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-
The EU Aquaculture Sector – Economic report 2020 (STECF-20-12)

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Abstract

Commission Decision of 25 February 2016 setting up a Scientific, Technical and Economic Committee for Fisheries, C(2016) 1084, OJ C 74, 26.2.2016, p. 4–10. The Commission may consult the group on any matter relating to marine and fisheries biology, fishing gear technology, fisheries economics, fisheries governance, ecosystem effects of fisheries, aquaculture or similar disciplines.

This report on the Economic Performance of the EU Aquaculture sector 2021 is the seventh report of its kind produced for the sector and provides a comprehensive overview of the latest information available on the production, economic value, structure and competitive performance of the aquaculture sector at the national and EU level. This report includes data for 2008 to 2018 and nowcasting for 2019. The data collected is reported by national totals and by segments divided on species. The sector has increased production over the period of data collected, and the turnover and economic performance indicators have increased over time. The EU aquaculture sector reached 1.2 million tonnes in sales volume and €4.1 billion in turnover, in 2018. The overall number of enterprise were estimated to 15 thousand, whereas the total number of employees reached 69 thousand in 2018.

The report furthermore contains three special chapters on the Covid-19 situation and its impact on the EU aquaculture sector, a chapter on the developed methodology for the nowcast, and finally a chapter analysing the social variables collected under EUMAP for the first time for the aquaculture sector.

SCIENTIFIC, TECHNICAL AND ECONOMIC COMMITTEE FOR FISHERIES (STECF) - The EU Aquaculture Sector – Economic report 2020 (STECF-20-12)

Request to the STECF

The STECF is requested to review the report of the STECF Expert Working Group meeting, evaluate the findings and make any appropriate comments and recommendations.

STECF observations

Following the 2020 call for economic data on the EU aquaculture, EWG 20-12 was requested to analyse and comment on the economic performance of the EU and national aquaculture sectors between 2008 and 2018, produce a nowcast for 2019 and analyse the effect of the COVID-19 outbreak in the aquaculture sector during the year 2020. It should be noted that this report is made on a biennial basis, and EWG 20-12 updated the time-series of the previous 2018 report, now including data for 2017 and 2018. Additionally, and for the first time, social data on gender, age, education and nationality were provided by the member states under the EU-MAP and could be analysed by the EWG.

The EWG met virtually, from 1-5 February 2021, and was attended by a group of aquaculture economic experts consisting of 32 experts from 22 countries and 3 JRC experts. The 2021 Economic Report of the EU Aquaculture Sector is the seventh report of its kind, providing a comprehensive overview of the latest information available on the production, economic value, structure and competitive performance of the aquaculture sector at the national and EU level for the years 2008 to 2018, covering the marine fish, shellfish and freshwater fish, segments. The EU aquaculture sector reached 1.2 million tonnes in sales volume and EUR 4.1 billion in sales value in 2018. This corresponds to an increase of 2% in sales volume and 11% in the sales value compared to 2016. However, the overall EU aquaculture sector has experienced a slight decrease in all economic performance indicators in 2018 compared to 2017. The negative economic development observed in 2018 compared to 2017 is driven by the marine fish segment, whereas the segments freshwater fishes and shellfish, experienced a slight increase.

STECF observes that for the first time a nowcast has been produced. In the EWG 20-12 this was performed for the year 2019. STECF notes that the nowcast is based on a similar methodology as the one used in the Annual Economic Report of the EU fishing fleet. The nowcast produces 2019 estimates of production in volume (total weight of sales), production in value (gross sales), and employment (both persons employed and FTE) at national level and for EU aggregate series.

A nowcast was also trialed for 2020, but reliable estimates could only be obtained for four countries, which is not sufficient for a quantitative nowcast for the overall EU sector. Furthermore, the impact of COVID-19 made extrapolation of data from previous years highly uncertain and the EWG 20-12 refrained from presenting estimates for 2020. Therefore, a key indication of the development of the aquaculture sector in 2020 is solely based on two surveys performed by the EWG, one asking for data to the EU aquaculture organizations and enterprises (58 interviews with enterprises and representatives of Producers' Organizations in 17 Member States) and a second one filled by the EWG experts (20 in total) which were requested to provide a brief description of the observed impacts on their national aquaculture industries. Additionally, the EWG experts participated in a Delphi survey in two waves for estimating the impact ranges in the same key performance indicators analysed with the producers' group.

Results show how that sales volume is expected to decrease more than 10% and prices are expected to fall by almost 5% due to the disrupted supply lines caused by the COVID-19. Furthermore, costs are increasing because fish/shellfish are kept longer in the aquaculture facilities to avoid losses. Together, these factors indicate an overall income loss in 2020 of about 10% for aquaculture farmers in the EU on average compared to 2019. According to the findings of the EWG, it seems that the employment was not affected in 2020, in a short run perspective.

STECF notes that there are some gaps in data time-series due to some Member States not reporting all their production (low response rates or minor segments). Additionally, the transition from DCF to EU-MAP has led to data breaks for some countries due to some changes in the definition of some sector segments between DCF and EU-MAP in some Member States.

STECF notes that under the EU-MAP, a minimum threshold of production for data collection was introduced. This causes consistency problems when interpreting the time series of the different indicators produced at national level when there are many small enterprises (e.g. for the case of Italy). The main consequence of these changes is the analysis at aggregated EU level does not fully match with the sum of the disaggregated analyses by aquaculture segments (divided by production techniques and species produced that present more data gaps than the aggregated values).

STECF further notes that the new thresholds also affects the comparison between EU-MAP and EUROSTAT data sources, where differences still occur when producing the same indicator.

STECF comments, observations, recommendations etc.

STECF concludes that the report provides a good and reliable overview of the economic performance of the EU aquaculture sector. However, the lack of obligation to provide data for the freshwater segment limits the possibilities for an overall EU data analysis of the entire sector and weakens the conclusions drawn from it. Furthermore, some data provision issues remain, including late submission (and continuous submission during the meeting) which reduces the available time that the EWG has to analyse the data and the drivers behind the indicators produced.

The differences between EUROSTAT and the data call used to produce the EWG 20-12 report are based on different definitions of the total population. Both DCF and EU-MAP collected data on the production of companies whose main activity is aquaculture while Eurostat collects data from the companies about their total production (even if part of it does not come from the aquaculture). Other sources of discrepancies with EUROSTAT are due to the threshold introduced in the EU-MAP data collection and confidentiality issues due to low samples. Therefore, STECF concludes that although a further convergence among the two data sources is desirable, these differences will persist in time, with EUROSTAT displaying in general higher production and employment values than those reported under the EU-MAP.

STECF concludes that the nowcasting procedure, based on the methodology of the AER of the EU fishing fleet, should be further developed specifically for aquaculture, including a prospective analysis of the available data (outside the data call) that could help produce more robust estimates of the indicators than the ones produced by the EWG 20-12.

STECF concludes that due to the increasing workload of the EWG, the need for data checks during the meeting and testing of an improved nowcast methodology, additional effort could be engaged for some preparatory work ahead of the meeting. This could be done through an ad-hoc contract or a preparatory EWG meeting where the data quality checks and the preparation of the nowcasting methodology is performed.

STECF concludes that the social data analysis provided by the EWG provides an important value added to the report as it gives the social perspective of the sector (e.g. age, gender, education and distribution of employment) and not only gross numbers such as FTE. However, to improve the reliability of this data, STECF concludes that the future provision of it by Member States and corresponding data calls should follow the guidelines in terms of aggregation and categories provided by the PGECON. In particular, the EWG suggested a better overview of the social dimension of the aquaculture sector would be provided if the age group 40-64 was split into smaller age categories and data was collected and reported at segment and/or technology level.

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REPORT TO THE STECF

EXPERT WORKING GROUP ON
The EU Aquaculture Sector – Economic report 2020
(EWG-20-12)

Virtual meeting, 1-5 February 2021

EXECUTIVE SUMMARY

The 2021 *Economic Report of the EU Aquaculture Sector* provides a comprehensive overview of the latest information available on the production, economic value, structure and competitive performance of the sector at the national as well as the EU level for the years 2008 to 2018. The current report replaces previous aquaculture reports.

In this report, a special effort has been made to present the development of the entire EU aquaculture sector from 2008 to 2018. The totals and the time trends presented in chapter 2 of this report are based on the data collected under DCF and EU-MAP, supplemented with EUROSTAT and FAO data, estimating missing values to be able to give a comprehensive overview of the EU aquaculture sector. Furthermore, a first attempt to do a nowcast for 2019 and 2020 is included in the report. However, do to the special circumstances with the Covid-19 pandemic, the nowcast only provides data for 2019, whereas indication of the development in 2020 is provided in a special chapter on Covid-19 effects on the EU aquaculture sector.

This report represents a transition from the former Data Collection Framework (DCF) program to the newly implemented EU-MAP program. For this data call, Member States should report data for 2017 and 2018 under the EU-MAP. Due to a new segmentation in the EU-MAP compared to DCF, some segments can only be presented with the new data in order to provide consistent results. Furthermore, due to the fact that United Kingdom has left the EU, data reported from United Kingdom is not part of the EU overview in chapter 2, however, a national chapter is provided in appendix I and data is integrated as a separate line in the different sectors in chapter 3.

Overall, the performance of the aquaculture sector is improving. The EU aquaculture sector reached 1.2 million tonnes in sales volume and €3.9 and 4.1 billion in turnover, in 2017 and 2018. This corresponds to an increase of 2% in sales volume and 4% and 11% in the turnover compared to 2016. The overall EU aquaculture sector has experienced a slight decrease in all economic performance indicators in 2018 compared to 2017. The negative economic development is driven by the marine fishes segment, whereas the segments freshwater fishes and shellfish, experienced a slight increase.

The effects of the Covid-19 pandemic on the EU aquaculture sector has been considered in a special chapter based on a small survey conducted among aquaculture producers, stakeholders and experts in the beginning of 2021.

A special chapter on the nowcasting procedure for the aquaculture sector is provided describing the development of the nowcasting tool and with an annex providing the methodological aspects of this exercise. The tool has been used to predict the development beyond the data provided within the data-call.

Finally, an analysis of the social data on gender, age, education and nationality provided by the member states under the EU-MAP has been analysed for the first time and is presented in a separate chapter.

To conclude, the EWG were able to adequately address all subject related to the TOR including an analysis of the Covid-19 effects on the EU aquaculture sector, a first attempted to provide a nowcast for the sector and develop a tool for this exercise and performing an analysis of the social data provide under the EU-MAP. Under each national chapter, there is a short summary of 3-5 lines describing the individual national sectors for each Member States.

KEY FINDINGS

The EU aquaculture sector reached 1.2 million tonnes in sales volume and €4.1 billion in turnover, in 2018. This corresponds to an increase of 1% in sales volume and 6% in turnover mostly due to increasing prices compared to 2017 as the production volume was almost the same as the year before. Compared to 2016, the increase in sales volume was 2%, whereas the turnover increased 11%. The estimates of the production volume and value are based on data collected under the DCF and the EU-MAP complemented with Eurostat and FAO data to provide a comprehensive overview of the aquaculture sector for all EU27 MS. EU aquaculture production is mainly concentrated in four countries: Spain (27%), France (18%), Italy (12%), and Greece (11%), making up 69% of the sales weight. These four countries are furthermore covering 62% of the turnover in EU27.

The total number of enterprises in EU is estimated to be around 15 thousand. More than 80% of the enterprises in the aquaculture sector are micro-enterprises, employing less than 10 employees.

The number of employees and full time equivalents (FTE) in EU was estimated to be 69 thousand and 39 thousand, respectively, in 2018. The degree of specialization slightly decreased from 2017 to 2018, which is considered the effect of the increasing contribution from the shellfish sector resulting in a decrease in the ratio between employees and FTE's. The use of part time labour contributes significantly to the workforce in the European aquaculture sector. The average yearly wage was €25 700, corresponding to an 11% increase compared to 2017.

Profitability for the EU aquaculture sector was positive in 2018, however the Gross Value Added decreased by 8% and EBIT decreased with 23%. The labour productivity decreased by 3%.

The EU aquaculture sector has three main production sectors: Marine fish, Shellfish and Freshwater fish production. The marine sector is the most important economically and generated the largest turnover of €1 811 million, followed by the shellfish sector with €1 266 million and the freshwater sector with €1 016 million and.

The main species produced in terms of value are rainbow trout and European seabass, whereas mussels dominate in weight. In the marine sector, Greece is the main producer of seabream and seabass covering 53% of the value.

In the shellfish sector, France and Spain are the most important countries in terms of production volume and value, employment and numbers of enterprises. France is the main producer of oysters covering 86% of the total production, whereas Spain is the main producer of Mediterranean mussels covering 50% of the volume. The main producer of clam is Italy covering 87% of the production.

The main species produced in freshwater is trout in terms of volume 53% and value 56%. The most important producers in terms of weight are Denmark (25%), Italy (21%), and France (20%). Carp is another important species mostly produced in Eastern Europe, where the main producer reporting under DCF are Hungary and Romania.

Covid-19:

The Covid-19 outbreak has shocked the economic activities and aquaculture is not an exception. The results from the different studies with the selected groups within this analysis point to a decrease in all income sources and an increase in all cost items. The most affected segment appears to be shellfish, at least in the decrease of incomes, as costs have not increased as much as in the other segments. Freshwater aquaculture follows in the rank of impacted segments and marine farming stands as the less affected industries. Although the important differences across species, industries and countries, the combination of decreased incomes and increased costs always is a challenge to the profitability in the sector. In experts' opinion the situation will be overpassed when the pandemic will be finally under control. However, this perception may change if the pandemic and the mitigation measures persist longer in time.

Nowcast:

Within this report, a nowcast has been conducted for the first. Carrying out a nowcast for the aquaculture sector is a considerable challenge, considering that the availability of economic data in official statistics at the European level and in other supranational organizations and global databases is lower than for other activities, such as fisheries or fish processing. The methodology developed for this report has been applied to make a preliminary attempt of nowcasting within this report, which could be improved in upcoming reports.

The results of the nowcast for national totals in 2019 are included and analysed in the EU overview chapter on sales volume, turnover and employment. Due to the special situation with the Covid-19 pandemic nowcast results for 2020 are not presented do to the high uncertainty for this year and lack of data reported by the member states. Instead, preliminary discussion on the effects on 2020 is presented in the special chapter on Covid-19 and in each national chapter produced by the experts.

Social data:

An analysis of social data collected under the EU-MAP has been performed for the first time. The data collected covers gender, ages, education and nationality of the people employed in the aquaculture sector.

The results show that the persons employed in the sector are primarily male (76%) and that the age class 40-65 constitutes about 43% of total employment. Education level shows large differences among MS’s, the production technology used and production sectors. The majority (83%) of people employed in the aquaculture sector are nationals of their own country, whereas the rest mainly comes from other EU MS’s. This is true for all technologies and production segments as well. The high share of national employment is in line with the findings for the fish processing industry.

1 INTRODUCTION

The 2021 biennial Economic Report of the EU Aquaculture Sector is the seventh report of its kind produced for the sector and provides a comprehensive overview of the latest information available on the production, economic value, structure and competitive performance of the aquaculture sector at the national and EU level for the years 2008 to 2018.

Europe represents one of the largest markets for seafood and is the second largest trader of seafood products in the world and consumption has steadily increased over the past decades. Per capita consumption is estimated to be 24 kilograms, in 2018 (EUMOFA 2020). On a global level, production of seafood for human consumption is almost equally divided between aquaculture and fishery. However, the EU market is still dominated by products originating from fisheries covering around 75% of the available seafood products. EU's consumption of seafood products is mainly covered by import making up around 60% of the total supply. The EU is therefore highly dependent on imported seafood to the EU market.

The future demand for fish is expected to increase due to increasing population and income and health benefits associated with fish consumption. The growing demand offers a unique opportunity to expand the aquaculture production in the EU. However, this also implies that the EU farmers continuously succeed in staying competitive on the global market for seafood products.

To increase EU own supply of seafood products, aquaculture seems to be the most obvious choice since the supply from fisheries has been stagnating since the late 1990's. However, the EU aquaculture production has over the period from 2008 to 2018 been quite stable and growth in global production is dominated by Asian countries covering about 90% of the global production volume. In contrast, the EU contribution to world aquaculture production (including aquatic plants) has been decreasing significantly over time in both volume and value terms, representing only 1.0% and 1.5% of global production in 2018 (FAO 2020).

A precondition to move the European aquaculture sector forward is to establish and increase the knowledge of the existing aquaculture production. In that respect, this report is an important contribution providing economic information on an overall EU level and furthermore providing a detailed description on the national level on production of main species produced and technique used in the sector.

This report responds to the requirements of the Terms of References (TOR), through the following structure. After the executive summary and key findings, a short introduction is presented in Chapter 1. Chapter 2 provides an overview of the EU aquaculture sector. Chapter 3 includes a detailed analyses of the aquaculture sectors (i.e. marine, shellfish and freshwater) and of the main species produced. Chapter 4 analyses the economic performance, structure and main species produced by each Member States as well as provides an outlook for future production trends.

This report includes three special chapters. Chapter 5 provides an assessment of the effects of the Covid 19 pandemic on the EU aquaculture sector. Chapter 6 provides an overview of the nowcasting tool provided for this report and further description of the methodology can be found in as an annex. Chapter 7 provides a first attempted to analyse the social data provided under the new EU-MAP.

Again, this year, a special effort has been made to provide time trends for the data collection period from 2008 to 2018 using estimated values when data has not been available under the DCF or EU-MAP. To support this effort, a nowcast tool has been developed for the aquaculture sector in order to estimate data for the years 2019 and 2020. However, do to the Covid-19 pandemics effects on the aquaculture sector, only estimates for 2019 are presented. The results of this effort can be seen in the EU overview (chapter 2) and the method is further described in an annex.

This report represents a transition from the former DCF program to the new and the recently implemented EU-MAP program. For this data call, Member States should report data for 2017 and 2018 under the EU-MAP. Due to a new segmentation in the EU-MAP compared to DCF, some segments can only be presented with the new data in order to provide consistent results. Furthermore, due to the fact that United Kingdom has left the EU, data reported from United Kingdom is not part of the EU overview in chapter 2, however, a national chapter is provided in appendix and data delivered according to the data call is integrated under the different sectors in chapter 3.

Data delivered from the reporting countries continue to improve, however, the EWG still encountered some data gaps. This relates primarily to the freshwater sector for which reporting is not mandatory, the newly implemented threshold and non-reporting countries. Details about data issues and how they have been addressed are explained in an annex. Furthermore, a returning issue is that countries report the data to late and that data have to be corrected during the meeting.

Finally, the report is completed with a Glossary, and the list of EWG participants.

1.1 Terms of Reference for EWG-20-12

The report has been produced by a group of aquaculture economic experts convened under the Scientific, Technical and Economic Committee for Fisheries (STECF). The expert group consisted of 32 experts from 22 countries and 3 JRC experts.

Following the latest call for economic data on the EU aquaculture, EWG 20-12 is requested to analyse and comment on the economic performance of the EU and national aquaculture sectors between 2008 and 2018.

