not for everyone.

[20] See: http://www.finish-project.eu/wp-content/uploads/2015/11/Upcom_FerTility_Presentation.pdf

Elements for Success

Before moving forward, the potential farmer must consider that there are five elements essential to a successful fish farming enterprise. If a farmer lacks any one of these elements, his or her chance of success is very small.

1. Suitable land.
2. Suitable water.
3. Adequate financing.
4. Sustainable market for product.
5. Management time and skills.

Risk Assessment

The potential farmer must understand the risks involved with the aquaculture industry. A quick list follows to consider before further planning or implementation. Each site and operation is unique but, conceptually, the farmer must be equipped to handle:

1. Poor water quality.
2. Disease and parasites.
3. Pesticide contaminations.
4. Poachers and vandals.
5. Competition from local and import products.
6. Business challenges unique to a costal and island environment (e.g., increasing costs for feed, distance to market).
7. Personal stress resulting from risk management.

Moving Forward

If the potential farmer feels confident that he or she has the elements for success and can manage the risks of operating an aquaculture operation, the next step is more detailed planning.

It is important for the potential fish producer to determine first what aspect of fish or mussel farming is of interest and how much it will cost to enter business. The checklist that follows is in the form of a long series of questions that should be fully answered.

MANAGEMENT

1. Do you or your production manager have the technical training or experience to manager your operation at optimum efficiency? If not, have you arranged for management consulting and periodic checks on your operation by expert consultants?

2. Are you, or do you have available, a fishery biologist competent to make immediate diagnosis and proceed with proper chemical treatment of diseases and parasites for fish stocks and to deal with other biological problems of hatching and rearing?

3. Do you adequate skilled help to efficiently carry out all phases of your operation, to maintain schedules, and to meet emergencies?

MARKETING

1. Have you studied your market outlets?

   a. Do you have reasonably firm market commitments as to quantity, price, and form of product?

   b. Do you have alternate market outlets?

   c. Can you adjust your harvest time to take advantage of high points in seasonal demand and price fluctuations if they exist?

   d. Can you provide maximum quality, type, form, and weight of products and

other services that your market outlet requires?

e. Do you have, or can you arrange for, adequate distribution facilities and dependable supply sources to meet the time, quality, and quantity demands of your markets?

f. Are you aware of trends in product forms, packaging, convenience, and prices of your and competing products in the market?

2. Have you planned for market promotion and education activities?

a. Have you scheduled an advertising budget to stimulate sales?

b. Have you participated in and contributed to industry association programs to create an appealing image for fish farming, and products for consumers and merchandisers?

c. Have you cooperated with news media staffs to develop reports and programs to increase public awareness of the industry?

6.11. Recommendations for consideration in the Implementation Phase.

Greek youngsters and scientists must continue to be major contributors to the international scientific and business community, providing relevant input to all stages of the aquaculture value chain. For the promotion of human capital, educational activities related to aquaculture should take place, such as professional training, lifelong learning, dissemination of scientific and technical knowledge and innovative practices and acquisition of new professional skills in aquaculture, with regard to the establishment of viable units and the reduction of the environmental impact of aquaculture operations. The aquaculture sector will be attractive to a wide range of highly educated people, as well as highly skilled workers with positive growth and employment opportunities. The industry will be characterised by its ability to fasttrack progress from knowledge development and intellectual protection through innovation, industrial application and product development. Greek aquaculture will adopt cutting edge knowledge management practices to

support state-of-the art technological development. This will be the key factor that will allow the aquaculture industry to meet the imminent market demand for fish & shellfish production, due to limited natural resources coupled with a growing world population.

This target and its supporting objectives will be met by achieving the following intervention axes and sub-goals.

Intervention axis 1: Manage knowledge efficiently and effectively within the Hellenic and European Aquaculture sector.

- Create knowledge that is focused on outcomes and impacts on industry and ensure that research effort is not duplicated.
- Manage and transfer knowledge including the dedicated transfer to identified users and translation of research results for stakeholder uptake.
- Encourage the protection of legal rights, management of intellectual property and adherence to ethical standards in a manner that ensures open innovation and the development of a sustainable sector.
- Promote sustainable aquaculture practices through the transfer and application of knowledge and technology, including the challenges of food production, environmental protection, product safety and economic viability.

