Future of Aquaculture in Europe: Prospects under current conditions

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Abstract

Fish consumption is limited by wild stocks. Globally aquaculture is seen as a key for satisfying growing fish demand while preserving stocks. Whether the same holds true, for EU countries is an open question, due to high production cost driven by labour and other inputs like feed. This study presents a status-quo simulation to the year 2030 for EU countries using AGMEMOD, a partial equilibrium model extensively used for the analysis of the EU agricultural markets. In this case, the study is based on the extended version of AGMEMOD which explicitly accounts for aquaculture and capture fisheries. Although aquaculture and capture production will increase, fish demand will outpace both by 84% in the European Union. Aquaculture production will reach circa 1.4 million tonnes in 2030, and only ‘molluscs except cephalopods’ and ‘freshwater and diadromous fish’ will have important shares of aquaculture production to satisfy the growing demand. Aquaculture in EU will need more investment and technologies to alleviate pressure on capture production without hampering agriculture.

Keywords: Aquaculture, Fish demand, EU, baseline projections, partial equilibrium model, AGMEMOD

1. Introduction

Ensuring global food security is a main goal for sustainable development and at the same time a critical challenge for the future years. In 2015, 795 million of the global population were undernourished and by 2050 it is expected to reach 2 billion, out of 9.7 billion global populations (Msangi et al, 2013). Food production systems will need to be sustainable improved to feed growing population. Up to now cereals and meat are considered as prior sources for food proteins but water and soil degradation provoked by their intensive production, rangeland limitations for livestock and the changes in dietary patterns may give fish production a prominent role in achieving the challenge.

Fish is recognized as important source for micronutrients and fatty acids and represents 17% of all protein consumed globally (WWF, 2016). Global per capita fish consumption has increased over the years, from 9.9 kg in 1960 to 19.7 kg in 2013. To satisfy such high demand growth, fish production would need to increase globally by 60% in 2050. At the same time capture fish production faces ecological constraints as well: 31.4 % of global marine fish resources are already over exploited and about 58.1% are fully exploited (FAO, 2016). As a consequence aquaculture is regarded as an interesting production method to provide increasing global fish supply.

In recent years, fish supply for human demand has increased mainly due to the impressive rise of aquaculture production. In 1994, aquaculture represented 26% of global fish supply reaching 39% by 2004. Currently about 45% of global demand is covered by aquaculture production and around 89% of it was provided by Asian countries (FAO, 2016). In contrast, European Union (EU) accounts only for 2.4% of world aquaculture production covering only 9% of its total food fish demand. The EU as single market is a main importer of fish for human consumption, accounting for 18.4% of the global imports. Likewise, 73% of its domestic demand is satisfied with imports. Under these circumstances an increase of aquaculture production might be helpful from both a global and a domestic perspective. However, high production costs, competition with agriculture for natural resources and its state as young business sector compared with agricultural business, may hinder aquaculture development.

Seafood covers a wide range of different categories and species, of which developments vary among each other. The Food and Agriculture Organization (FAO) distribute fish species in 7 categories. However, projections of developments within the realm of seafood are mostly only available at an aggregated level. Different models of global seafood supply and demand such as the IMPACT Model (Delgado 2003, Msangi et al, 2013), the Asia Fish Model (Dey, 2008) or the Aglink-Cosimo model (OECD-FAO, 2016) establish long term baselines covering future changes in the fish sector in total, all supporting the relevance of aquaculture in satisfying growing human demand. Under the Aglink-Cosimo model, FAO (2016) estimates 52% share of aquaculture of global fish production by 2025, while under the IMPACT model this estimate grows to 60% by 2030, equalling the capture production level by 2030 (Msangi et al, 2013). Both studies raise concern about the intensified competition between aquaculture and livestock for fishmeal. There are also remarkable differences in specific species groups such as freshwater species, where 60% will come from aquaculture production (FAO, 2016). Nevertheless, these models are highly aggregated by sectors and regions, hindering the evaluation of interactions across fish categories within the EU member states (EU MS), main importer of fish. None of the previous models was appropriate to estimate the development of the aquaculture sector by categories and address impacts of changes in supply and demand drivers in the different fish groups. In contrast, AGMEMOD (AGricultural Member States MODelling details see Chantreuill, Hanharan and Van Leeuwen 2012, Salamon et al 2009) provides significant detail of agricultural market at EU MS levels. Additionally, AGMEMOD initial version has been extended to capture the dynamic of the fisheries and fish farming sectors. Therefore, this study uses AGMEMOD to present baseline outcomes for the fishery sector within the EU MS.

Aim of the paper is to reflect on the possibilities to provide quantitative projection[1] based on a fish model for European countries[2] and disaggregated fish categories that can be used to conduct impact analysis to capture effects of different policy measures, innovations and macroeconomic and environmental changes. This paper provides an overview of the current aquaculture market in Europe and integrates 1) estimates of fish supply and demand by categories and countries using AGMEMOD; and 2) long-term baseline projections of fish aquaculture supply for the European Union. The paper is organized as follows. Section 2 describes the aquaculture market in the EU. Section 3 presents the model methodology and data sources. Section 4 provides the projection results and discusses the outcomes of the empirical analysis and section 5 concludes with some remarks of next steps.