In 2021, the special chapters contain:

- A survey on the impact of the Covid-19 pandemic and its consequences for the European aquaculture sector in 2020.
- A nowcast methodology report and the first attempted to do nowcasting using the data and knowledge provided by the expert group
- An analysis of the social data provided under the EU-MAP for the aquaculture sector.

TERMS OF REFERENCE

Background and objectives

The report on the EU Aquaculture Sector is one of the main sources of economic and socio-demographic data for scientific advice on the performance of the EU aquaculture industry. It is also increasingly used by scientific bodies, national administrations and international institutions.

Following the 2020 DCF/EU-MAP call for economic data on the EU aquaculture sector, the EWG is requested to analyse and comment on the economic performance of the EU and national aquaculture sectors between 2008 and 2018 (2019 when available).

The report should provide an in-depth look at the different factors affecting the economic performance of the EU aquaculture industry with a special focus on the major drivers and issues affecting the sector. Besides interpreting and explaining the quantitative values, the report should contain qualitative information and analysis on the drivers and trends in aquaculture performance and other aspects of policy relevance based largely on the scientists' expert knowledge. The main objectives of the report is to obtain high quality interpretation of all data outputs to ensure the usefulness of the report for DG MARE's policy development, Member States and the industry. Among other, the relevance and role of some or all of the following factors could be taken into account: markets and trade determinants of aquaculture production, competitiveness, market prices and consumption, sustainability, innovation, links and interconnections with the local fishing fleet and the fish processing sector, the role of European Maritime Fisheries Fund support, contribution to the local communities and the Blue Economy, strengths, weaknesses, opportunities and threats.

To achieve that, the main socio-economic indicators, if possible and where relevant, should be put into context with homologous figures at the EU and national levels, e.g., national average salaries, GDP, etc. Imputation of missing values may be required to obtained coherent time series and indicators that reflect a robust estimate of EU aggregates.

Experts are asked to analyse the sector and its components. Given the social importance of this activity in many communities, particular emphasis should be paid to the socio-demographic aspects of the analysis including trends on employment, salaries, labour productivity and breakdown of the aquaculture employment by gender, education level and nationality (nationals, EU nationals, non-EU nationals).

The final draft of the EWG report will be reviewed by the STECF during its plenary meeting in Spring 2021.

Structure and content

Being the basis for the structure of the report, the EWG is requested to work and comment on, at least, the following items:

- An executive summary containing the key findings (abstract). This should also include a 2-3 lines abstract of the main features / data for each Member States.
- An overview of the economic performance of the EU aquaculture sector. This should include the drivers and main trends based on expert knowledge. It must include the following:
    - EU aquaculture sector overview. This would include the evolution for the EU total for the main variables as well as a comparison across aquaculture segments (marine finfish, marine shellfish, freshwater).
    - Economic data and performance indicators (e.g. production, revenue items, cost items, earnings, profitability, etc.).
    - Employment and socio-demographic indicators (e.g. employment by gender, labour productivity and average salaries, education level, nationality, etc.).
    - Comparative across Member States highlighting the differences and similarities of national industries.
    - Analysis of economic performance by aquaculture segment (marine finfish, marine shellfish, freshwater) and species.
    - Drivers, trends and outlook.

- - National chapters on the economic performance of the fish processing industry providing:
    - National aquaculture overview including industry structure.
    - Production and sales.
    - Economic performance indicators.
    - Employment and socio-demographic indicators.
    - Structure and performance of aquaculture segments.
    - Description of trends and drivers based on expert knowledge.
    - Outlook.

In the sections of drivers and outlook, the expert should use their expert knowledge to provide an indication about what they considered have been the main consequences of the outbreak of COVID-19 in the EU aquaculture sector and the expected recovery path.

- - Special topic on nowcast:

  Economic data series will be available up to 2018 or, in a few cases, up to 2019. Those data start to be a bit outdated by the time the report becomes public in late 2020 or early 2021. Experts should analyse which leading indicators could be the basis for the "nowcast" estimation of a selection of indicators (i.e. for 2019 and 2020) and propose a tentative methodology to do so. The methodology will be then apply to make a preliminary attempt of the nowcasting exercise, which could be improved in upcoming reports. This becomes more paramount on the wake of the COVID-19 pandemic.

- - Annexes
  - Data coverage and quality.
  - Potential complementary charts and tables not included in the main text.

Streamlining of the report and data issues

After six reports, efforts should be invested in streamlining the structure and content of the report. In particular, the following should be taken into account:

It shall be considered whether some specific (sub)sections provide limited value added and therefore should be dropped from the report. The possibility of improving the readability of the report by grouping some of the charts and tables should be explored.

Given the increasing length of the time series, the tables in the report could be shortened by presenting only indicative numbers (e.g. one out of two years or one out of five). However, the last three years should appear in the time series tables (both for the EU overview and the national chapters). The workbook(s) accompanying the report should still include the whole database with all years in the series.

The narrative should add value to the figures compiled in the charts and tables. This could be achieved by highlighting a few figures with special relevance and by explaining what are the drivers and/or consequences.

The experts are expected to add value to the report from their knowledge of the sector. This should be an important criteria for the selection of experts invited to participate in the working group. Given that the latest available values will refer to 2018 in a report to be prepared in late 2020, experts should provide a forward looking spin to the report about their knowledge about the developments in the sectors throughout 2019 and 2020.

The main socio-economic indicators, if possible and where relevant, should also be put into context with homologous figures at the EU and national levels (e.g., national average salaries, GDP, etc.), or in relations with the other fisheries sectors (the fishing fleet and fish processing).

Given the experience of the past with missing data and that the collection and transmission of data on fresh aquaculture is only done on a voluntarily basis, the use of complementary source of data (e.g. from Eurostat and FAO) may be required for some countries.

When aggregating national indicators to obtain the EU totals, special attention should be made to maintain a homogeneous number of Member States. The data for EU total should reflect an estimation of the actual evolution and should not be distorted by the inclusion (or exclusion) of Member States throughout the analysed period. The compilation of EU aggregates may require the use of imputation in some Member States. The imputation of missing values should follow similar principles to the ones approved by the STECF plenary in 2019 for the fish processing sector.

The economic report on the aquaculture sector is produced on a biennial basis. This should be taken into account when presenting the information and making the interpretations. Besides the long-term evolution, a special focus should be made not only on the last year, but rather on the last two years, when relevant. Indications on the latest developments should be presented in annual terms and not with respect to the previous report (which implies an increase or decrease over two years).

A discussion and explanation about data coverage, data issues and how they were addressed should be included in an Annex.

Data transmission

The EWG is requested to ensure that all unresolved data transmission (DT) issues encountered prior to and during the EWG meeting are reported on-line via the Data Transmission Monitoring Tool (DTMT). Guidance on precisely what should be inserted in the DTMT, log-on credentials and access rights will be provided during the EWG.

2 EU AQUACULTURE SECTOR OVERVIEW

For the first time in the aquaculture report, a nowcast exercise has been conducted. Carrying out the nowcast for aquaculture is a considerable challenge, considering that the availability of official statistics on aquaculture at the European level and in other supranational organizations and global databases is lower than in the fishing sector, where a nowcasting exercise has also been performed. This exercise follows the recommendations and principles for estimation of the main variables for EU aggregates approved by the STECF plenary in 2019.

The methodology developed for this report has been applied to make a preliminary attempt of the nowcasting exercise, which could be improved in upcoming reports. The scope of the nowcast for this first attempt is limited to estimate the production in volume (Total weight of sales), the production in value (Turnover), and the employment (both persons employed and persons employed FTE) at national level, which is aggregated to the EU level.

The information obtained during the EWG has allowed a quantitative nowcast at national level for 2019, based on data from EU-MAP, Eurostat and final and estimated data from national public bodies provided by the experts. In the case of the weight of sales and turnover the nowcasting coverage for 2019 is equivalent to 97% and 98% of the production volume and value in 2018, respectively. In the case of employment, the availability of data has been lower and the nowcast coverage decreases to 81% and 65% in the case of employees and FTE, respectively. In the EU overview, the 2019 estimates were produced by the nowcast exercise for EU 27 totals regarding production, turnover and employment. For countries with missing nowcast data for 2019, values from 2018 were used as an approximation.

In the case of 2020, estimates are only obtained from 4 countries, which does not allow for a quantitative nowcast like the one carried out in 2019. Furthermore, the impact of Covid-19 makes extrapolation of data from previous years highly uncertain and the experts have therefore refrained from presenting estimates for 2020.

Instead, key indication of the development of the aquaculture sector in 2020 is therefore solely based on the survey made in relation to this EWG report on the Covid-19 effects on the aquaculture sector. The survey is based on 58 interviews with enterprises and representatives of Producers' Organizations in 17 Member States on one side, and 20 national experts participating in the STECF Aquaculture Economics working group on the other. The survey was conducted over the period 1/1-2021 to 31/1-2021. The species include in the survey covers carp, mussels, oyster, salmon, seabass, sea bream, and trout. It should be stressed that this survey is not representative for the EU aquaculture sector as a whole and results should only be interpreted as an indication of the development in 2020.

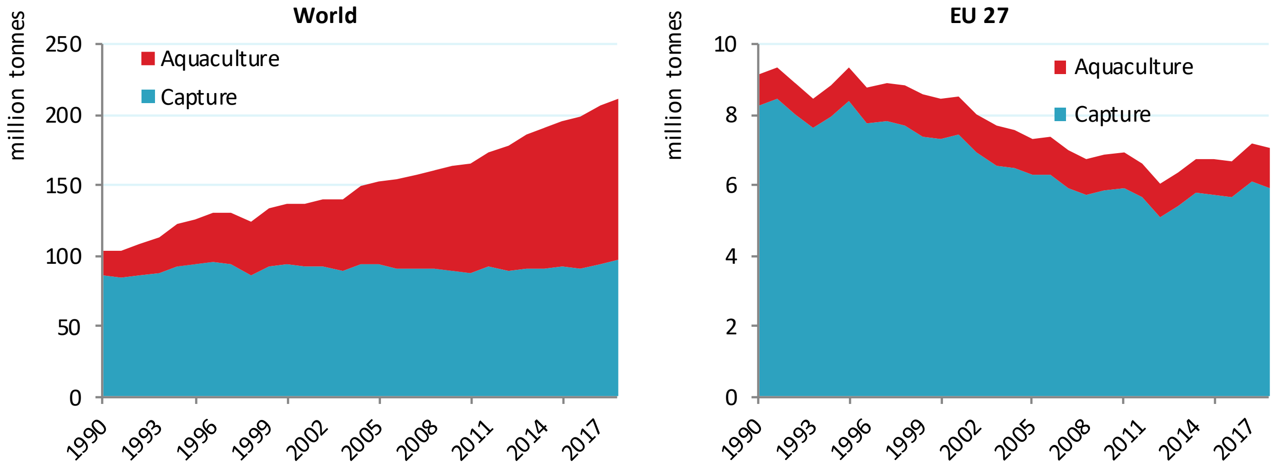
The overall average survey results show that sales volume is expected to decrease more than 10% and prices are expected to fall by almost 5% due to the disrupted supply lines. Furthermore, costs are increasing due to the fact that fish/shellfish are kept longer in the aquaculture facilities to avoid losses. Together these factors indicate an overall income loss of about 10% for aquaculture farmers in EU on average. For 2020, which is a short run perspective, it seems that the employment is not affected. For more information on the Covid-19 analysis, please see chapter 5.

2.1 World and EU-27 seafood production

Aquaculture is one of the fastest growing food producing sectors in the world and is an increasingly important contributor to global food supply and economic growth. The share of global supply of fish products for human consumption from aquaculture went from being 16% in 1990 to 54% in 2018 including aquatic plants. The total estimated global production from captured fisheries and aquaculture increased from 199 million tonnes in 2016 to 212 million tonnes in 2018. The production from world capture fisheries has been fluctuating around 90 million tonnes per year during the last two decades, but has shown an increase from 2016. In contrast, the global aquaculture production has been steadily increasing, as shown in Figure 2.1.

The global value of aquaculture production reached €219 billion (264 billion USD) in 2018 (FAO, 2020). The sector has increased production more than 4 times since 1990 (see Figure 2.1). However, this growth has primarily been driven by Asian countries producing 92% of the world aquaculture products. China is the most important producer of aquaculture products in the world, producing 58% of the global aquaculture products. European Union aquaculture production represented only 1.0% of the world aquaculture production in terms of weight and 1.5% in value.

Figure 2.1: World and EU27 seafood production (capture and aquaculture): 1990-2018.



Source: FAO, 2020

The aquaculture production in EU has increased by 24% from 1990; however, since 2007 the production has only increased by 6%. As EU capture fisheries production has been showing a decreasing trend from 1990 to 2018, aquaculture has become relatively more important to supply the seafood market. In 2018, the aquaculture sector provided around 20% of the fish and shellfish supply in EU.

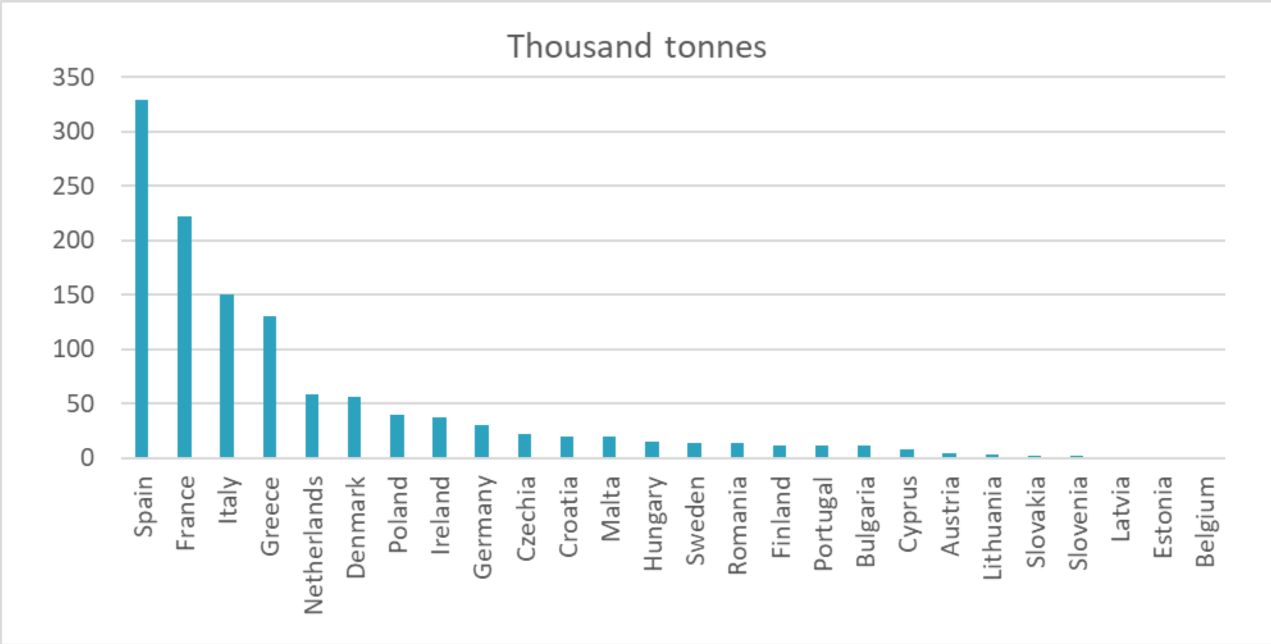
2.2 The EU aquaculture sector

In this section, a special effort has been made by the EWG to present the development of the entire EU aquaculture sector covering all 27 Member States from 2008 to 2019. The totals and the time trends presented in this chapter are based on the data collected under DCF and EU-MAP, supplemented with EUROSTAT and FAO data, estimating missing values where necessary to be able to give a comprehensive overview of the EU aquaculture sector. The methodology used is included as annex 2 in this report.

Aquaculture production in the 27 EU Member States reached 1.2 million tonnes and accounted for €4.1 billion in 2018 (DCF and EWG estimates). The EU represents 1.0% of the world aquaculture production in volume and 1.5% in value[1]. EU aquaculture production is mainly concentrated in four countries: Spain (27%), France (18%), Italy (12%), and Greece (11%). These four countries account for 69% of the total EU aquaculture production volume (Figure 2.2).

[1] FAO Fishstat production data for fish, crustaceans and molluscs, aquatic plants and animals.

Figure 2.2: Aquaculture production in EU MS in terms of weight: 2018.



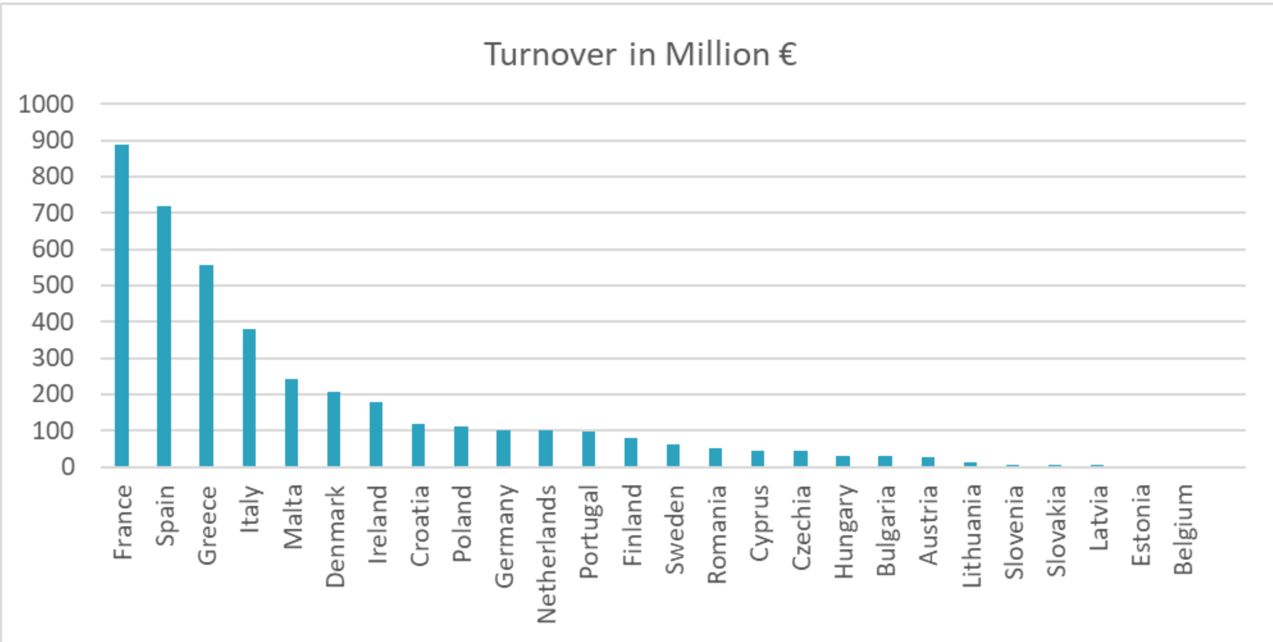
Source: EU MS data submission and EWG estimations, 2021.

In terms of value, France is the largest contributor in EU with 21% of the total turnover, followed by Spain (18%), Greece (14%) and Italy (9%). These five countries combine 62% of the total EU aquaculture turnover (

Figure 2.3).