Intervention axis 2: Ensure the availability and efficient use of aquaculture research infrastructures across all boundaries to benefit the industry.

- Ensure international and inter-regional cooperation to develop research infrastructures that can meet emerging needs.
- Increase the awareness of existing research infrastructures (functionalities, scale, services and access) for all stakeholders.

Intervention axis 3: Collect and collate evidence for informed communications on the benefits of the Hellenic aquaculture sector for Society and the Environment.

- Develop an evidence-based knowledge resource to inform communications on the environmental and societal attributes provided by the different sectors of European aquaculture.

- Understand better the perceptions of aquaculture across Europe and identify stakeholder groups as advocates so that public communication campaigns are targeted and responsive.

Intervention axis 4: Foster and build the human capital of the Hellenic aquaculture sector.

- Promotion of formal and informal lifelong-learning opportunities at all levels as a central strategy to ensure knowledge transfer for a sustainable, innovative and competent workforce.
- Explore new models and partnerships for learning and its accreditation to encourage career development and innovation in the sector.
- Attract and retain talented, enthusiastic and able individuals to work in the aquaculture sector and to foster entrepreneurship.
- Seek to maximise appropriate career pathways and job satisfaction.
- Promote and enable peer-to-peer networking and collaboration as key components of an innovative Hellenic aquaculture sector.
- Create and sustain effective links between industry and research communities.

Regulation (EU) No 508/2014 (Article 50) mentions that in the period 2014-2020, EMFF will support the promotion of human capital and networking. In order to promote human capital and networking in aquaculture, the EMFF may support:

a) professional training, lifelong learning, the dissemination of scientific and technical knowledge and innovative practices, the acquisition of new professional skills in aquaculture and with regard to the reduction of the environmental impact of aquaculture operations;

(b) the improvement of working conditions and the promotion of occupational safety;

(c) networking and exchange of experiences and best practices among aquaculture enterprises or professional organisations and other stakeholders, including scientific and technical bodies or those promoting equal opportunities between men and women.

In order to foster entrepreneurship in aquaculture, the EMFF (Regulation (EU) No 508/2014, Article 52) may support the setting-up of sustainable aquaculture enterprises by new aquaculture farmers.

Support shall be granted to aquaculture farmers entering the sector provided that they:

(a) possess adequate professional skills and competence;

(b) set up for the first time an aquaculture micro or small enterprise, as managers of that enterprise; and

(c) submit a business plan for the development of their aquaculture activities.

In order to improve the overall performance and competitiveness of aquaculture farms, and to reduce the negative environmental impact of their operations, the EMFF (Regulation (EU) No 508/2014, Article 49) may support:

(a) the setting-up of management, relief and advisory services for aquaculture farms; (b) the purchase of farm advisory services of a technical, scientific, legal, environmental or economic nature.

In order to acquire adequate professional skills, aquaculture farmers entering the sector may benefit from support under point (a).

Support by EMFF for the implementation of community–led local development strategies (Regulation (EU) No 508/2014, Article 63) may be granted for the following objectives:

(a) adding value, creating jobs, attracting young people and promoting innovation at all stages of the supply chain of fishery and aquaculture products;

(b) supporting diversification inside or outside commercial fisheries, lifelong learning and job creation in fisheries and aquaculture areas;

(c) enhancing and capitalising on the environmental assets of the fisheries and aquaculture areas, including operations to mitigate climate change;

(d) promoting social well-being and cultural heritage in fisheries and aquaculture areas, including fisheries, aquaculture and maritime cultural heritage;

(e) strengthening the role of fisheries communities in local development and the governance of local fisheries resources and maritime activities.

From all the above it appears the need to support Universities and Institutes for providing advisory services, education and research to promote human capital, networking, entrepreneurship, competitiveness and innovation in the sector of Aquaculture. There is an apparent need to further create a cluster for aquaculture with the participation of the private sector (enterprises) and the public sector (Universities, Research Institutions), to facilitate and support, especially young entrepreneurs, in their very first steps.

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