2. Aquaculture markets in the EU

Global fishery has increased by 160% from 62 mio tonnes in 1973 to 166.2 mio tonnes in 2014[3]. During the same period, production in EU shows a minimal growth of 3% and since 2000, there is a decline. Moreover, EU's global production share dropped from 7% in 2000 to 5% in 2014. Wild fish has the largest share in the total production (capture and aquaculture) which represents 85% of total fishery in the EU. Although this share has stayed constant over the last decade, capture fish depicts a decreasing path which is also mirrored in aquaculture.

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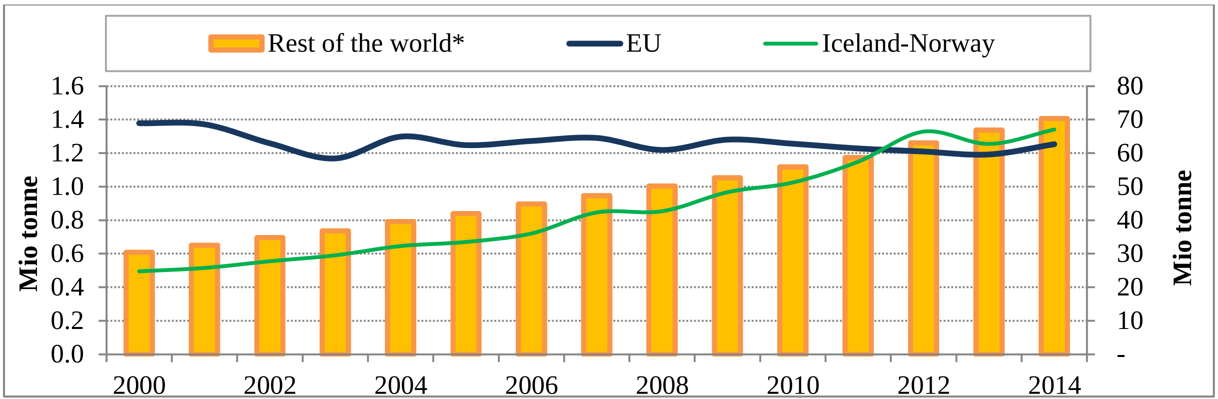
[1] The paper is based on draft results of an EU Horizon 2020 Project "Strategic Use of Competitiveness towards Consolidating the Economic Sustainability of the European Seafood sector". We would like to thank the EU Commission for its financial contribution. The project is focused on consolidating the economic sustainability of European fisheries and aquaculture sectors by boosting the competitiveness of EU seafood products. Under this project, model approach for the fishery market is designed with the purpose of assessing the EU's fishing and fish farming sectors (www.success.eu).

[2] The paper concentrates on the EU member states, but the project also covers other countries like Iceland, Norway and Turkey.

[3] Figures based on FAO FishStat database.

Figure 1 displays a slightly shrinkage in aquaculture production in the EU, in comparison with other European countries such as Iceland and Norway. These two countries (expressed as a group) have nearly tripled their production in 15 years. Five countries represented 75% of limited aquaculture in the EU in 2014: Spain (22%), United Kingdom (16%), France (16%), Italy (13%) and Greece (18%). However, only United Kingdom and Greece have increased their production since the year 2000, with 34% and 10% respectively. Nearly all the aquaculture production in EU is focused in three categories: Molluscs except cephalopods (49%), freshwater and diadromous fish (38%) and demersal marine fish (13%). While molluscs´ aquaculture production has declined by -20% since 2000, demersal marine fish production has significantly risen (50%). This is driven by the fact that the main producers, Greece and Spain, have notably improved their production, by 38% and 133% respectively.

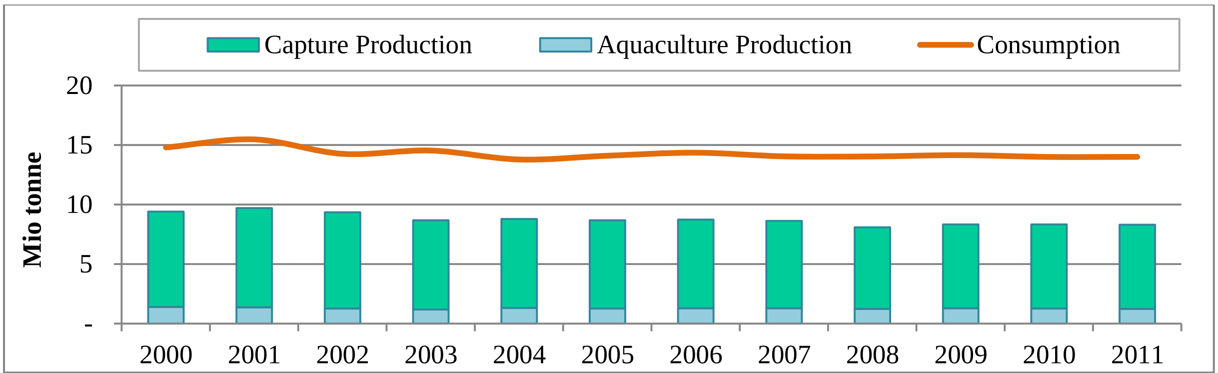


* Right axis for Rest of the World

Source: Own figure based on FishStat database

Figure 1. Development of aquaculture production (million tonnes) by region, 2000-2014