It should be noted that even though Spain has the largest aquaculture production volume (24%) it is only second in value (18%). This is due to the relative low market value of mussels, which represented three quarters of the Spanish aquaculture production volume, but only one quarter of the sales value.

Figure 2.3: Aquaculture production in EU MS in terms of value: 2018.



Source: EU MS data submission and EWG estimations, 2021.

2.3 Economic performance of the EU aquaculture sector

Table 2.1 provides an overview of the size of the EU aquaculture sector across Member States in terms of number of enterprises, sales volume, turnover and employment. The table shows in more detail the production related to the number of enterprises and employment in each of the countries. For instance, the largest producer Spain has a sales volume of 329 tonnes, which provided a turnover of €719 million of production. The production was carried out in 2 895 enterprises employing 18 586 persons, corresponding to 6 730 full time employees. A more detailed analysis of each of these indicators is presented in this section.

Table 2.1: Economic and employment indicators for the EU aquaculture sector: 2018.

	Total weight of sales (tonnes)		Turnover (million euro)		number of enterprises (number)		Total employees (number)		FTE (number)	
	2017	2018	2017	2018	2017	2018	2017	2018	2017	2018
Austria	3,862	3,991	25.3	26.4	85	85	366	374	182	186
Belgium	75	111	0.7	0.8	2	2	9	10	43	48
Bulgaria	9,492	9,848	21.1	25.6	588	588	1,048	1,159	925	1,023
Croatia	17,519	19,741	107.7	122.6	187	187	2,183	2,334	1,618	1,730
Cyprus	7,365	7,438	43.6	45.3	16	16	453	462	398	406
Czechia	21,685	21,751	42.7	45.2	150	150	1,569	1,615	875	901
Denmark	49,741	48,355	189.2	176.6	107	107	555	537	370	358
Estonia	465	504	1.8	2.0	10	10	38	40	31	33
Finland	12,669	12,301	80.0	72.1	173	173	532	506	366	348
France	236,464	245,729	844.0	888.1	2,700	2,700	15,850	16,265	9,292	9,535
Germany	35,336	33,585	136.4	150.2	490	490	2,033	2,136	1,193	1,254
Greece	137,214	144,721	604.3	597.9	328	328	3,852	3,832	3,543	3,524
Hungary	18,258	17,852	38.7	38.4	120	120	2,331	2,321	880	877
Ireland	49,693	40,356	211.6	189.1	289	289	2,203	2,086	1,161	1,099
Italy	200,401	182,962	556.3	610.1	711	711	5,205	5,456	3,135	3,287
Latvia	1,529	1,570	6.1	5.4	85	85	259	245	175	166
Lithuania	3,749	3,750	12.2	12.5	47	47	499	506	217	220
Malta	15,978	22,537	193.3	305.0	6	6	257	332	219	283
Netherlands	47,381	47,472	53.9	57.3	70	70	189	195	195	201
Poland	38,800	43,361	110.9	121.1	1,242	1,242	8,348	8,731	3,307	3,459
Portugal	13,065	12,339	101.2	88.2	1,402	1,402	3,144	2,942	984	921
Romania	12,677	12,182	32.7	30.5	430	430	3,362	3,252	2,647	2,560
Slovakia	2,646	2,224	6.1	5.5	19	19	1,098	1,042	736	698
Slovenia	633	702	0.8	1.1	7	7	19	22	19	22
Spain	323,460	361,724	638.4	625.4	2,990	2,990	17,977	17,794	6,595	6,528
Sweden	15,624	12,328	62.6	48.2	136	136	501	443	302	267
TOTAL	1,275,780	1,309,434	4,121.5	4,290.5	12,389	12,389	73,881	74,634	39,409	39,931

Source: EU MS data submission (DCF, EU-MAP), Eurostat, FAO and EWG estimations, 2021.

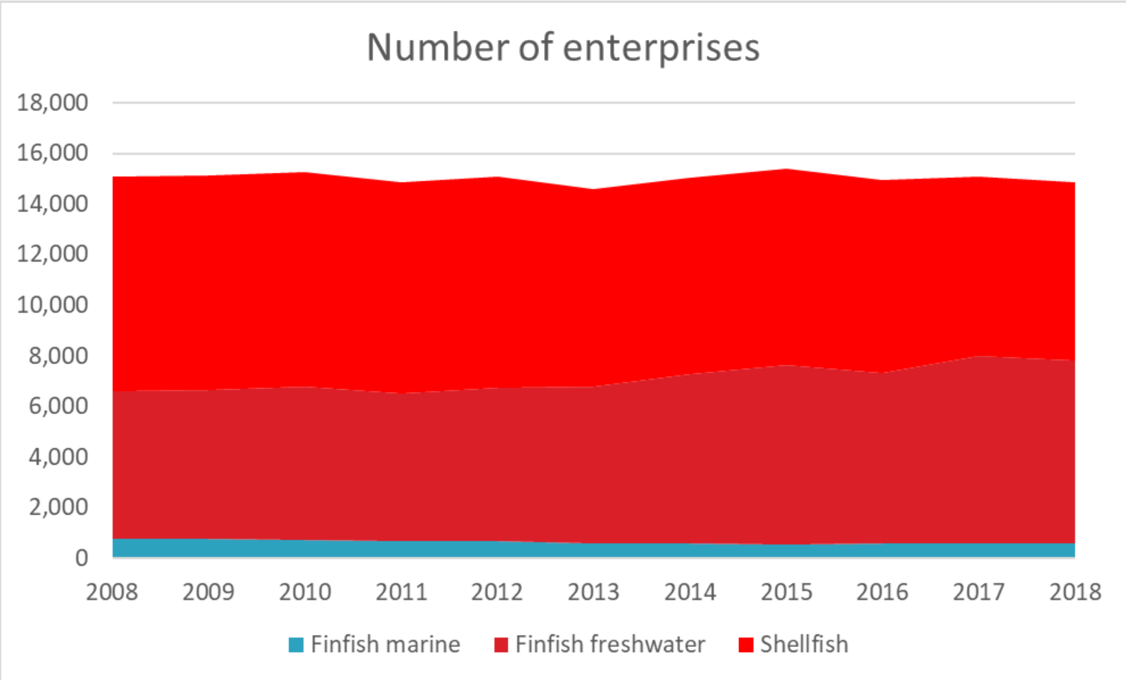
Number of enterprises

A total of almost 13 thousand enterprises were reported under EU-MAP, in 2018. It is further estimated that the total number of enterprises in the EU aquaculture sector is around 15 thousand taking into account the EU countries not reporting data. This number has fluctuated around 15 thousand, within a range of a few hundred enterprises, since 2008 (

Figure 2.4)

The figure 2.4 shows that the enterprises mainly belongs to the freshwater (48%) and the shellfish (47%) sector, whereas only 4% operates in the marine sector. The majority of the enterprises in the EU aquaculture sector are micro-enterprises with less than 10 employees. In 2017 and 2018, these comprised almost 80% of all aquaculture enterprises in the EU. These micro-enterprises tend to be family owned and are using rather extensive production methods and systems. The number of microenterprises has decrease by 3% between 2017 and 2018, whereas the estimated data indicates that there has been an increase of 17% in the number of enterprises employing 10 employees or more from 2017 and 2018.

Figure 2.4: Total Enterprises in the EU Aquaculture sector: 2008-2018.



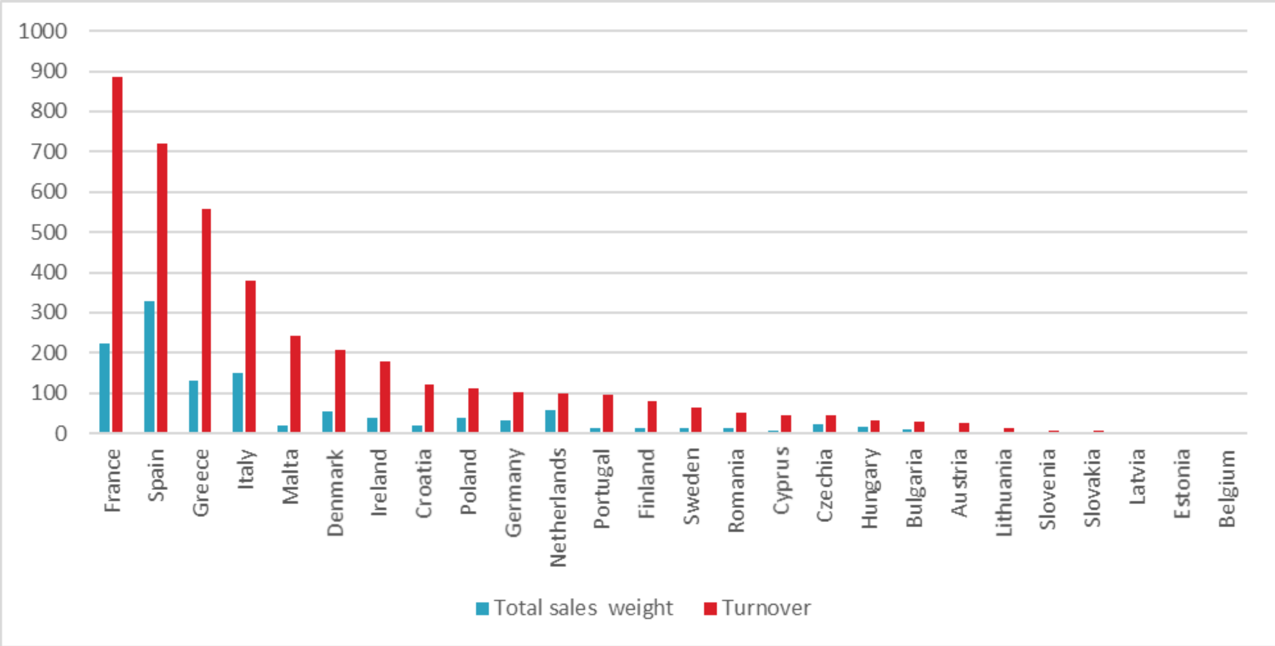
Source: EU MS data submission (DCF, EU-MAP), Eurostat, FAO and EWG estimations, 2021.

Production and sales

The total EU aquaculture production is estimated to be 1 199 and 1 215 million tonnes in 2017 and 2018, respectively. This corresponds to a 1% increase from 2016 to 2017 and a 2.4% increase from 2016 to 2018.

Large differences in the volumes and turnovers from aquaculture are observed across the 27 EU Member States, with the four main producers being France, Spain, Greece and Italy with reported turnovers between €380 million to €886 million and production being between 131 to 330 thousand tonnes.

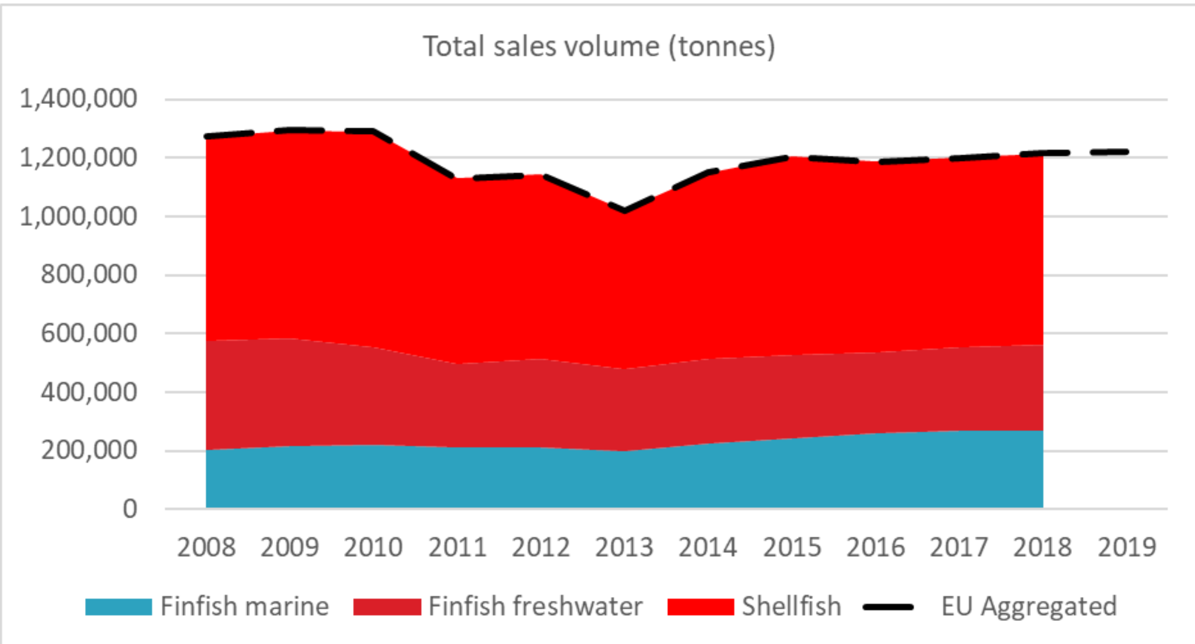
Figure 2.5: Total sales weight (in thousand tonnes) and turnover (in million €) in the EU Aquaculture sector per MS: 2018.



Source: EU MS data submission and EWG estimations, 2021

Figure 2.6 shows the aggregated total production in the EU aquaculture sector from 2008 to 2018 and a nowcast estimate for 2019. Between 2008 and 2018, the overall EU production seems to be rather stable slightly above 1.2 million tonnes. However, a noticeable decrease is observed between 2010 and 2013, which is mainly due to a decrease in the production of mussels affected by environmental conditions, such as "red ties" in Spain, and shellfish diseases. The recovery from 2013 to 2016 can again be explained by increasing productions of shellfish catching up from earlier years. The shellfish production accounted for 54%, freshwater finfish 24% and marine finfish 22% of the total production in 2018. The nowcast estimate shows a slightly increase in production of 1% in 2019.

Figure 2.6: Total production in the EU Aquaculture sector: 2008-2019.

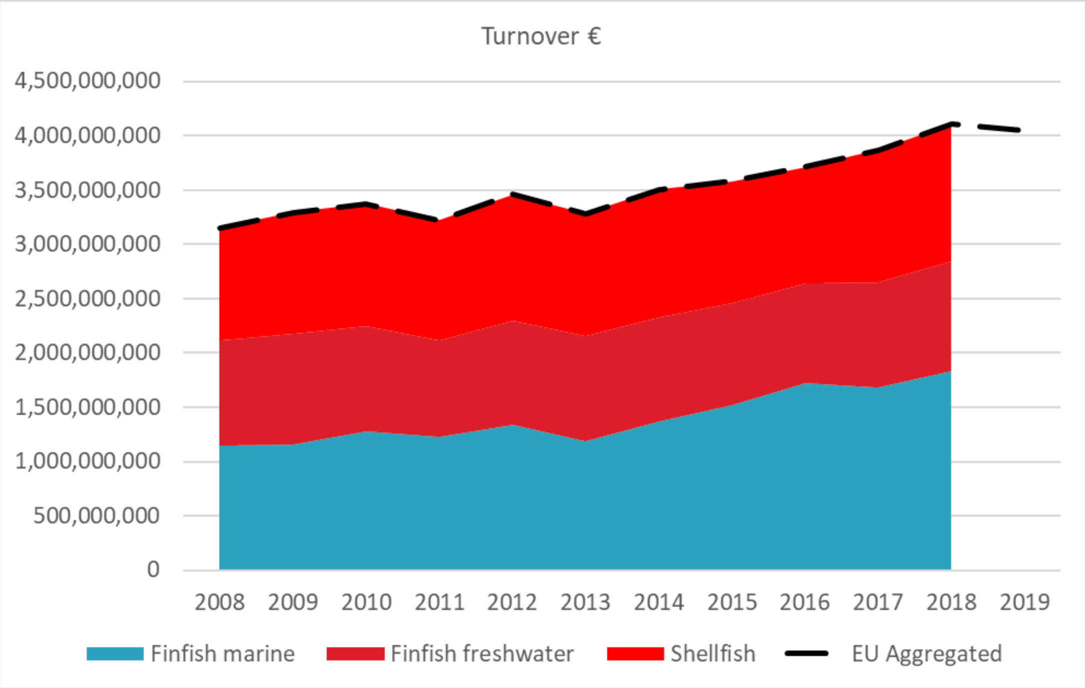


Source: EU MS data submission and EWG estimations, 2021.

Turnover

The total nominal turnover from the EU aquaculture sector was €3.9 and €4.1 billion in 2017 and 2018, respectively. This represents a 6% increase from 2017 to 2018, while the increase from 2016 to 2018 is 11% over the two years. A driver to the increase in turnover since 2013 is related to a general rise in prices. The increasing prices together with the increase in the overall production in the EU aquaculture sector contribute to the increase in turnover from 2013 to 2018. The majority of the turnover at the EU level comes from marine finfish production (45%), while shellfish production accounts for 31% and freshwater finfish production 25%. The nowcast estimate for 2019 indicates a decline in turnover to €4 050 million for EU in total due to decreasing prices in 2019, which correspond to a decrease of 1.4% compared to 2018 (figure 2.7).

Figure 2.7: Aquaculture turnover in nominal and real values at EU28 level: 2008-2019.



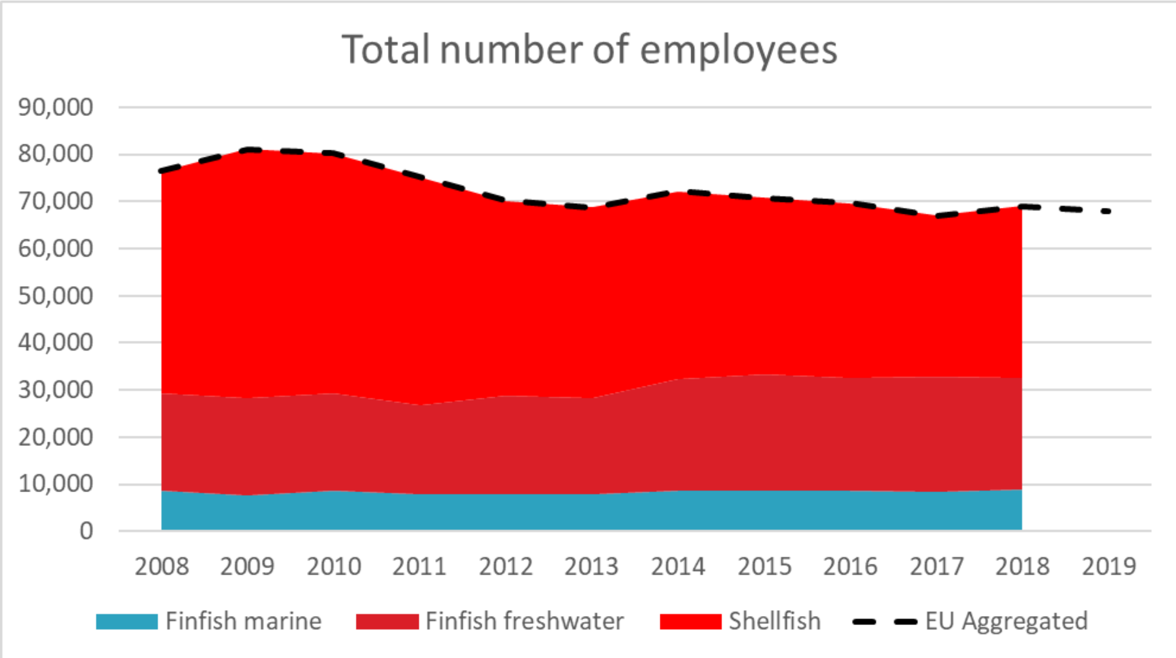
Source: EU MS data submission and EWG estimations, 2021

Employment

From an employment perspective, the social importance of the aquaculture sectors is not always reflected in the contribution to the total value in EU totals. Thus, shellfish production employs more labour compared to the marine and freshwater production. The shellfish sector most often consist of small family owned businesses and have a large social importance for some regions in EU.

The reported EU-MAP data displays an employment of approximately 56 400 persons in 2018, which was 4% more than in 2017 (54 400 employed). Taking into account the estimates for the Member States not reporting data, the EU 27 aquaculture sector directly employed around 69 000 persons in 2018 (figure 2.8). The estimated EU 27 employment in 2019 was close to 68 000 persons, corresponding to a decrease of 2%. The shellfish sector is employing over half of the employees in the sector covering 53% of the employment. Moreover, freshwater finfish production employs 35% and marine finfish production 13% of the persons employed in the EU aquaculture.

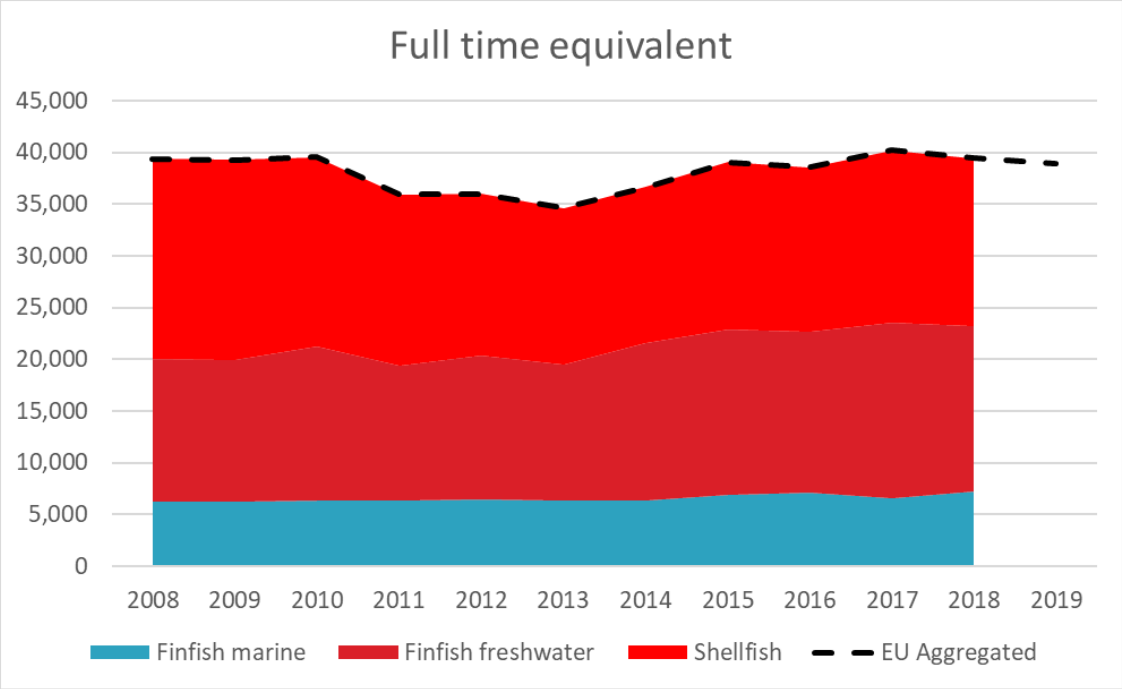
Figure 2.8: Numbers of Employees in the MS Aquaculture sector: 2008-2019.



Source: EU MS data submission and EWG estimations, 2021.

Looking at the full time equivalents (FTEs) of the data collected under EU-MAP, there has been a decrease of 2% from the 32 400 FTEs reported in 2017 to the 31 800 FTEs reported in 2018. Overall, it is estimated that the FTEs in the EU 27 countries amounted to 40 200 and 39 500 in 2017 and 2018, respectively, corresponding to a 2% decrease (Figure 2.9). The nowcast for 2019 indicates a minor decrease of full time employment to 39 000 FTEs, corresponding to a decrease of 1%.

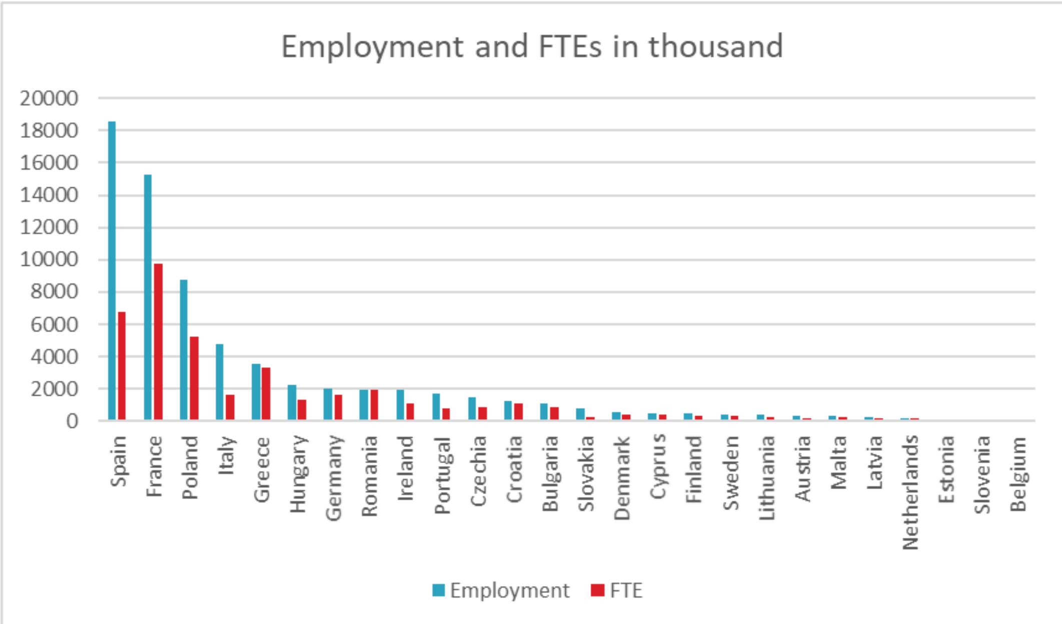
Figure 2.9: Number of FTEs in the MS Aquaculture sector: 2008-2018.



Source: EU MS data submission and EWG estimations, 2021.

The EU aquaculture sector has a significant component of part-time work. This can be seen from the ratio of full time equivalents (FTE) to total employees. The lower the ratio, the more part-time or seasonal work exists, while the higher (closer to 1) the ratio, the more occupation is full time. The estimated data shows that the ratio for the EU aquaculture sector was 0.60 in 2017 and 0.57 in 2018. This is at the same level as the previous report. The falling ratio may be seen in combination with the higher contribution in volume and value from the mussel sector, because a large proportion of part-time and seasonal employment in the aquaculture sector is originating from the shellfish segments.

Figure 2.10: Numbers of Employees and FTEs in the Member States Aquaculture sector: 2018.

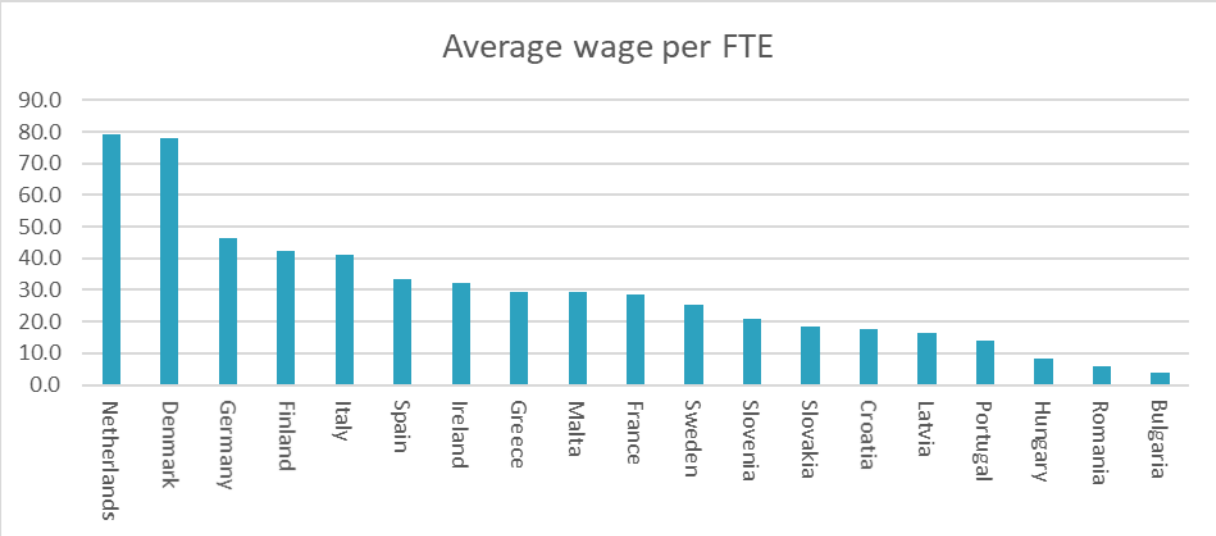


Source: EU MS data submission and EWG estimations, 2021

Mean wages

The average wage is calculated as the sum of the costs in wages and salaries and the imputed value of unpaid labour divided by the total number of FTEs. DCF data from 19 countries show that the average wage per FTE for the EU aquaculture sector in 2018 was about €25 700 per year. This is an increase of 11% from the €23 200 reported in 2017.

Figure 2.11: Average wage in the EU Aquaculture sector per MS: 2018.



Source: EU MS data submission, 2021

Gross Value Added

DCF data from 18 countries (some of the countries did not submit the necessary data for calculation of GVA) show that the EU aquaculture sector generated about €1 844 million in GVA in 2017 and €1 705 million in GVA in 2018, corresponding to a decrease of 8%.

Table 2.2: Economic performance Indicators for the EU aquaculture sector: 2018.

Country	GVA		EBIT		ROI		Labour productivity		Capital productivity	
	million €		million €		%		thousand €		%	
	2017	2018	2017	2018	2017	2018	2017	2018	2017	2018
Bulgaria	10,5	13,5	2,2	7,6	4,2	18,7	9,6	15,2	20,0	33,3
Croatia	76,4	59,2	47,9	28,4	11,5	6,4	68,4	54,6	18,3	13,4
Denmark	57,6	55,6	22,3	15,0	9,9	5,8	148,4	139,3	25,5	21,4
Finland	25,0	21,6	6,5	3,8	4,4	2,9	71,4	67,4	16,9	16,4
France	421,5	457,6	128,3	136,6	11,2	11,1	42,9	46,8	36,8	37,0
Germany	42,7	84,5	-35,9	8,3	-23,0	6,0	26,3	51,8	27,3	61,4
Greece	193,7	61,9	99,9	-26,2	7,3	-1,9	66,3	18,5	14,1	4,5
Ireland	92,1	60,9	55,5	19,8	28,6	8,2	90,5	56,1	47,5	25,3
Italy	244,0	216,7	164,0	128,4	41,1	28,9	114,7	134,7	61,2	48,7
Latvia	0,9	1,4	-1,3	-1,5	-4,7	-5,2	5,0	7,4	3,1	4,8
Malta	-24,8	15,1	-31,8	2,3	-76,7	5,1	-115,0	58,6	-59,9	33,7
Netherlands	23,1	29,9	4,7	11,8	4,9	11,3	125,1	165,1	23,7	28,7
Portugal		68,9		50,8		47,0		86,8		63,8
Romania	9,2	13,8	-10,8	0,6	-8,8	0,3	4,1	7,0	7,6	6,5
Slovenia	0,2	0,1	-1,2	-1,3	-16,9	-19,1	10,1	3,8	3,2	1,5
Spain	231,7	224,0	30,5	6,5	3,5	0,7	36,8	33,3	26,6	23,9
Sweden	18,8	34,7	4,5	21,5	5,9	28,8	36,8	115,7	24,6	46,4
Total EU	1844,2	1704,9	859,5	665,9	15,6	11,3	54,4	53,0	33,5	29,0

* Portuguese data for 2017 are considered unreliable by the EWG.
Source: EU MS data submission, 2020.

EBIT (Earnings Before Interest and Taxes or Operating Profit)

DCF data from 18 countries show that the EU aquaculture sector was less profitable in 2018 with a reported total EBIT of €666 million, which is a decrease of 23% from the €860 million reported in 2017.

ROI (Return On Investment)

ROI is a performance measure to evaluate the profitability of an investment. ROI is calculated as EBIT divided by total assets. DCF data from 18 countries show an average ROI of the EU aquaculture sector of 11.3% in 2018, which is a decrease from the 15.6% reported in 2017.

Labour productivity

The labour productivity is calculated as the Gross value added divided by the total number of FTEs. DCF data from 18 countries show that the labour productivity for the EU aquaculture sector was about €53 thousand per FTE in 2018. This represents a 3% decrease from the €54 thousand per FTE reported in 2017.

There is a large variation between member states in the estimated labour productivity. Slovenia and Romania had the lowest labour productivity of €3.8 and €7 thousand, whereas Netherlands had the highest with a labour productivity of €165.1 thousand.

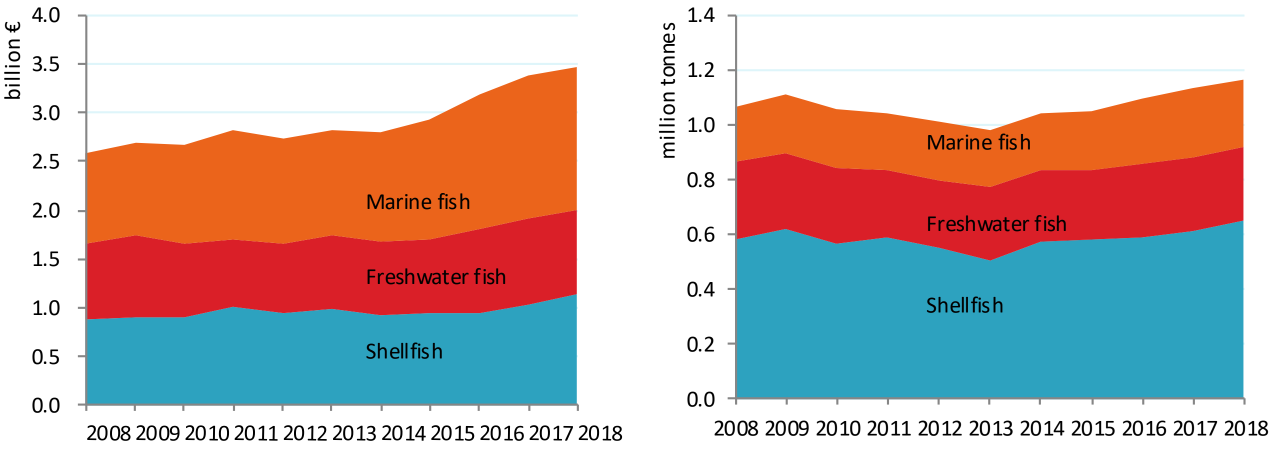
Capital Productivity

Capital productivity is calculated as Gross Value Added (GVA) divided by Capital value (total value of assets) in percentage. The indicator describes the average value added to the economy per unit of capital invested in the aquaculture sector. DCF data from 19 countries show that the capital productivity for the EU aquaculture sector was 29.0% in 2018, which was slightly lower than the 33.5% reported in 2017.

3 THE STRUCTURE OF THE EU AQUACULTURE SECTOR

In 2018, marine fishes, freshwater fishes and shellfish accounted for 21%, 23% and 56% of the EU production of aquaculture in terms of weight, respectively. In value terms, marine fishes, freshwater fishes and shellfish accounted for 42%, 25% and 33% of the production value (Figure 3.1).

Figure 3.1: EU (27) aquaculture production in weight and value by subsector: 2008-2018.



Source: Own elaboration from FAO, 2021

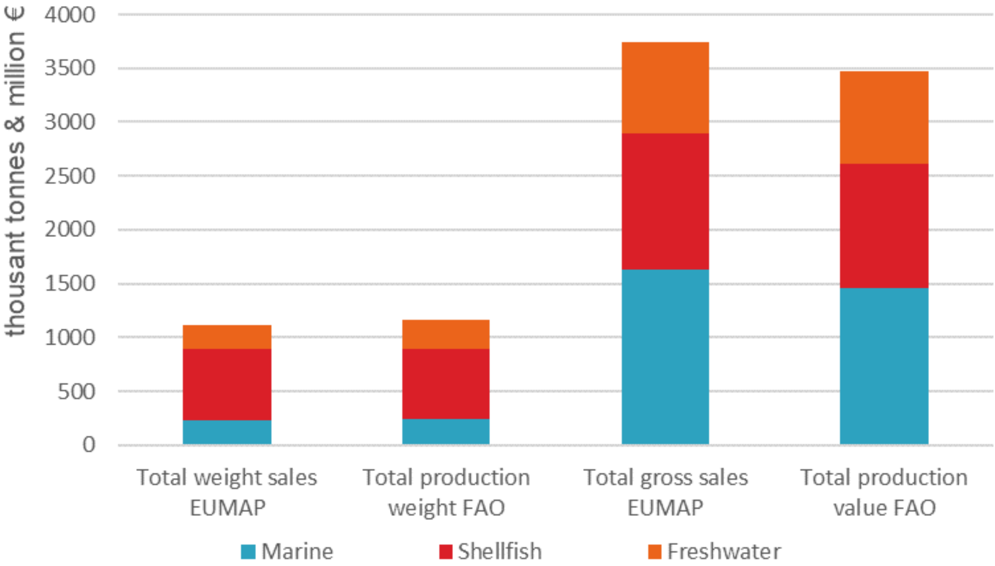
Given that not all Member States report the economic indicators of their aquacultures sector, the EWG performed some estimations of total EU sales and economic performance[2]. Figure 3.2 shows the total sales in weight and value reported by MS under the EUMAP and total production from FAO for the EU 27 in 2018. The total weight of sales reported under the EUMAP were 1 115 thousand tonnes, whereas the total estimated production was 1 167 thousand tonnes. The total value of sales reported under the EUMAP was €3 738 million, whereas the estimated value of the total production was €3 469 million. The main difference is found in the freshwater sector due to the fact that reporting of freshwater activities is not mandatory under the DCF (EU MAP).

The estimates for total production in weight and valued were calculated on the basis of alternative sources (i.e., FAO). However, most economic variables are only available from the DCF/EUMAP data collection and not from those alternative sources. Therefore, the rest of this chapter focuses on DCF/EUMAP data. This being said, the DCF/EUMAP data represent 96% of the estimated EU total production according to the FAO, and therefore they can provide a good approximation of the overall EU aquaculture performance.

Figure 3.3 shows that income (mainly the gross sales and other income) in the EU aquaculture sector is mainly generated in the marine sector (€2 076 million, 46% of the total) followed by the shellfish sector (€1 338 million, 29%) and the freshwater sector (€1 147 million, 25%).