Pelagic and demersal marine fish are the most preferred fish with respect to consumption in the EU. Together with freshwater and diadromous fish, they represented 76% of the total fish consumption in the EU in 2011. However, the consumption of pelagic marine fish depicted a decline by 29% from 6.6 mio tonnes in the year 2000 to 4.7 mio tonnes in the year 2011[4], while demersal marine fish consumption remained quite static, displaying a slight decline from 4 mio tonnes in 2000 to 3.9 mio tonnes in 2011. In contrast, consumption of freshwater and diadromous fish has appreciable increased by 76%. Total fish consumption in EU has almost double fish production in 2011, despite it has remained stable during the last years.



Source: Own figure based on FAOStat and FishStat database

Figure 2. Wild fish and aquaculture production and consumption (million tonnes) in EU, 2000 - 2011

[4] Latest available consumption data cover the year 2011

3. The Supply Model

a. <u>State of the Art</u>

Partial and General Equilibrium (PE and CGE) models are used to project the mid-term supply and demand patterns of different production systems and assess impacts of technology, market and policy changes. Delgado et al (2003) included the fishery sector in a model of global supply and demand for food and feed commodities by the use of IMPACT, they developed a baseline for 36 regions to 2020 starting from the year 1997. The fish sector presented in IMPACT was disaggregated in four categories for human consumption: high-value and low-value fish, crustaceous and molluscs; and two for feed input: fish oil and fishmeal; for the purpose of evaluating the impacts of price changes with respect to different specie groups.

Aware of the importance of Asia in the fish market, the Asia Fish Model, was developed for nine major fish producer in Asia: Bangladesh, China, India, Indonesia, Malaysia, Philippines, Sri Lanka, Thailand and Vietnam (Dey et al, 2005). This model was developed as a tool for strategies development, attempted to highlight the effects of heterogeneity of fish types, productions sources and demand regarding to income groups (Dey et al, 2008). By using an Applied General Equilibrium model they evaluated demand classifying regions between urban and rural areas, and high and low income areas; applied for selected countries. Likewise, supply was differentiated across categories, either by production type (aquaculture and capture fishery), fish value type (high and low-value) or source type (freshwater or marine) depending on the country considered. Moreover, the model prioritizes species, according their importance in each country, which differed across the countries evaluated but limiting comparison across countries.

Based on the results from Delgado et al (2003), the World Bank in collaboration with the International Food Policy Research Institute (IFPRI), FAO and the University of Arkansas updated the IMPACT model in the “Fish to 2030” study (Msangi et al, 2013). Their objective was to simulate interaction across countries by projecting the global fish market into 2030. In that case, fish were grouped according their diet, the ones which require animal-proteins and others raised on a plant based-diet. Other additional category included fish that are grown in fertilized ponds, and in the case of molluscs, prawns and shrimp were excluded from the category and treated independently.

In the year 2010 the FAO in collaboration with the Organization for Economic Co-Operation and Development (OECD) developed the “FAO Fish Model” (FAO, 2012), for exploring the potential development for aquaculture and capture fishery. This fish model is based on the macroeconomic assumptions and prices employed by the agricultural market model AGLINK-Cosimo. In this manner, the fish model is linked to agricultural production to depict the interactions between the agricultural and fish sector. Although the FAO Fish model classifies supply between aquaculture and capture production, the demand side is presented as aggregated. The FAO Fish Model is the prevailing model used to present annually the state of the global fishery sector and its respective long-term projection.

Comparable to AGLINK which represents only aggregates for the EU, AGMEMOD captures details at EU member states levels (Jongeneel et al. 2016; Salamon et al. 2015). As AGMEMOD strives for member state projection results, its approach is used for projecting the fish markets for EU member states at category level. The paper shortly describes the implementation of a new fish model, disaggregating the supply side in two: aquaculture and capture production for seven fish categories, and applied for respectively supply, demand, and price formation.