[2] For further details, see the section on data coverage and the Annex on how the estimates have been calculated.

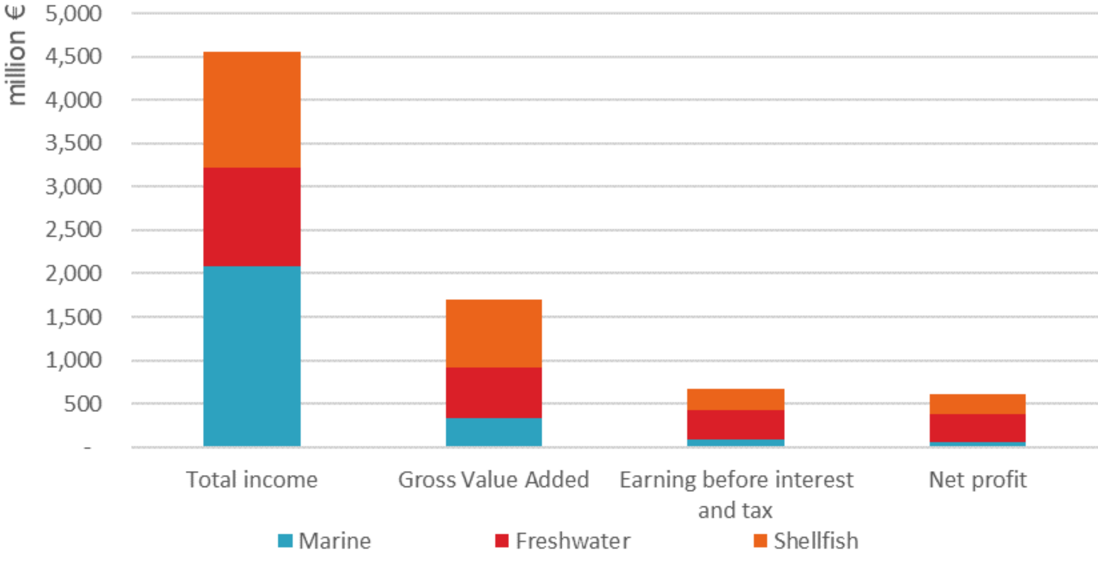
Figure 3.2: EU-27 Aquaculture sales and total income by subsector: 2018.



Source: EU Member States DCF data submission, 2021 and FAO, 2021.

The GVA is generated in the marine sector (€328 million, 19% of the total), the shellfish sector (€780 million, 46%) and the freshwater sector (€588 million, 35%). EBIT is generated in the marine sector (€85 million, 13% of the total), the shellfish sector (€246 million, 37%) and the freshwater sector (€338 million, 51%). Net profit are generated in the marine sector (€53 million, 9%), the shellfish sector (€224 million, 37%) and the freshwater sector (€328 million, 54%). Therefore, the shellfish sector tends to generate higher GVA relative to the income than the other two sectors, while the freshwater sector tends to generate higher profits (i.e., EBIT and net profits) in relation to the income.

Figure 3.3: EU-27 Aquaculture economic performance by subsector: 2018.



Source: EU Member States DCF data submission, 2021

Main species in the EU aquaculture

In 2018, according to FAO data, the production weight by specie for the EU aquaculture was 1.17 million tonnes. The main aquaculture species produced were sea mussels nei (mostly consisting of Mediterranean mussels) (286 thousand tonnes, 25% of total EU production), rainbow trout (162 thousand tonnes, 14%), blue mussels (129 thousand tonnes, 11%), Mediterranean mussels (98 thousand tonnes, 8%), gilthead seabream (92 thousand tonnes, 8%), Pacific cupped oysters (96 thousand tonnes, 8%), European seabass (84 thousand tonnes, 7%), , common carp (75 thousand tonnes, 6%) and Japanese carpet shell (33 thousand tonnes, 3%). These nine species account for the 90% of the total EU aquaculture production in weight.

We observe a certain specialisation in the production across countries. The major shellfish producers were Spain, France, Portugal and Italy. Pacific cupped oysters were mostly produced in France, whereas Rainbow trout was produced mainly in Denmark, France and Spain.

In 2018, the main aquaculture species produced in value were rainbow trout (€563 million, 16% of total EU value), European seabass (€490 million, 14%), Pacific cupped oysters (€483 million, 14%), and gilthead seabream (€459 million, 13%). These four species accounted for 57% of the total EU-27 aquaculture production in value.

Figure 3.3: Main species produced in EU-27 aquaculture: 2018.

Source: FAO, 2021

3.1 Marine finfish aquaculture

Fish production in marine aquaculture is characterised by being capital intensive, in the sense that relative large investment is needed on physical equipment and stoking of cages compared to the input of labour.

Table 3.1.1. Economic indicators for the EU marine aquaculture: 2017-18.

Country	Number of enterprises		Total sales volume		Turnover		Employment		FTE		Average wage	
	number		thousand tonnes		million €		number		number		thousand €	
	2017	2018	2017	2018	2017	2018	2017	2018	2017	2018	2017	2018
Croatia	30	26	12.9	15.9	92.3	111.6	792	766	684	700	18.2	19.5
Denmark	4	4	13.8	14.4	74.3	71.8	133	142	94	101	66.1	61.3
Finland	28	29	9.0	8.2	51.0	48.0	177	153	132	111	37.5	35.8
Greece	343	347	98.5	105.7	527.9	539.0	3,026	3,064	2,574	2,958	22.1	17.7
Ireland	28	26	18.9	12.2	138.6	119.6	204	225	176	191	49.6	45.5
Italy	46	46	14.3	13.0	103.2	95.4	411	375				
Malta	7	7	15.7	19.3	180.4	242.7	256	320	216	258	15.9	25.4
Portugal	15	18	3.8	3.9	26.0	29.8	64	274	54	266	91.3	26.3
Slovenia	1	1	0.1	0.1	0.3	0.4	10	12	10	12	26.1	26.3
Spain	56	53	65.3	63.2	398.6	478.8	2,454	2,772	1,921	1,926	31.3	33.9
United Kingdom	50	46	190.4	156.7	1,204.9	1,000.0	1,871	1,885	1,753	1,800	57.8	57.4
Other none DCF			11.7	11.8	72.4	73.9						
Total DCF reported	**608**	**603**	**442.7**	**412.6**	**2,797.6**	**2,736.8**	**9,398**	**9,988**	**7,614**	**8,323**	**35.8**	**33.1**
Total EU			**454.3**	**424.3**	**2,870.0**	**2,810.7**						

* Italian data on FTE and on average wage are not reported as the EWG considers them to be unreliable.

Source: EU Member States DCF data submission 2018 and EUROSTAT

The total sales volume for the EU28 marine aquaculture sector is estimated to be 415 thousand tonnes generating €3.08 billion of turnover in 2018. Compare to 2017 total weight and turnover of marine aquaculture for the EU28 (excluding Portugal and Romania) decreased by 7% and 3% respectively. Available data report 633 enterprises in the marine sector in 2018. Employment reached 10 076 employees and 8 521 FTEs. Most employees in the marine sector were working full time. On average, the enterprises had 16 employees.

The average wage for the EU marine aquaculture sector was €32.8 thousand in 2018, with a significant variability across countries (e.g. from €4.4 thousand in Bulgaria to €61 thousand in Denmark). This variability can be explained by differences in labour productivity and the capital and production intensity of the different techniques.

The marine sector provided €585.1 million in GVA and €148.6 million net profit. Compare to 2017 GVA and net profit of EU28 (excluding Portugal and Romania) marine aquaculture declined by 42% and 75% respectively. Mainly due to the remarkable decline of profitability in UK and Greece. Decrease of 2018 overall economic performance in marine aquaculture was due to the 14% increase in total operating costs compare to 2017. Major costs as livestock surged by 24%, energy costs 19% and 12% raw material, when revenues decreased by 3%. ROI decreased to 5.4% in 2018 and labour productivity declined to €55.5 thousand.

Table 3.1.2: Economic Performance indicators for the EU marine aquaculture: 2017-18.

Country	GVA		EBIT		ROI		Labour productivity		Capital productivity	
	million €		million €		%		thousand €		%	
	2017	2018	2017	2018	2017	2018	2017	2018	2017	2018
Croatia	49.8	47.0	28.0	23.7	9.5	7.1	72.7	67.1	16.9	14.0
Denmark	20.6	19.7	12.6	11.9	22.3	23.2	219.2	195.2	36.6	38.5
Finland	18.2	19.8	11.6	14.3	21.7	30.8	138.2	178.3	34.0	42.7
Greece	224.0	53.0	143.3	-24.6	10.5	-1.8	87.0	17.9	16.5	3.9
Ireland	49.1	26.2	37.2	13.8	45.9	12.2	279.9	137.0	60.7	23.2
Italy	58.6	51.9	42.4	36.1	31.3	30.4			43.2	43.7
Malta	-23.5	13.0	-28.5	2.8	-85.3	7.3	-108.8	50.3	-70.3	34.3
Portugal	8.4	7.5	0.2	-2.2	0.3	-2.8	154.5	28.1	11.8	9.6
Slovenia	-0.4	-0.5	-0.9	-1.0	-34.4	-43.0	-43.2	-44.3	-16.5	-22.5
Spain	99.3	85.7	31.9	6.0	5.8	0.9	51.7	44.5	18.1	12.6
United Kingdom	489.2	256.8	335.7	100.6	58.8	15.5	279.1	142.7	85.7	39.5
Total EU	993.2	580.0	613.4	181.5	19.1	5.2	102.1	55.5	31.0	16.8

* Italian data on labour productivity are not reported as the EWG considers them to be unreliable.

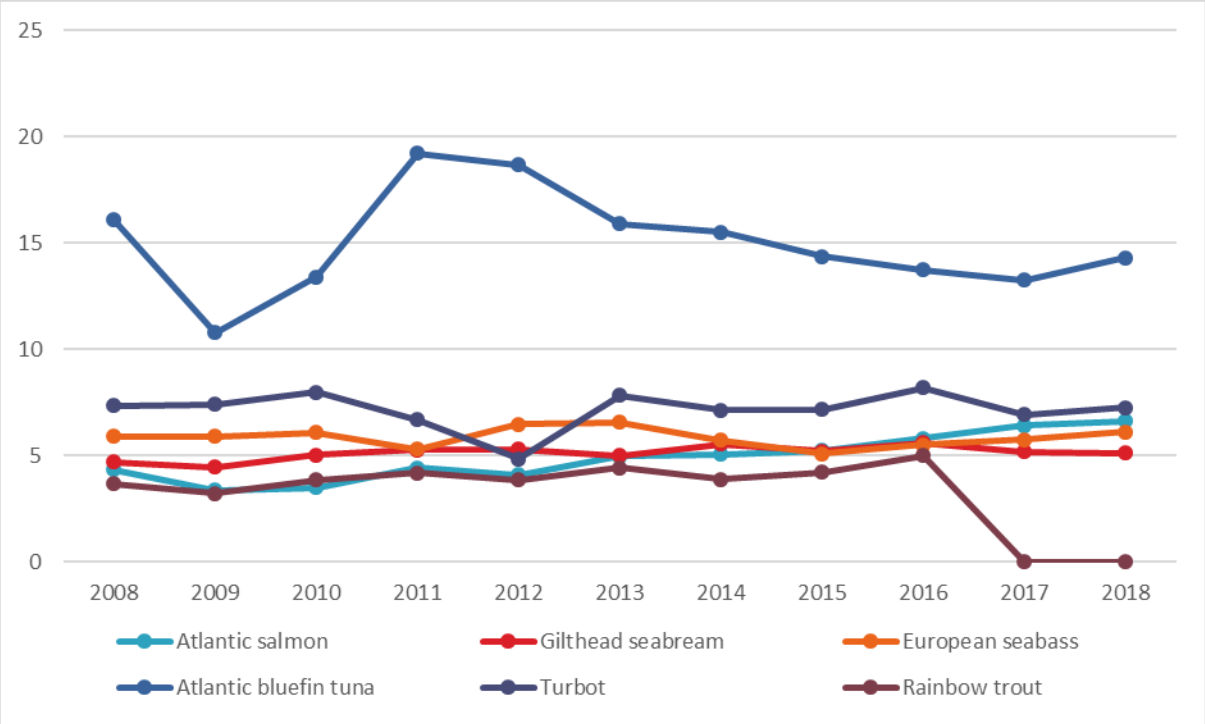
Source: EU Member States DCF data submission, 2021

The most produced marine species in terms of sales volume was Atlantic salmon representing 43% followed by gilthead seabream (22%) and European seabass (20%). In terms of total sales value, Atlantic salmon represented 46% followed by European seabass (20%) and gilthead seabream (18%). Around 92% of Atlantic salmon production in EU28 comes from UK farms. During the 2017-2018 period average market price for Atlantic salmon and European seabass increased 3.1% and 6.2% respectively, whereas price for gilthead seabream decreased by 1.3%.

Figure 3.1.1: Main species produced in the EU marine aquaculture: 2018.

Source: FAO, 2021

Figure 3.1.2: Price (€/kg) evolution of the main species produced in the EU marine aquaculture: 2008-18.



Source: EU Member States DCF data submission, 2021

3.1.1 Salmon

FAO statistics demonstrate that Atlantic salmon is the main species of salmon farmed with a global aquaculture production in 2018 of 2.44 million tonnes, valued at US$ 17.1 billion (€14.5 billion). It is farmed worldwide. Norway is the world leading producer (53% of global volume), followed by Chile (27%). The EU (UK, Ireland, Denmark, and France) produced 7%, and the remaining 13% of farmed Atlantic salmon was produced across Canada, Faroe Islands, Australia, Russian Federation, USA, Iceland and Dem. People's Rep Korea. Various Pacific salmon species [coho (=silver), chinook (=spring=king), and pink(=humpback) salmon] are also farmed, but production is minor (0.2 million tonnes in 2018) relative to Atlantic salmon. Interestingly, Denmark reported production to the FAO of 36 tonnes of coho salmon in 2017.

According to EUMAP marine finfish data, in 2018 the EU produced 168 933 tonnes of Atlantic salmon, valued at €1.12 billion. Only three countries reported marine production: United Kingdom (156 633 tonnes, 93%), Ireland (12 236 tonnes, 7%) and Spain (64 tonnes, less than 1%). According to the separate EUMAP freshwater finfish data set, there was an additional 121 tonnes, valued at €2.5 million, produced by Finland (97 tonnes) and Spain (24 tonnes); this freshwater production is understood to be juveniles (e.g. fry, smolt) produced by trout segment enterprises for either on-growing or angling (or environmental stocking schemes). The difference in derived sales price (€6.6 per kg for marine compared to the €26 per kg for freshwater) supports this interpretation.

The FAO salmon production data for 2018 indicate additional EU salmon production in Denmark (1 030 tonnes) and France (300 tonnes) which was not reported via EUMAP. Exclusion from EUMAP may reflect application of MS reporting thresholds or exclusion due to other reasons (e.g. not mandated if not marine production; confidentiality due to limited number of enterprises).

The main indicators for EU marine Atlantic salmon aquaculture collated under the DCF are presented below. EU figures largely reflect the dominant UK industry. The UK is the main EU producer of Atlantic salmon with 93% of the production by weight and 89% by value. The UK also provides the greatest employment with 1 721 FTEs and 1 800 employees in 2018. The average annual wage in salmon aquaculture in the UK was €60 000. Ireland was the other main producer representing 7% of the total production volume. The Irish employment covered 225 employees and 191 FTEs, receiving a lower average annual wage of €45 500.

The salmon segment employed 2 056 workers in 2018. Part-time work is minor since the ratio between employment measured in full time equivalents (FTE) and total employment was 94% in 2018.

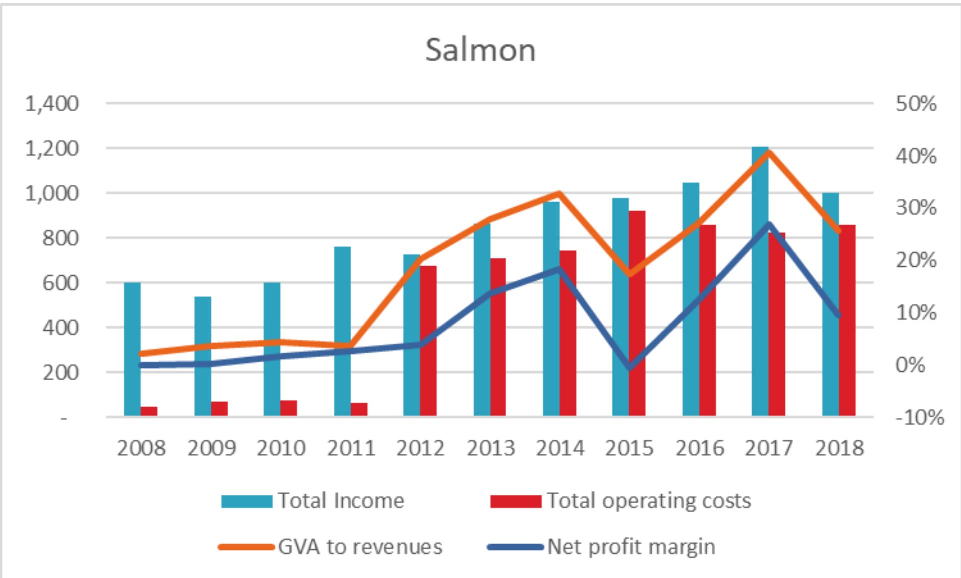
Table 3.3: Economic indicators for EU salmon aquaculture: 2018.

Country	Number of enterprises		Total sales volume		Turnover		Employment		FTE		Average wage	
	number		thousand tonnes		million €		number		number		thousand €	
	2017	2018	2017	2018	2017	2018	2017	2018	2017	2018	2017	2018
Ireland	28	26	18.9	12.2	138.6	119.6	204	225	176	191	49.6	45.5
Spain	3	4	0.1	0.1	0.2	0.0	17	31	13	21	15.7	18.9
United Kingdom	38	36	190.3	156.6	1,203.8	998.8	1,788	1,800	1,677	1,721	60.4	60.0
Other none DCF			1.7	1.9	8.0	8.9						
Total DCF reported	***69***	***66***	***209.3***	***168.9***	***1,342.6***	***1,118.4***	***2,009***	***2,056***	***1,866***	***1,933***	***59.0***	***58.1***
Total EU			**211.0**	**170.8**	**1,350.7**	**1,127.4**						

Source: EU Member States DCF/EUMAP data submissions, 2021

The Figure below shows a time series of economic performance indicators for salmon aquaculture for 2008-2018. These largely reflect the figures submitted for the UK salmon segment. Please note that the UK submitted sales (=income) data for 2008-2011 but not economic variable data. Total income shows an increasing trend, as do operating costs, with income consistently greater than operating costs, although the magnitude of the profit varies between years.

Figure 3.4: Economic performance indicators for salmon aquaculture: 2008-2018.



Source: EU Member States DCF/EUMAP data submissions, 2021

In 2018, EU salmon aquaculture produced an estimated Gross Value Added (GVA) of €283 million and an EBIT (earnings before interest and tax) of €113.5 million. The ROI (return on investment) was 14.8%. Labour productivity was €146.4 thousand per FTE. The capital productivity was 36.9%.