b. The Fish Model in Agmemod

AGMEMOD (Chantreuill, Hanharan and Van Leeuwen 2012, Salamon et al 2009) is a dynamic, multi-country, multi-market, partial equilibrium model that details the main agricultural production and processing markets for all EU Member States and some EU neighbours. The model has been extensively used for the analysis of the EU agricultural markets and policies at Member State level as well as for generating baseline projections. The initial AGMEMOD version is extended to explicitly account for fisheries and fish farming sectors. To the common commodity market template already developed under AGMEMOD, data on fishery and aquaculture commodity markets of EU countries, Norway and Iceland have been added with respect to fish. The extended version covers supply, when possible, for a period from 1973 to the latest available year separated in to aquaculture and capture fish. The data for each country includes market balances measured in volumes and in addition prices. A second data set deals with explanatory, exogenous variables such as GDP, population growth, which were incorporated from the U.S. Census Bureau, International Data Base (2015), and technical progress and demand trends. A third set of information comprises prices elasticities of supply and demand, income, labour and capital cost elasticities. These elasticities are commodity-country specific and have been incorporated from the literature (Asche, & Bjoerndal, 2001, Fousekis et al, 2004, Asche et al, 2005, Dey et al, 2008, STECF, 2016), in order to get an starting base for the calibration procedure.

The fish module in AGMEMOD covers seven fish categories: *Cephalopods* (such as octopuses, squids, cuttlefish, nautiluses, etc.); other m*olluscs excluding Cephalopods* (such as mussels, oysters); Crustaceans (such as shrimp, prawn, lobster, crab, seabob, among others); *Demersal marine fish*; *Pelagic marine fish*; *Other marine fish*; and *Freshwater and Diadromous fish*. Data on capture and aquaculture fisheries markets for AGMEMOD have been compiled from two main sources:

- *FishStatJ (FAO)*: provides annual data on captured and aquaculture fish for each of the seven fish categories. From FAO´s FishStatJ database, the following data was used: capture and aquaculture production (quantity, tonnes); imports and exports of fishery products (quantity, tonnes); imports and exports of fishery products (value, thousand US$).
- *FaoStat's* Balance Sheets (FBS): provides data on balances for each country until 2011[5]. The model works with *Utilization* data from the database, which covers feed use, seed use, food use and other use.

Additionally, import data in values and quantity from FishStatJ is used to define wholesale prices, as a proxy of annual import unit values resulting from the division of import values by import quantities for each of the seven categories, including total fish as a whole.

Table 1 describes the main equations of the core model, which are standard for all countries and the fish categories. The respective endogenous variable is described on the left hand side of each equation. Distinctions between countries and species groups are represented within the model through parameters. Behaviour equations are computed using logarithmic functional forms. The equations include behavioural parameters, while the respective intercepts and elasticities of the equations are omitted for readability reasons.

[5] For 42 countries information is available until 2013, according FAO the data is in the process of being updated.

Table 1: Overview of equations in AGMEMOD fishery markets

Supply equations			
(1) Production of caught fish	$PROD\_TYPE_{indCntr,com,SPRc}$	=	f ($PI_{indCntr,comm, SPRc}$, $tp\_gr_{indCntr,comm,}$ $lab\_ind_{indCntr,comm, SPRc,}$ $cap\_ind_{indCntr,comm, SPRc}$)
(2) Production of aquaculture fish	$PROD\_TYPE_{indCntrc,com,SPRa}$	=	f ($PI_{indCntr,comm, SPRa}$, $tp\_gr_{indCntr,comm}$, $lab\_ind_{indCntr,comm, SPRc,}$ $cap\_ind_{indCntr,comm, SPRc}$)
(3) Total fish Production	$SUPPLY_{indCntr,comm}$	=	$PROD\_TYPE_{cc,com,SPRc}$ + $PROD\_TYPE_{cc,com,SPRa}$
Demand equations			
(4) Human demand	$HDEM_{indCntr,comm}$	=	f ($PC_{indCntr,comm}$, $pop\_gr_{indCntr}$, $inc\_gr_{indCntr}$, $hdem\_tr_{indCntr,comm)}$
(5) Total domestic use	$TUSE_{indCntr,comm}$	=	$HDEM_{indCntr,comm}$
Price equations			
(6) World market price	$PD_{indCntr,comm}$	=	PW_{comm}
(7) Consumer price	$PC_{indCntr,comm}$	=	$PD_{indCntr,comm}$ + $pctax_{indCntr,comm}$
(8) Producer incentive Price	$PI_{indCntr,comm,fishprods}$	=	$PD_{indCntr,comm}$
Other equations			
(9) Net exports	$NETEXP_{indCntr,comm}$	=	$SUPPLY_{indCntr,comm} - TUSE_{indCntr,comm}$
(10) World market clearing	$NETEXP_{row,it}$	=	$\sum_{realCntr} NETEXP_{realCntr,comm}$

Source: Own compilation.

Supply (Eq 1) is described as the aggregation of the two main production systems: capture fisheries (Eq 3) and aquaculture (Eq 2), which are expressed as two endogenous variables. On the other hand, Demand is only expressed by one aggregate commodity, due to insufficient information. Demand (Eq 4) is directly influenced by the variation on prices, population, income and consumption trends, while supply is affected by technological changes in production, prices, capital and labour costs.