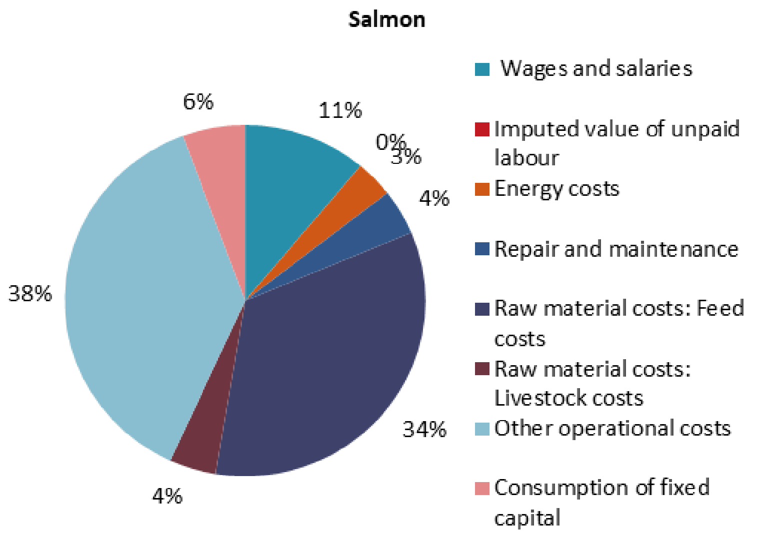
Table 3.4: Economic performance indicators for EU salmon aquaculture: 2018.

Country	GVA		EBIT		ROI		Labour productivity		Capital productivity	
	million €		million €		%		thousand €		%	
	2017	2018	2017	2018	2017	2018	2017	2018	2017	2018
Ireland	49.1	26.2	37.2	13.8	45.9	12.2	279.9	137.0	60.7	23.2
Spain	0.5		0.2		10.1		34.0		23.2	
United Kingdom	489.2	256.8	335.7	100.6	58.8	15.5	291.7	149.2	85.7	39.5
Total EU	538.8	283.0	373.1	114.4	57.0	14.9	288.8	146.4	82.4	36.9

Source: EU Member States DCF/EUMAP data submissions, 2021

The most important cost category for the EU salmon segment is Other operating costs, representing 38% of total costs. This variable covers goods and services not included within the other economic variables. It is currently unclear what costs are reflected by this variable, e.g. health management, insurance, equipment rental, etc. In future revisions of EUMAP it might be worthwhile revising the economic variables to provide greater transparency on this key economic variable. Feed costs represented 34% of the total costs, followed by labour (11%), consumption of fixed capital (6%), repair and maintenance (4%), livestock (4%), and energy costs (3%). It is noteworthy that the value of unpaid labour is negligible in comparison to paid labour costs; this reflects the highly professional nature of commercial salmon farming with a fully contracted workforce.

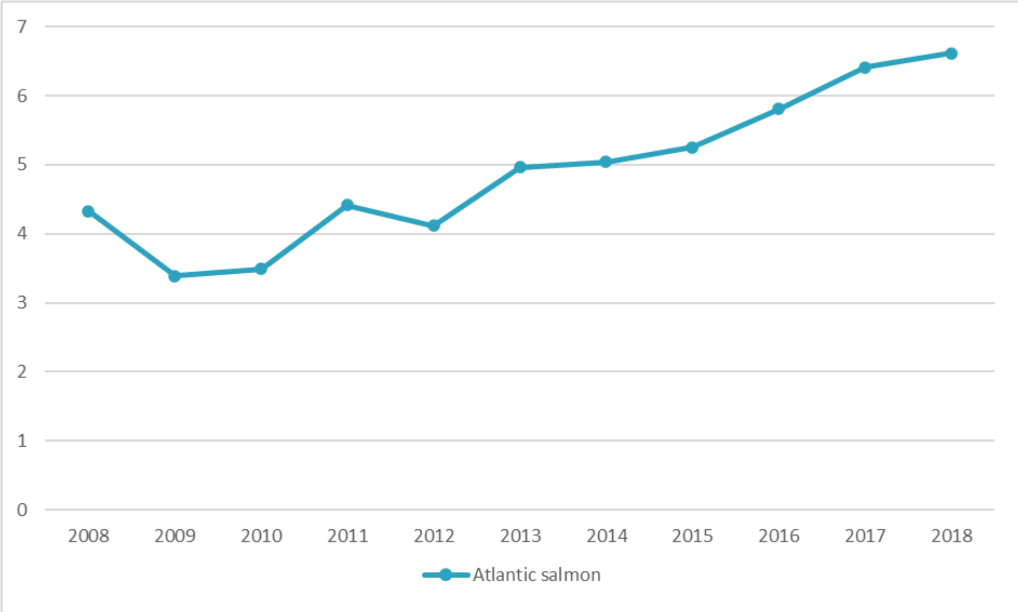
Figure 3.6: Costs breakdown for the EU salmon aquaculture: 2018.



Source: EU Member States EUMAP data submissions, 2021

The average price of Atlantic salmon has shown an increasing trend over the period 2008-2018, showing a minimum in 2009-2010 (€3.4 per kg) and a maximum in 2018 (€6.6 per kg). Please note that these prices are not corrected for inflation. Prices for EU salmon are likely to reflect the global market, influenced by the larger industries in Norway and Chile.

Figure 3.7: Price (€/kg) evolution of salmon: 2008-2018.



Source: EU Member States EUMAP data submissions, 2021

3.1.2 Seabass & Seabream

According to FAO production data, the combined production of European seabass (*Dicentrarchus labrax*) and Gilthead seabream (*Sparus aurata*) almost doubled during the 2008 – 2018 period from 245.3 thousand tonnes valued 1 480 million USD in 2008 to 464 thousand tonnes valued 2 247 million USD in 2018. Twenty-six countries were producing one or both species in 2018. Leading production countries are Turkey and Greece producing 42% and 22% of the total volume and 36% and 26% of the total value in 2018, respectively. The eight largest producing countries: Turkey, Greece, Egypt, Spain, Tunisia, Italy, Croatia and Cyprus produced more than 95% of the total volume in 2018. Turkey, Egypt, Tunisia and Albania have considerably increased the production volume since 2008. The EU member states Croatia and Cyprus have also considerably increased production volume since 2008, whereas the main EU production member states, Greece, Spain and Italy have increased production volume at a lower rate during the same period by 19%, 10% and 6%, respectively. Thus, the volume share of the EU producer countries have decreased from 60% in 2008 to 38% in 2018. Accordingly, the value share of the EU producer countries has decreased from 65% in 2008 to 50% in 2018 (FAO, 2021).

Global production of European seabass according to FAO production data, has doubled during the 2008 – 2018 period from 115 thousand tonnes valued 781 million USD in 2008 to 236 thousand tonnes valued 1 165 million USD in 2018. Turkey and Greece are the world seabass leading producers with 50% and 20% of the volume and 44% and 24% of the value produced in 2018, respectively. The EU member states produced 84 thousand tonnes, valued 579 million USD, in 2018. The main European producer is Greece with 47 thousand tonnes, followed by Spain and Croatia with 21.3 and 6.2 thousand tonnes, respectively. The volume share of the EU producer countries have decreased from 52% in 2008 to 36% in 2018. Accordingly, the value share of the EU producer countries has decreased from 61% in 2008 to 50% in 2018 (FAO, 2018).

Global production of Gilthead seabream according to FAO production data, increased during the 2008 – 2018 period from 130 thousand tonnes valued 698 million USD in 2008 to 229 thousand tonnes valued 1 082 million USD in 2018. Turkey and Greece are the world Gilthead seabream leading producers with 34% and 25% of the volume and 29% and 28% of the value produced, respectively. The EU member states produced 92 thousand tonnes, valued 543 million USD, in 2018. The main European producer is Greece with 56.2 thousand tonnes, followed by Spain and Italy with 13.8 and 7.3 thousand tonnes, respectively. The volume share of the EU producer countries have decreased from 68% in 2008 to 40% in 2018. Accordingly, the value share of the EU producer countries has decreased from 70% in 2008 to 50% in 2018 (FAO, 2021).

The European seabass and Gilthead seabream sector was undergoing a consolidation phase during the past decade. The three major production companies in Greece are now part of a large company group under the same ownership, which also includes companies in Spain. The Spanish production suffered significant damages by the Gloria storm during 2020 allowing other producing countries partially offset the lower demand due to Covid-19. In Italy, many companies have consolidated their negotiation position, thanks to the acquisition of smaller fattening companies, but also through an operation which, to date, has also registered vertical integration both upstream (hatchery) and downstream (processing and packaging) and nowadays the vast majority of the production is controlled by three companies. In Italy, the investment in aquaculture has significantly increased during 2018, partially owing to the launch of EMFF calls. In Portugal, offshore aquaculture has started to emerge. The Croatian production continues to expand, followed by increased investments in processing facilities in order to maintain profitability, enhance the efficiency of business procedures and reach wide range of target customers through premiumisation – providing high valued innovative products and constantly expanding the product portfolio.

The vast majority of seabass and seabream is produced and consumed in Southern European and other Mediterranean countries. New markets are steadily emerging and exports to North America and Middle East are nowadays becoming regular. The European industry in 2018, according to the DCF data consists of 457 enterprises (number of units in the case of Greece which does not correspond to companies), which is same as in 2017. Most of these firms combine the production of the two species, and volumes of each may change yearly according to the demand, prices and fingerling availability. When price of seabream decreases, producers usually increase the production of seabass and vice versa.

Table 3.5: Economic indicators for the EU seabass & seabream aquaculture: 2018.

Country	Number of enterprises		Total sales volume		Turnover		Employment		FTE		Average wage	
	number		thousand tonnes		million €		number		number		thousand €	
	2017	2018	2017	2018	2017	2018	2017	2018	2017	2018	2017	2018
Croatia	25	21	10.3	12.1	67.1	72.1	473	474	418	425	18.9	19.7
Greece	343	347	98.5	105.7	527.9	539.0	3,026	3,064	2,574	2,958	22.1	17.7
Italy	46	46	14.3	13.0	103.2	95.4	411	375	100	109	130.7	111.7
Portugal	8	11	1.0	1.1	6.0	6.3	34	57	30	51	16.3	39.4
Spain	35	32	45.0	37.1	217.0	222.9	1,531	1,299	1,113	874	30.5	32.8
Other none DCF			13.3	12.7	75.1	75.8						
Total DCF reported	**457**	**457**	**169.1**	**169.0**	**921.1**	**935.6**	**5,475**	**5,269**	**4,235**	**4,417**	**26.5**	**23.4**
Total EU			**182.4**	**181.7**	**996.2**	**1,011.4**						

Source: EU Member States DCF data submission, 2021

Based on DCF data, in the reference period the seabass and seabream segment slightly decreased in terms of production and employment. EU production decreased in 2018 to 166.9 thousand tonnes. At national level, relatively biggest growth was recorded in Croatia (18%). In absolute values Croatian production in 2018 reached 12 thousand tonnes, mostly intended for export. The value of EU production increased during 2018 to €1 011 million. Croatia, Portugal, Spain and Greece recorded an increase of the turnover (7%, 4%, 3% and 2%) while Italian turnover decreased by 8%. Slovenian and Maltese data could not be reported here because of confidentiality issues.. Employment decreased to 5 269 employees corresponding to 4 417 FTEs.

On average the wages in the EU seabass and seabream aquaculture segment slightly increased, compared to 2017, except for Italy and Greece but increased compared to 2016.

Since 2012, the EU production of seabass and seabream has stabilised. The most important factors driving this stabilization refer to the 2008/2009 price decline and the weak demand in southern Europe as an effect of the lower income due to the recent debt crisis. Southern European member states have been influenced by the global economic crises (Italy, Slovenia, Croatia, Spain and Greece) during the recent years. Low credit availability in southern Europe also contributed to the stabilization of production. On top, rising feed costs have weakened the economic performance of the sector. Recent liquidity problems of the Greek producers did not allow the sector to fully recover from the 2008/2009 price decline up until 2016. In Greece, the concentration process of the sector during the past years was mainly financed by loans. A large number of Greek SME's and larger aquaculture enterprises were unable to repay these loans and a new restructuring and concentration cycle has started in Greece during 2014. The ownership of the major seabass and seabream aquaculture companies was transferred to the Greek banks during 2015/2016 thus later facilitating the flow of working capital. Ownership was then transferred during 2018 to an investment fund, which now controls the three larger production companies in Greece and companies in Spain under the same brand name. Further consolidation of the seabass and seabream sector in Greece is less likely; nevertheless, other investment funds have also expressed their interest to consolidate production in Greece. On the other hand, in the case of Croatia, there is a growth in production after the opening of the EU market for Croatia in 2013 (109% from 2013 to 2018) and overcoming the economic crises, following the investments and improvements in technology and distribution of fish products, as well as vertical integration towards processing, and more emphasis on ecolabelling which is expected to further encourage the total production and may have an impact in further positioning of Croatia in EU aquaculture sector.

In addition, based on the national strategic plans for the development of aquaculture, as production growth is expected in forthcoming years, there is a need to reduce dependency on domestic market sales and increase the export market penetration of the species through collaboration and collective marketing strategies. Also, the need for improved data collection and dissemination is being recognized, so as the need for better environmental regulations and practices. Although profitability in the reference period has been the major issue, some steps should be taken towards laying a more stable foundation and encouraging the sustained growth of the industry in the future. In the next reporting period, it is expected to see results from product modernization and diversification, with more emphasis on preparation, portioning and packaging, also as in ecolabelling and organic certification, which should provide more added value, higher prices and better profitability.

Since 2008, non-EU countries such as Turkey, Egypt and Tunisia have considerably increased production of the two species. Until 2012, approximately 10% of the Turkish production was controlled by Greek enterprises, but since then, most of these assets were transferred to new owners. While Turkish seabream production is significant, large quantities produced are consumed in the local market. On the other hand, Turkish seabass production is exported to EU countries.

According to FAO market reports, for the last decade, Turkish production has been steadily increasing production volumes due to instabilities in the Greek industry, but also due to advantages in terms of production costs and received substantial investment and government support, which allowed pricing bellow Greek counterparts and entering into established and emerging markets alike. On the other hand, there exists a price premium for the European seabass production, which is attributed to the quality of the product. The delay of approximately one day for Turkish fresh seabass to reach the EU markets is reflected in the quality and the price of the product. The export subsidy that used compensate for the lower price of the Turkish product has also contributed to the lower price of the product in the EU market. Nowadays, Turkish producers leverage the logistics developed in Greece to facilitate the exports of aquaculture to EU countries so Greece has become the second largest export destination for seabream and seabass of Turkish origin. After the imports clearance in Greece, the Turkish products are distributed (as of Turkish origin) throw-out Europe.

While export subsidies in non-EU countries seem to have been eliminated, still the playing field is not levelled for the EU seabass and seabream producers. Non-EU production is not regulated to the same EU extend and producers do not need to maintain the same production standards (thus allowing for lower production costs). Nevertheless, both EU and non-EU producers compete in the same markets. A new label "Fish from Greece" has been introduced recently targeting export markets in order to differentiate from non-EU imported products. If successful, this label may aid to level the playing field between the Greek products produced under strictly regulated conditions in the EU and non-EU products.

For the EU countries that reported seabass and seabream economic performance data by segment the turnover reached €1 011 million in 2018, mainly originating from the cages segment. Due to the transition to EUMAP segmentation where some of the countries reported their data in DCF segments and others adapted to EUMAP segments, there could be some inconsistencies in segments compared to previous time series. Also, as the overall dominance of cage farming techniques is present, economic results on sea bass and sea bream are being shown in total.

Performance indicators for the EU seabass and seabream producer countries are presented in the table below. It is obvious that for most of the EU countries, the seabass and seabream segment despite obtaining positive economic returns (with exception of Portugal), got worse economic returns in 2018 compared to previous year.

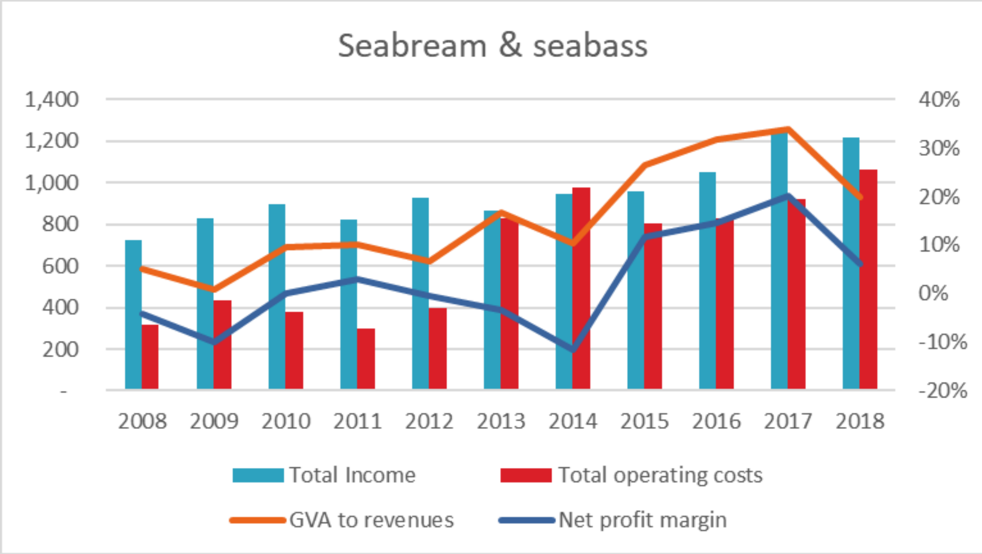
Table 3.6: Economic Performance indicators for the EU sea bass and sea bream aquaculture: 2018.

Country	GVA		EBIT		ROI		Labour productivity		Capital productivity	
	million €		million €		%		thousand €		%	
	2017	2018	2017	2018	2017	2018	2017	2018	2017	2018
Croatia	36.3	27.6	22.2	12.7	12.1	5.9	86.9	65.0	19.8	12.8
Greece	280.4	118.9	206.0	47.8	17.2	4.0	110.8	40.8	23.5	10.0
Italy	58.6	51.9	42.4	36.1	31.3	30.4	585.7	476.1	43.2	43.7
Portugal	0.8	-1.3	-0.3	-3.5	-3.7	-27.1	26.3	-24.8	10.8	-9.9
Spain	45.8	43.0	11.3	8.7	4.4	3.1	41.2	49.1	18.0	15.2
Total EU	421.9	240.1	281.6	101.7	15.8	5.6	100.7	54.9	23.7	13.2

Source: EU Member States DCF data submission, 2021

Despite the negative evolution of these indicators in 2018, in general economic performance of the industry has turned to positive results. The evolution of the markets during 2019 and 2020 will determine if the process of improving the economic results is consolidated or, on the contrary, the industry re-enters a negative context, having in mind the situation with pandemics' outbreaks. The increase in supply, the behaviour of prices, and the ability of the industry to diversify products and markets, adapt to rapidly changed market needs and consolidate improvements in the production process will be the main determining factors of this evolution.