Specific prices are represented to describe varying supply and demand conditions for both production types. As prices are not consistently available, unit values of imports have been used as proxy for trade. However, the diverting composition of trade within the fish categories across countries may lead to significant differences across the EU member states in the respective unit values. An alternative approach – not yet pursued – might be the use of selected tariff lines as price proxy.

Trade behaviour is designed as net-export (NETEXP) and it is calculated as the difference between total supply and total domestic use. The market clearing condition use the sum of net exports for the evaluated countries and equalizes it to the net exports of the rest of regions in the world (ROW) making the world net exports equal to zero.

Based on respectively the implemented equations, their parameters and projected values of the exogenous variables, AGMEMOD provides projections on an annual basis up to 2030. These projections are mainly driven by (1) world market prices for represented products, (2) macroeconomic variables such as GDP and population; and (3) demand and supply drivers like e.g. consumer preferences and/or production technologies. Through changes in these drivers their impact on fishery and aquaculture markets are analysed.

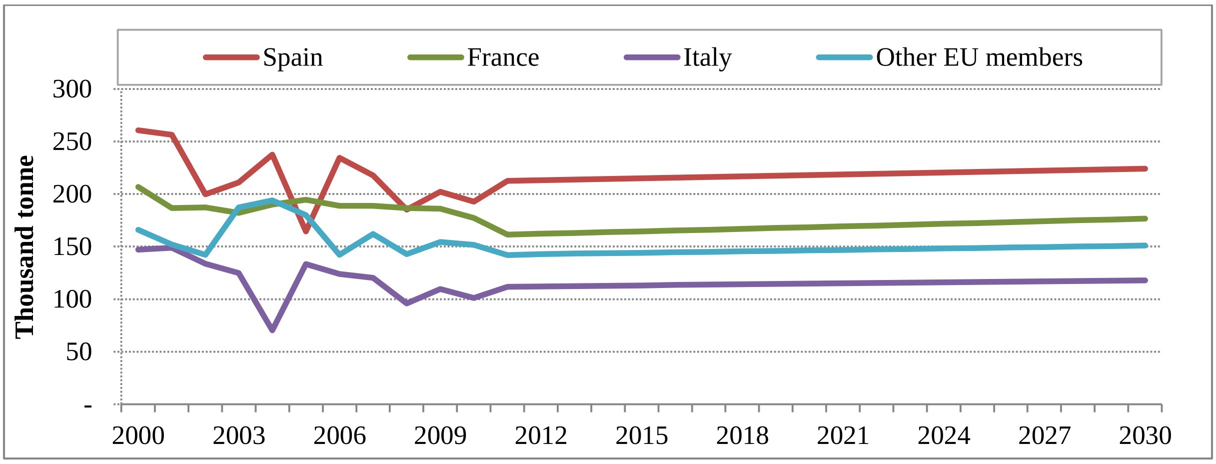
4. Results and Discussion

Population and income growth, new trends for healthy food and technical progress in fisheries definitely influence the development of the sector. Therefore, these four key drivers are included in the model as exogenous variables. The assumption about an increasing population in the EU amounts to circa 0.26% albeit it differs among countries, ranging between 0.2% and 1.2% with the exception of Germany that will meet a slight decrease of -0.19 %. For most of the EU state members, GDP growth will stay around 1% on average; but with the exception of Ireland, Sweden and United Kingdom, in which growth varies between 2 and 4%. Italy and Finland are the only countries that face a GDP decrease, although it is smaller than 0.5%.

Based on the assumptions concerning the exogenous variables the model system has generated a first baseline which was validated by experts. Through the use of a questionnaire, market expert knowledge has been exploited in order to validate the evolution path of fish demand and supply. This questionnaire was delivered to market experts of the fishery sector from the private sector and research institutions to obtain their opinion of the market development for each of the seven fish categories

Results for EU show an increase of 18% in fish consumption from 2011 to 2030 driven by population and mainly income growth. In contrast, total fish production depicts a slower growth 7 % across all member states, stemmed primarily by the limited increase in capture production. Thus, consumption levels would outpace supply and will over-shot by 84% total fish production in the EU member states. Production of aquaculture within the EU member states will increase until 2030; however, the production increase is slow, especially compared to the dynamics displayed in the Rest of the World. Although the model estimates a technology improvement for aquaculture production, experts agree with many other considerable factors that might stem the growth in this sector. Natural resources availability may lead to conflicts with agriculture associated to competition for water availability and land uses. EU will face problems in conversion agricultural land for aquaculture purposes. As aquaculture is a young sector compared with farm activities for crops and livestock production will need to develop ways of minimize use of water and increase yield production, to reduce the pressure of the agricultural sector. However, the major constraint in aquaculture is considered the feed for two main reasons. First, farming of predatory fish places pressure on wild stocks for production of fishmeal. Secondly, aquaculture is competing with agriculture for supply of feed, either fishmeal or from vegetable sources as soy meal. Initially, fishmeal was allocated to terrestrial livestock production, such as poultry and pig farming. After the development of aquaculture, demand for fishmeal has increased, while fishmeal production has remained almost unchanged. Thus, poultry and pig sectors might find a solution in vegetable fish meal.