Figure 3.11: Economic performance indicators for sea bass and sea bream aquaculture: 2008-2018.

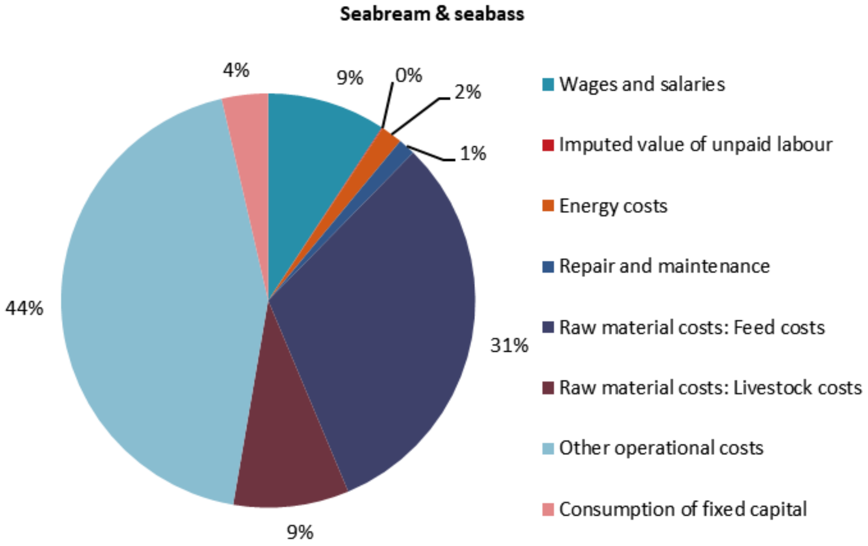


Source: EU Member States DCF data submission, 2018

As presented in the figure above, the EU seabass and seabream sector from 2012-2014, presents operating costs higher than the turnover thus growing losses are recorded for 2013 and 2014. However, due to market stabilization, turnover in 2015 has for the first time since 2010 exceeded the total operating costs. This trend was halted in 2017, when total revenue decreased and operating costs continued to rise. The negative trend continued in 2018, when rising operating costs and stagnant revenues caused the GVA to revenues and net profit margin to fall to pre-2015 levels.

In the figure below, the cost structure of the EU seabass & seabream aquaculture sector is presented for 2018. In total, raw material (feed costs and livestock) account for 40% of the total cost, slightly increasing from 2008. From 2017 to 2018, feed costs share decreased from 34 to 31%, following increase of share of livestock costs from 8% to 9%. Other operational costs rose from 34% in 2017 to 39% in 2018, which started an increasing trend compared to varying shares between 15% and 20% since 2008. Wages and salaries account for 11% in 2017 and 9% of the total cost respectively in 2018, with decreasing trend started in 2016. Part of the decreasing trend may be attributed to the decreasing wages and salaries in the southern EU countries but also to the outsourcing of some activities in the segment. After increase from 1% in 2008 to 7% in 2014 reflecting the increasing fuel prices for the period 2008 to 2014, the energy cost share decreased to 2% in 2016 and remained same during 2017 and 2018. According to market reports, in the next reporting period, it is expected to realize improvements in production, processing, logistics and marketing that will help to boost company margins through demand generation and cost savings.

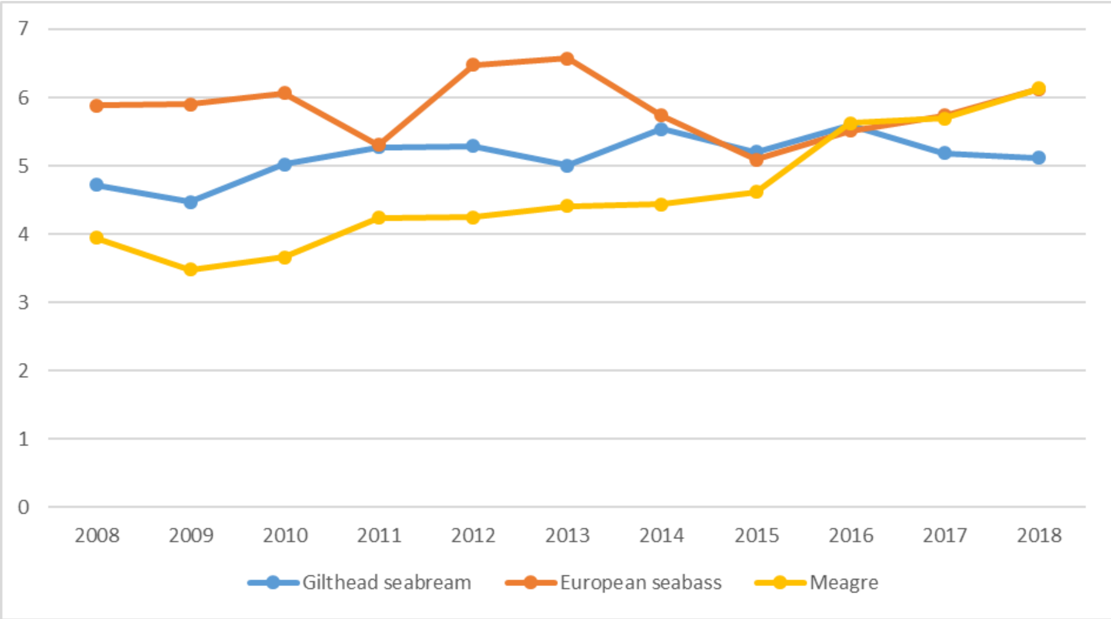
Figure 3.13: Costs breakdown for the EU sea bass and sea bream aquaculture: 2018.



Source: EU Member States DCF data submission, 2018

In the next figure, the price evolution of European seabass and seabream is presented. Low seabream price for 2008-2009 is identified while since 2010 the price is more than €5 per kg with annual fluctuations. On the other hand, seabass price is rather stable until 2011, presents an upward trend up to 2013 and, for both species, the price seems to converge in 2015 and further in 2016 at approximately €5.6/kg. The price for seabass continued to grow in 2018. The price of meagre presents an constant upward trend since 2010 and converges to the price of seabass through 2016, 2017 and 2018. The predictions for 2019 are uncertain due to a higher harvest volume expected during 2019 and 2020 in the largest producing countries – Turkey, Greece and Spain, the impact of Covid-19 and the impact of Gloria storm in Spain. Due to Covid-19 and lower demand in the traditional markets, producers in Greece turned to stocking of products (frozen) and new markets while recently announcing the lunch of new mainly ready to cook and ready to eat products. On the other hand, a significant rise in the production of marine species other than seabass and seabream is expected in Greece. In order to maintain stable market prices, it is necessary to level the playing field for EU and non-EU producers, diversify the export markets and develop a wider range of products.

Figure 3.14: Price (€/kg) evolution of the main species of sea bass and sea bream group: 2008-2018.



Source: EU Member States DCF data submission, 2018

3.1.3 *Atlantic Bluefin Tuna (Thunnus thynnus)*

The current production status of Atlantic Bluefin tuna (*Thunnus thynnus*) farming for 2018 from DCF data shows that Croatia, Malta and Spain are the three main EU member states involved in the production of the species. All three countries are operating in the Mediterranean and using the same production method of trapping, on-growing and enhancing in sea cages. The overall total sales volume in 2018 reached 29.1 tonnes. The production overview in Table 3.1.3.1 shows Malta with 60% of production, followed by Spain with 27% and Croatia at 13% in 2018.

Table 3.1.5.1: Economic indicators for EU tuna aquaculture: 2018.

Country	Number of enterprises		Total sales volume		Turnover		Employment		FTE		Average wage	
	number		thousand tonnes		million €		number		number		thousand €	
	2017	2018	2017	2018	2017	2018	2017	2018	2017	2018	2017	2018
Croatia	4	4	2.6	3.7	25.3	39.5	311	284	260	269	17.4	19.5
Malta	6	6	13.1	17.3	168.4	228.6	185	247	153	198	22.5	33.1
Spain	4	4	5.1	8.0	79.1	139.3	207	329	184	307	46.3	38.5
Other none DCF			0.0	0.0	0.0	0.0						
Total DCF reported	**14**	**14**	**20.8**	**29.1**	**272.7**	**407.4**	**703**	**860**	**598**	**774**	**27.6**	**30.5**
Total EU			**20.8**	**29.1**	**272.7**	**407.4**						

Source: EU Member States DCF/EUMAP data submissions, 2021

The overall value generated by all three production countries in 2018 was in the range of €407 million in sales value which Malta had the largest turnover of 56% followed by Spain at 34% and Croatia at 10%.

The economic performance of the EU tuna aquaculture sector improved in 2018, resulting in an overall positive economic performance in all indicators. GVA reached €43.8 million, EBIT €10.9 million, and ROI was 3.9%. Despite his overall increase driven by the improvements in the economic results of Croatia and Malta; the economic performance of the Spanish sector worsened in 2018.

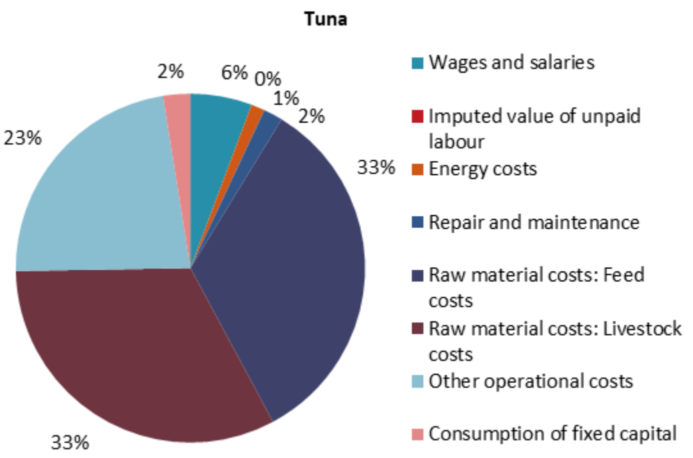
Table 3.1.6.2: Economic performance indicators for EU tuna aquaculture: 2018.

Country	GVA		EBIT		ROI		Labour productivity		Capital productivity	
	million €		million €		%		thousand €		%	
	2017	2018	2017	2018	2017	2018	2017	2018	2017	2018
Croatia	14.2	20.1	6.7	11.9	6.2	10.2	54.5	74.6	13.1	17.2
Malta	-23.5	13.0	-28.5	2.8	-85.3	7.3	-153.6	65.5	-70.3	34.3
Spain	20.1	10.7	9.6	-3.8	19.3	-3.1	109.0	35.0	40.5	8.8
Total EU	10.7	43.8	-12.2	10.9	-6.4	3.9	18.0	56.6	5.6	15.8

Source: EU Member States DCF/EUMAP data submissions, 2021

The main operational costs of the EU tuna aquaculture sector are feed and livestock costs, each of them representing a 33% of the total costs, followed by other operational costs with 23%. Wages and salaries represented the 6% of the total costs, while depreciation the 2%.

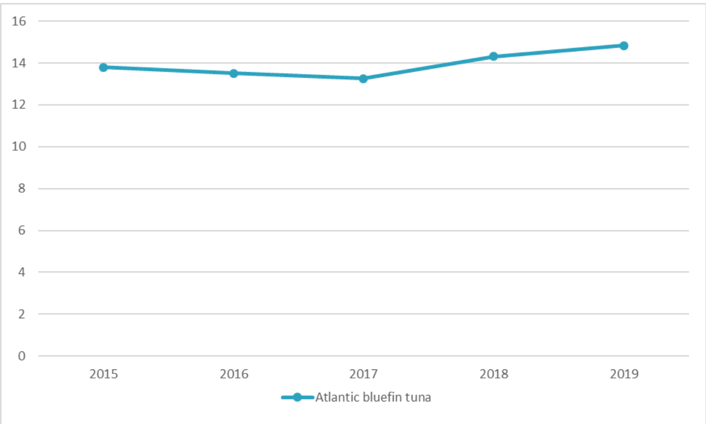
Figure 3.6: Costs breakdown for the EU tuna aquaculture: 2018.



Source: EU Member States EUMAP data submissions, 2021

The average price of Atlantic Bluefin tuna in 2018 was €14.3 per kg and €14.8 per kg in 2019. The price per kg of farmed tuna has seen an increase since 2017 where it was at a low €13.3 per kg. Previous reports have stated the price at a high of €19.2 per kg in 2012, which followed with a decline in price until 2017.

Figure 3.1.3.3. Average price/kg of Atlantic Bluefin tuna: 2018

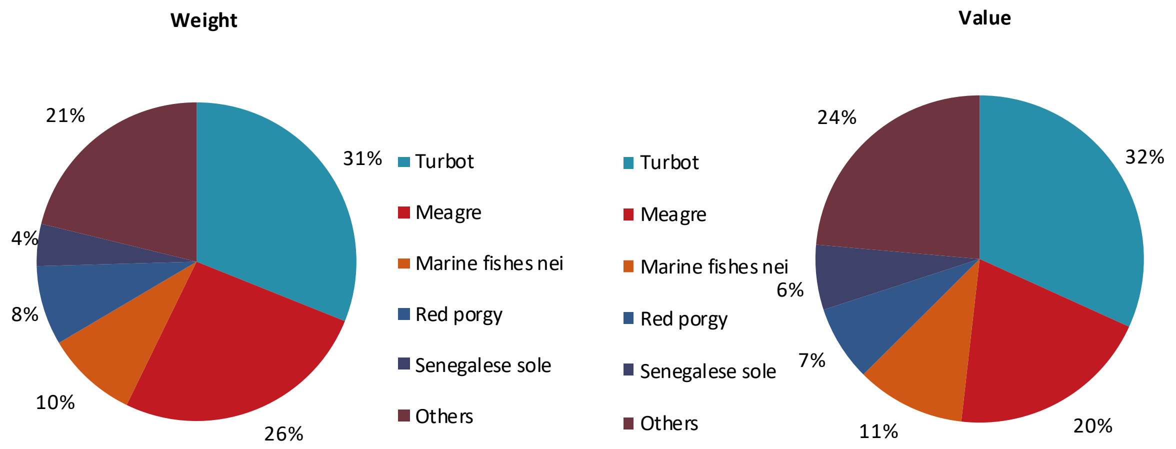


Source: EU Member States EUMAP data submissions, 2021

3.1.4 Other marine fish species

Figure 3.1.4.1 shows the remaining marine species produced in the EU. The total value of those species was €171 million corresponding to 24 thousand tonnes in 2018. Turbot was the most important species in terms of value and volume, contributing with €63 million and over eight thousand tonnes. Turbot was mainly produced in Spain and Portugal. The second most valuable species was meagre, contributing 20% to the total value and 26% to the total volume. The main producers for meagre were Spain, Greece, Croatia and Portugal. Red porgy and Senegalese sole also had quite significant share in other marine species production. Red porgy was farmed in Greece and Senegalese sole mainly in Spain.

Figure 3.1.4.1: Main species, produced in the other marine fish farming facilities: 2018.



Source: FAO, 2021

3.2 Shellfish aquaculture

Worldwide seafood demand for bivalves continue to grow. The different species of shellfish produced in aquaculture include Mediterranean mussel, Blue mussel, Pacific cupped oyster, Venus clams nei, See mussels nei, Grooved carpet shell, others. The main species of shellfish produced Mediterranean mussel counting for 50% of total production, Blue mussel and Pacific cupped oyster, as well as Venus clams nei for 5% (FAO, 2018).

Seventeen Member States (still including UK) are involved in the EU shellfish sector in 2018. In the EU producing countries total production increase up to 675 thousand tonnes in 2018, versus 2017 production of 668 thousand tonnes, with a total value of €1.30 billion, comparing with 2017 production value of €1.26 billion, corresponding to an increase of 1% in weight and 3% in value. This production is particular important because it is mainly produced by small-scale farms, with high employment and therefore has an increasing importance from social-economic reasons.

The number of enterprise diminished to 7 250 units in 2018, versus 7 322 units in 2017, while the number of total employees increased from 34 856 in 2017 to 37 010 employees in 2019. The main important countries are Spain with 2 701 enterprises and 14 905 employees (FTE 4 125), France 2 455 enterprises and 13 710 employees (8 363 FTE), Italy 400 enterprises, 3 703 employees (1 361 FTE), and Portugal 820 enterprises, total employees 1 337 (FTE 495).

Table 3.2.1: Economic indicators for the EU shellfish aquaculture: 2017-2018.

Country	Number of enterprises		Total sales volume		Turnover		Employment		FTE		Average wage	
	number		thousand tonnes		million €		number		number		thousand €	
	2017	2018	2017	2018	2017	2018	2017	2018	2017	2018	2017	2018
Bulgaria	31	27	1.6	1.3	1.1	1.0	87	45	75	43	4.3	3.6
Croatia	103	97	1.0	0.9	1.7	1.7	154	178	71	88	15.4	13.2
Denmark	4	6	2.4	3.1	1.4	2.3	17	22	12	16	57.8	53.6
France	2,455	2,455	171.3	180.5	650.7	703.9	13,710	13,710	8,633	8,633	23.3	25.9
Germany	8	8	18.6	15.9	25.5	32.5	110	117	96	104	56.8	52.2
Greece	201	193	16.6	20.9	6.1	6.5	325	325	199	199	34.9	25.2
Ireland	249	249	26.2	24.4	60.0	58.2	1,698	1,707	831	878	22.5	26.1
Italy	400	400	104.7	96.2	183.5	156.0	3,546	3,703	1,933	1,361	22.5	33.4
Netherlands	69	69	46.5	51.9	60.7	67.5	234	231	234	231	64.0	62.0
Portugal	846	820	6.4	7.2	53.7	65.1	1,471	1,337	881	495	5.9	14.1
Slovenia	6	6	0.7	0.6	1.0	1.0	17	17	13	14	16.1	16.5
Spain	2,721	2,701	246.7	248.6	167.4	169.8	12,729	14,905	3,679	4,125	31.0	28.0
Sweden	18	14	2.0	2.0	1.3	0.6	42	37	26	21	24.1	16.7
United Kingdom	210	205	23.7	20.9	46.3	32.1	716	675	493	459	19.7	15.2
Other none DCF			0.0	0.0	0.3	0.3						
Total DCF reported	**7,322**	**7,250**	**668.4**	**674.4**	**1,260.3**	**1,298.1**	**34,856**	**37,010**	**17,176**	**16,668**	**24.6**	**26.9**
Total EU			**668.4**	**674.5**	**1,260.7**	**1,298.4**						

Source: EU Member States DCF data submission, 2021

Data submitted by MS show an increase of GVA from €773.6 million in 2017 year to €794.6 million in 2018, and an EBIT value of €249.8 million in 2018, decreasing from € 257.2 million in 2017.