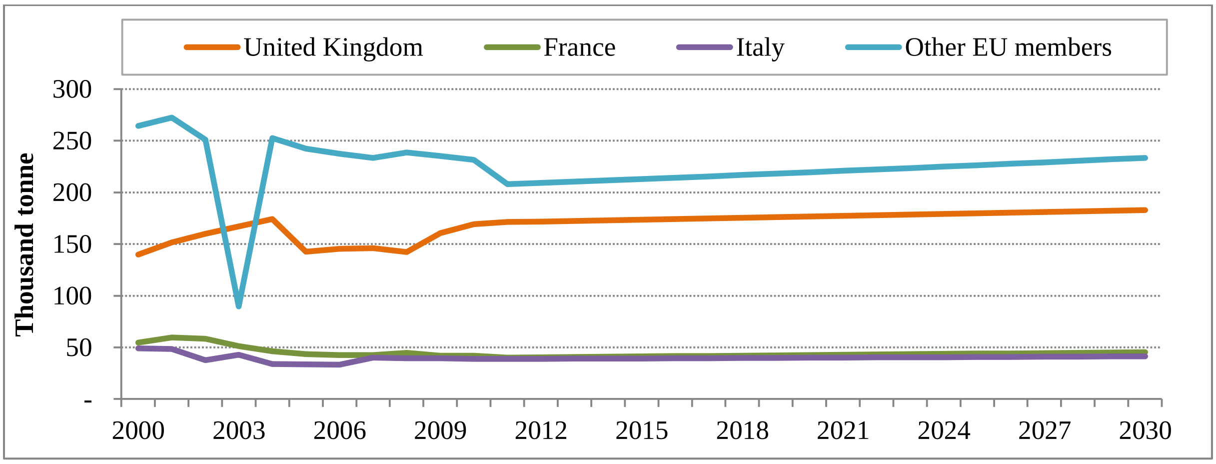
Aquaculture production will reach circa 1.4 million tonnes in 2030, 10 % higher than 2011, encouraged by the increase in molluscs except cephalopods (7%), freshwater fish (10%) and demersal marine fish (27%). Together, these three group species are the main aquaculture produce and by 2030 represent nearly 99.7% of total aquaculture production. Molluscs are the dominant specie produced by aquaculture in the EU. The main producers in terms of volume (life weight) are Spain, France and Italy. At the beginning of the millennium, aquaculture production of molluscs suffered from a remarkable drop (see Figure 3). However, due to consumption preferences and technological improvement in the aquaculture systems, its production seems to slightly recover up to 2030, but despite it is expected to remain under the initial volume levels from year 2000. As molluscs are non-carnivorous species that live in marine or freshwater and even terrestrial habitats, the limited accessibility to water of good quality and land will influence in its slow recovery.



Source: Own figure based on projections

Figure 3. Evolution of aquaculture production of Molluscs in the EU 2000-2030 (million tonnes)

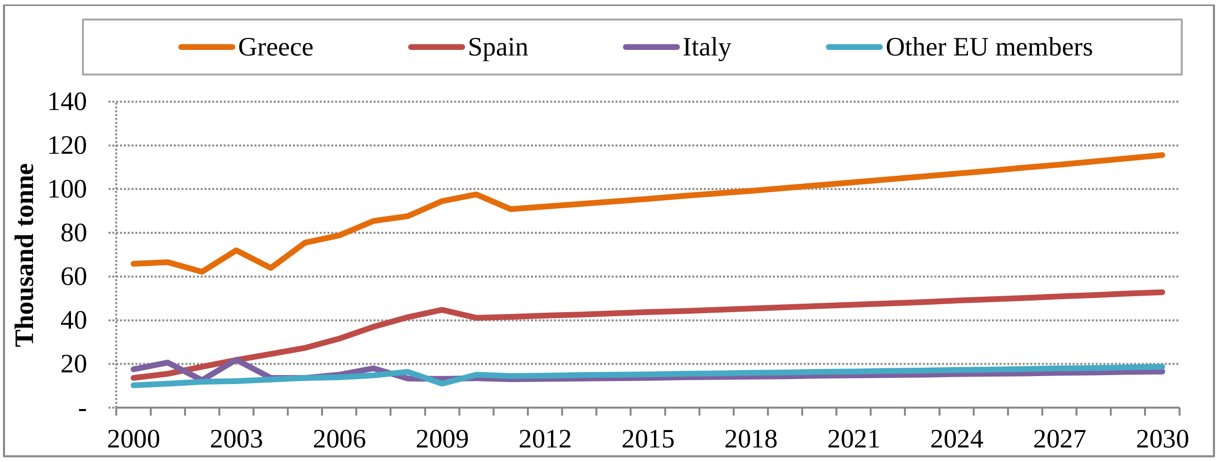
Freshwater and demersal marine fish comprise omnivorous and carnivorous species. Therefore, fishmeal availability would affect their production path. Carnivorous species required more feed, thus, their production is more input intensive and feed dependent. Since wild production is increasing, fishmeal continues growing. However, in countries with intense livestock production, competence for feed use would lead to increase fishmeal prices. The rise in feed cost would limit the expected growth in aquaculture of these fish categories in some countries. Freshwater fish production represents 36% of total aquaculture production in EU by 2030. United Kingdom stands out as the main supplier, followed by France and Italy (see Figure 4). From these three, United Kingdom is the only one with an expected growth. On the contrary, France and Italy will face a reduction of circa -17% by 2030 in comparison with the initial values in 2000.



Source: Own figure based on projections

Figure 4. Evolution of aquaculture production of Freshwater fish in the EU 2000-2030 (million tonnes)

Aquaculture demersal marine fish have steadily grown (see Figure 5). Greece produces 57% of aquaculture demersal marine fish in EU and it is expected to steeply rise in 75%. However, the fastest increase is observed in Spain, which production in volume terms will abruptly rise from 13.6 thousand tonnes in 2000 to 52.8 thousand tonnes in 2030.

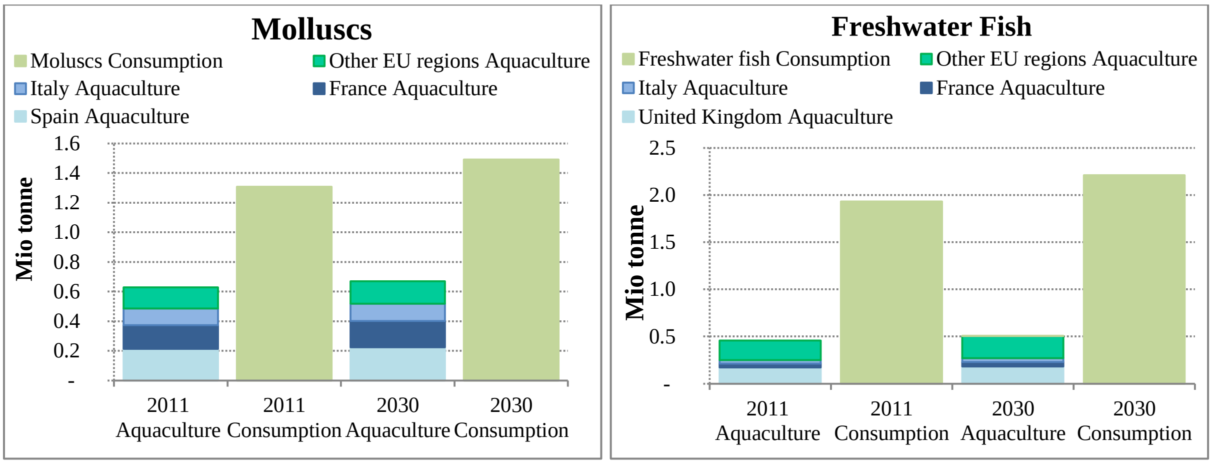


Source: Own figure based on projections

Figure 5. Evolution of aquaculture production of demersal marine fish in the EU 2000-2030 (million tonnes)

Fish consumption in EU shows an expanding path to 2030, as results of an increase of living standards and recognition of fish as nutritious food in comparison with meat. The major fish consumer countries in EU will increase their demand in at least 9%: United Kingdom (22%), Spain (19%), Germany (16%), France (13%) and Italy (9%). These five countries together represent 64 % of total consumption by 2030. The most preferred fish categories remain pelagic marine fish, demersal marine fish, freshwater fish and molluscs, representing 35%, 28%, 13% and 9% respectively of total fish consumption in EU. Aquaculture production in EU of pelagic marine fish is still minimal, and despite its expected growth of 17% by 2030, the production level will remain under 4 thousand tonnes.

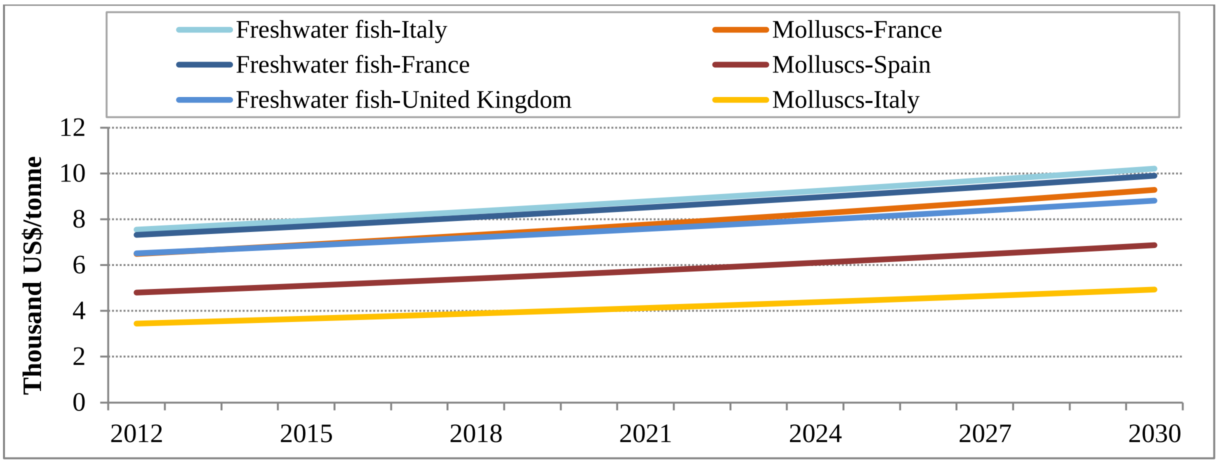
By 2030, 45% of consumption of molluscs in EU and 23% of freshwater fish consumption will be satisfied by domestic aquaculture production. Spain, France and Italy together will provide about 77% of molluscs from aquaculture within the EU (see figure 6); while United Kingdom, France and Italy will provide 54% of freshwater fish from aquaculture in EU. In contrast, demersal aquaculture production in EU represents only 4% of its demand in EU.



Source: Own figure based on projections

Figure 6. Consumption of molluscs and freshwater and diadromus fish in EU and main EU aquaculture producers in 2011 and 2030 (mio tonnes)

Prices in nominal terms between countries and categories may differ. However, they are expected to be higher than in 2011 motivated by the growing demand-supply gap. For important aquaculture producing countries such as Spain, France and Italy, this positive trend will promote aquaculture production. Prices of freshwater fish in the EU will remain higher than for Molluscs; although in the case of France prices for both species are very similar (see Figure 7).



Source: Own figure based on projections

Figure 7. Price Projection for Molluscs and Freshwater fish by countries (thousand US$/tonne)

5. Summary and Conclusions

The present study aims to present projections of the aquaculture sector in the European Union, distinguished by category of species and countries. Thus, it may expect that in EU aquaculture production would alleviate the pressure of capture fisheries in only three fish categories: molluscs, freshwater and diadromous fish and demersal marine fish. For this analysis, a new module for the fish market was developed and implemented in the AGMEMOD Model. Based on the extended AGMEMOD model, projections until the year 2030 for the European sea food market were conducted considering market drivers as population growth, income, demand trends and technological improvements in production, and validated by fish market experts.

The projections are driven by assumptions on exogenous factors. Changes in those factors may lead to quite different outcomes, although some variations of variables did not indicate strongly different outcomes. Some interactions are not yet captured by the model, for example supply of non-protein feed in the aquaculture sector or a demand shift towards consumption of fish from aquaculture to pursue more sustainable production system. Additional factors may lead to diverting outcomes. There are other factors that are not yet considered in the model such as biomass stocks, climate changes, detailed fishing regulation, that although affect directly the capture fishery would indirectly either promote or slow down the aquaculture production path. The increase in wild stocks, increase of quotas levels and policies that facilitate fishing rights will encourage capture fisheries. Although feed fish input increases, this also creates substitution between both production systems.

The results show an increasing gap between fish demand and supply in European countries. EU fish demand is projected to reach 16.5 million tonnes by the year 2030 and fish production only 7 million tonnes, whereas 20% will be contributed by aquaculture production mainly from Spain, France, United Kingdom and Italy. Although aquaculture production in EU is increasing as well, it will only be able to satisfy 8% of its total consumption. However, as aquaculture in EU is focused in some species groups such as molluscs, freshwater and diadromous fish and demersal marine fish, the share of these specific cases is much higher. In the case of molluscs this figure reaches 45%, and 23% for freshwater and diadromous fish. Demand will outpace fish supply in EU provoking a price increase. Thus could promote aquaculture production. Moreover, experts expect a recovery in wild stocks may allow increases in capture production. But only a limited number of fish categories are ruled by quotas and not in all cases quotas are binding as the example of plaice in Germany show. In contrast, aquaculture production will smoothly go up. Furthermore, since demand does not distinguish between capture or aquaculture fishery, for those categories without quotas capture fishery still represents an important competitor for aquaculture growth. On the other hand, aquaculture may focus in niche markets. Since standards of living are improving in the EU, higher value fish is becoming more preferred.

So far, under current foreseeable circumstances aquaculture in EU member States will only depict a quite limited growth, while only a limited number of member states play a key role. Thus, pressure on wild stocks would not be brief alleviated. To change this situation will require significant efforts with respect to policies, to protect wild stocks, technologies and investments, to improve productivity in aquaculture that face the scarcity of available land and water resources, and feed conversion, to satisfy the increasing feed demand. However, these changes will bring conflicts with agriculture for natural resources and trades off for feeding purposes.

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