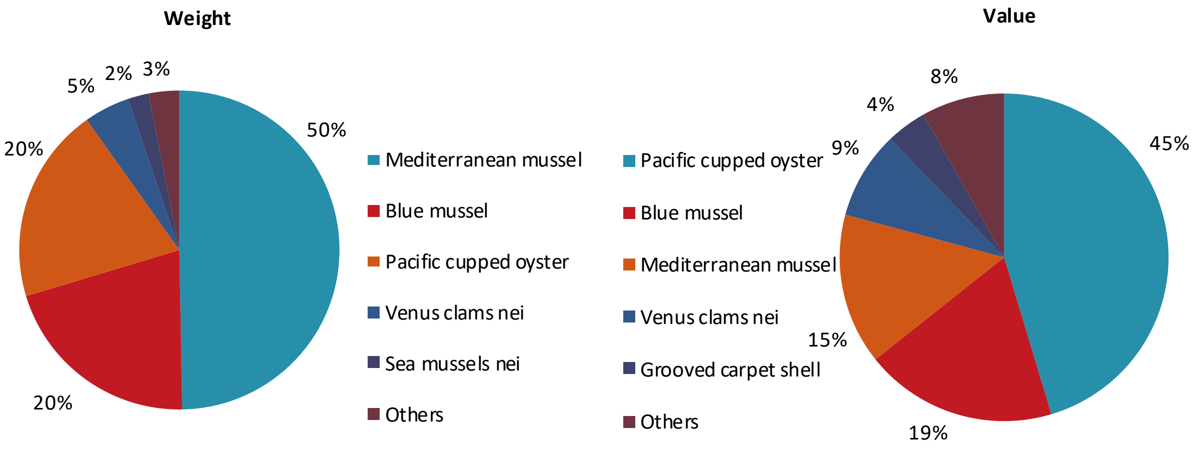
Table 3.2.2: Economic indicators for the EU shellfish aquaculture: 2017-2018.

Country	GVA		EBIT		ROI		Labour productivity		Capital productivity	
	million €		million €		%		thousand €		%	
	2017	2018	2017	2018	2017	2018	2017	2018	2017	2018
Bulgaria	1.3	1.2	-0.2	0.8	-2.9	9.4	16.9	27.7	16.3	13.4
Croatia	1.4	1.1	0.1	-0.7	6.4	-10.8	19.2	12.0	58.5	15.6
Denmark	0.7	1.5	-0.1	0.5	-3.0	13.9	61.2	95.4	27.6	42.0
France	363.8	403.3	96.8	111.2	9.6	9.9	42.1	46.7	36.0	36.0
Germany	9.6	17.5	2.2	10.4	4.9	57.6	99.8	168.5	20.9	97.3
Greece	5.7	5.8	-1.3	0.8	-121.8	65.8	28.6	29.4	546.5	481.0
Ireland	42.2	34.4	17.9	5.9	16.2	4.7	50.8	39.2	38.2	27.4
Italy	138.4	108.1	89.4	57.3	67.6	44.6	71.6	79.4	104.7	84.2
Netherlands	23.1	29.9	4.7	11.8	4.9	11.3	98.4	129.4	23.7	28.7
Portugal	46.0	59.5	39.2	51.0	147.7	170.7	52.2	120.2	173.2	198.9
Slovenia	0.7	0.6	-0.3	-0.3	-7.1	-6.5	51.8	43.4	14.2	14.0
Spain	112.9	116.3	-3.0	-2.8	-1.4	-1.8	30.7	28.2	51.1	74.2
Sweden	1.1	0.8	-0.6	-0.2	-11.7	-4.5	43.2	37.6	23.0	20.3
United Kingdom	26.7	14.6	12.3	4.1	17.8	5.2	54.3	31.8	38.7	18.5
Total EU	773.6	794.6	257.2	249.8	14.8	13.9	40.3	42.5	44.5	44.4

Source: EU Member States DCF data submission, 2021

The main species produced in EU shellfish farming facilities in volume, were Mediterranean mussels 50%, Blue mussels and Pacific cupped oyster for 20% each species, and Venus mussels for 5% and See mussels for 2%, others. In value terms, the most important species are Pacific cupped oyster 45%, Blue mussels 19%, Mediterranean mussel 15%, Venus clams 9%, Grooved carpet shell 4%, others shellfish species 8%.

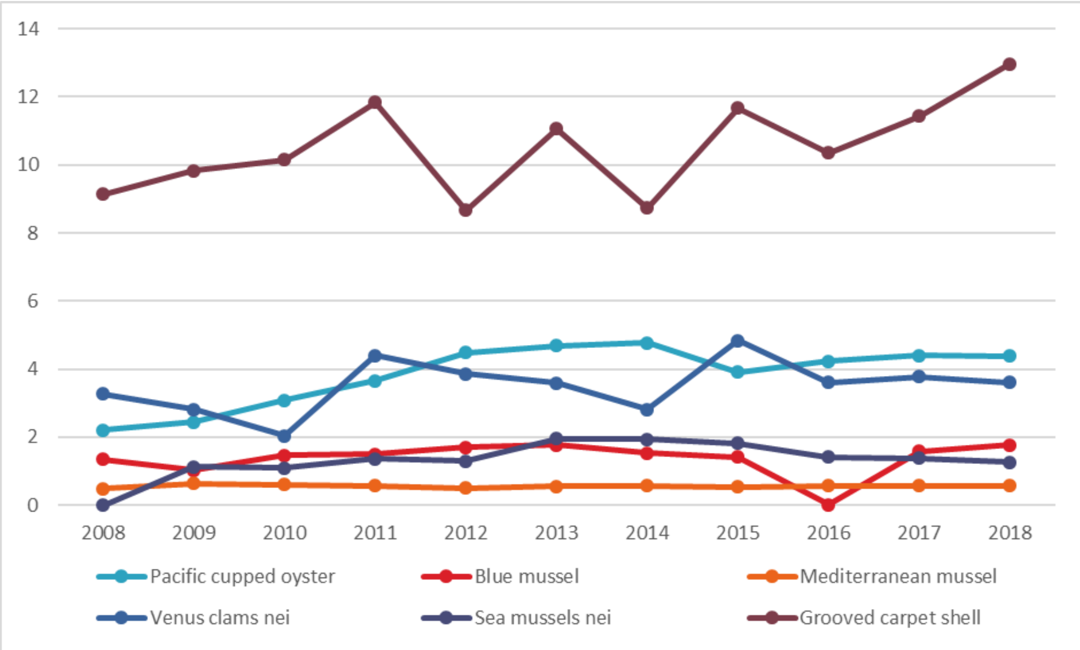
Figure 3.2.1 – composition in weight and value of the main shellfish species produced by the EU aquaculture sector: 2018



Source: EU Member States DCF data submission, 2021

The price evolution of shellfish prices during 2008-2018 analysed period is shown in Fig. 3.17 observing that for Grooved carpet shell starting with 2016 year a continue trend from €10.3 per kg up to €13 per kg in 2018 year. Pacific cupped oyster registered a slight increase from 2016 year €4.2 per kg until €4.4 per kg in 2017, maintained in 2018. A similar trend is observed for Blue mussel in the last years from € 1.4 per kg in 2014 up to €1.8 per kg in 2018. A relative stability of price level is recorded for Venus clams, Sea mussels, and Mediterranean mussel.

Figure 3.2.2 - Average prices (€/kg) for the main shellfish species produced by the EU aquaculture sector: 2008-2018



Source: EU Member States DCF data submission, 2021

3.2.1 Mussel

World´s total mussel production reached 2.1 million tonnes and 4.5 billion USD in 2016 (FAO, 2019). According to the data reported to FAO, the EU represents approximately 25% of world production of blue and Mediterranean mussel, both in volume and value. However, it is known that some countries do not report production per species, instead opting to refer to the country of production (e.g. Chilean mussel).

The main species of mussels farmed in the EU are blue mussel (*Mytilus edulis) and Mediterranean mussel (Mytilus galloprovincialis). Other species of mussels relevant in the international markets and farmed outside the EU are Chilean mussel (Mytilus chilensis) or (Mytilus edulis platiensis); the New Zealand* green-lipped mussel, (*Perna canaliculus*); and the Korean mussel (*Mytilus Coruscus)* and (*Crenomytilus grayanus)*. In the data set of the United Kingdom some production of *Mytilus Edulis* is reported as "Sea mussel nei", in the figure 3.21 above they was thus merged with "blue mussel" data reported by other Member States.

In Table 3.2.1.1 economic indicators for the mussel sector in the EU is shown. According to data collected under DCF for the year 2018, the volume of mussels produced in the EU is 485 thousand tonnes, valued at €447.8 million. In comparison to 2016, this represents a 1% increase in volume and a 23% increase in value. This is due to the 13% increase in production in Spain. For Spain, the main producer of mussels, this results in a 137% increase in turnover. The sales volume in The Netherlands decreased with 7% but the turnover still increased with 20%. Blue mussel prices are higher in 2018 compared to 2016, while Mediterranean mussel prices remain stable. Two main species produced in EU are Mediterranean mussel (332 thousand tonnes) and blue mussel (132 thousand tonnes).

93% of the companies reported under the DCF/EUMAP area are concentrated in six countries: Spain (63%), France (11%), Italy (7%), Greece (6%), United Kingdom (3%) and Croatia (3%).

More than 80% of the sales volume is concentrated in the same countries, with a turnover representing 77% of the total segment (2018). Spain represents 50% of the sales volume and accounts for 30% of the total turnover. Although France only accounts for 10% of the sales volume, it also represents 30% of the total turnover. An analysis of employment data shows that the six Member States account for more than 93% of employment, which corresponds to around 90% FTE of the mussel segment in the EU. The highest average salary of all EU Member States is paid to Dutch workers (about €79.2 thousand per year) followed by Danish workers (about €53.2 thousand per year) and German workers (about €52.2 thousand per year). If we compare salaries among the top 6 MS producers, the UK leads with an average wage of about €29.4 thousand per year, closely followed by Spain (about €27.7 thousand per year) and France (about €27.1 thousand per year). In Bulgaria, the average wage is €3.6 thousand, the lowest average wage recorded. In Croatia, the average wage is about 54% lower than the average EU one. In Italy, the average wage is about 45% lower than the average EU salary per FTE (€27.2 thousand) one. The average wages differ significantly between countries, which can be seen as an indicator of technological and organisational development in the various countries.

Table 3.2.1.1: Economic indicators for the EU mussel aquaculture: 2018.

Country	Number of enterprises		Total sales volume		Turnover		Employment		FTE		Average wage	
	number		thousand tonnes		million €		number		number		thousand €	
	2017	2018	2017	2018	2017	2018	2017	2018	2017	2018	2017	2018
Bulgaria	31	27	1.6	1.3	1.1	1.0	87	45	75	43	4.3	3.6
Croatia	84	80	0.9	0.9	1.6	1.6	132	159	64	80	14.9	12.5
Denmark	4	6	2.4	3.1	1.4	2.3	17	22	12	16	57.8	53.6
France	351	351	48.4	49.6	116.1	133.9	1734	1734	1322	1322	23.0	27.1
Germany	8	8	18.6	15.9	25.5	32.5	110	117	96	104	56.8	52.2
Greece	201	193	16.6	20.9	6.1	6.5	325	325	199	199	34.9	25.2
Ireland	82	83	16.0	13.9	14.6	12.0	364	340	214	210	23.4	21.8
Italy	224	224	68.5	65.1	46.9	43.9	986	970	980	820	12.8	14.9
Netherlands	48	48	43.9	49.3	47.8	53.9	184	181	184	181	81.4	79.2
Portugal	3	5	0.1	0.3	0.1	0.2	20	26	19	22	18.4	17.2
Slovenia	6	6	0.7	0.6	1.0	1.0	17	17	13	14	16.1	16.5
Spain	1965	1974	241.6	243.4	130.8	134.6	7415	8005	2684	3138	32.0	27.7
Sweden	9	7	2.0	2.0	1.2	0.5	30	29	24	20	24.5	17.7
United Kingdom	100	98	21.4	18.7	37.3	24.0	373	363	255	238	38.0	29.4
Other none DCF			0.0	0.0	0.0	0.0						
Total DCF reported	**3,117**	**3,110**	**482.7**	**485.0**	**431.4**	**447.8**	**11,795**	**12,333**	**6,142**	**6,408**	**28.4**	**27.2**
Total EU			**482.7**	**485.0**	**431.4**	**447.8**						

Source: EU Member States DCF data submission, 2021

Social importance of mussel sector

The mussel is cultivated mostly in Galicia, where it is a traditional and consolidated sector. The industry has a significant impact on the Galician economy. Most of the people working in the sector is from the local area. It is a sector with a high volume of production. The workers are often self-employed people and there are a lot of part time workers; many of them belonging to the same family as the owner. Other workers are fishers who work on the rafts during the season where the fisheries are closed.

It is important to highlight that the sector is closely related to the canning industry, also situated in the same areas, and in which most of the inputs are from the Galician. Furthermore, there are no external investments in the Spanish mussel sector.

The second country where mussels are cultivated is France where a specific breeding cultivation system on poles, called "bouchots", has existed since the Irishman Patrick Walton fortuitously invented this method in 1235, after a shipwreck in the Bay of Aiguillon. These poles are now part of the landscape of the Atlantic coast and the Channel. These family-owned businesses provide many family jobs. From the Normandy coast to the Belgian border, these companies are becoming more and more important with many salaried jobs, which benefit coastal residents. A few of these companies have also started to deploy offshore longlines in the Mediterranean and Charente Maritime. Investments then become much higher and jobs much more specialized. This cultivation requires specific flat-bottomed barges to approach the poles in the intertidal zone of about fifteen meters. In Normandy, this zone is directly accessible from land and operations are carried out using tractors instead of barge. Purification of mussels, when necessary, is carried out in mussel-farming establishments with sanitary approval for this purpose.

In Italy, mussel farming has become an important work activity in terms of employees. In some Adriatic regions, companies, most producer cooperatives, are starting investments to buy boats equipped with mussel purification plants. The boats are more than 18 meters long and have the double function of being at the service of the installations and also of bagging the product intended for commercialization. In the last three years, important innovations are taking place in the sector, especially with regards to the vertical integration of the production chain. Further interest has been that of being able to sell pre-growth product to other installations both in Italy and abroad.

Main techniques

Three main farming techniques are being used in the production of mussels in the EU. Rafts, long line and bottom harvest are well differentiated methods of production, which set further differences in terms of costs and market prices.

The bulk of the whole EU mussels' production is harvested in the Spanish North West region of Galicia where rafts are the dominant technique. A raft is a floating platform with pending ropes of around 30 meters in the form of a matrix, which can be folded according to the depth where the platform is located. The mussels are attached to the rope and covered with a net produced with organic materials that will be progressively disappearing until the mussel fixes to the rope in a natural way. Every row in the matrix corresponds to a particular harvest, which will be collected and replaced in the appropriate date maintaining a continued production along the whole year. Rafts require a minimum depth of around 8 to 10 meters in order to result in efficient outputs.

Long line cultivation in Italy, Ireland, and more recently in The Netherlands, shares with rafts the use of a main rope of 500 meter where vertical ropes or mussel bags are hang. This fact results in larger needs of space which not are always available due to competing water usages near the coasts. However, it allows mussel culture in shallow waters where rafts would not be suitable. This technique is also the only one that can be envisaged in the context of offshore production and can now be combined spatially with floating or fixed wind farms (pilot project in Belgium).

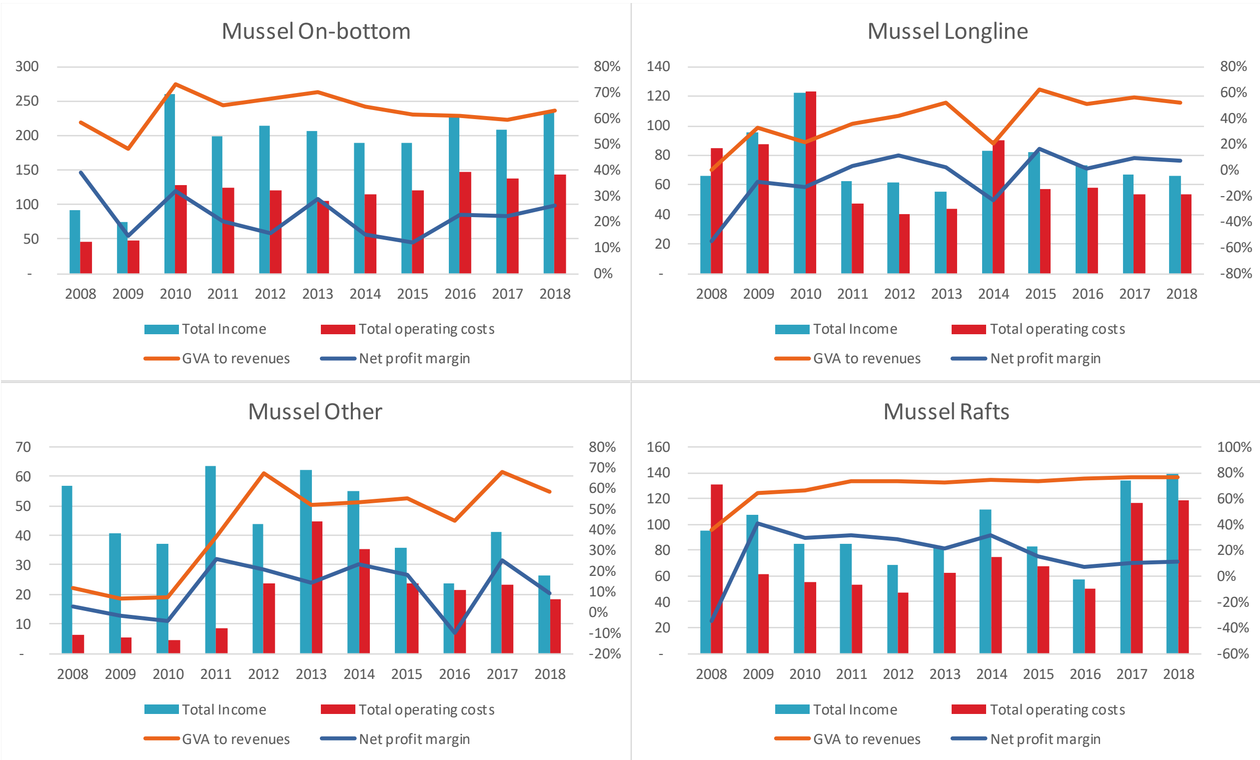
Bottom cultivation uses beds in The Netherlands and Ireland or poles (bouchots) and tables, very similar to rafts in France fixed in the seabed where the mussels are deposited or attached. This type of breeding "on bouchot" also makes it possible to benefit from the swaying of the tides, the mussels being alternately emerged and submerged and thus feeding on the various nutrients existing in the entire height of the water column. This specificity gives the mussels thus cultivated an inimitable taste which is crowned by a European "Traditional Specificity Guaranteed (TSG)".

The seed mussels are collected from special areas and are then carried to areas where the growth conditions are better for the mussels. These areas are assigned by state authorities for a certain fee and timely limited. In the case of bouchot, the excess seed is collected from the wild in Charente Maritime and Vendee on ropes suspended over the seabed on tripods, and they are then wound up and fixed helically on the poles.

The mussels are then, after mainly one year, more rarely two, harvested from the cultural fields. The harvest is done by dredges or beam trawl from the bottom, with a special sucker to collect the mussels fixed on the poles, with a specific pulley to turn the long lines and recover the ropes attached vertically and the mussel rolls that have developed there.

Small volume of product harvested are mostly sold directly to the local supermarkets or fishmongers. For more important quantity, the supermarket purchasing centers and the auction at Yerseke in the Netherlands play a major role: the most important markets for mussels from Germany and Denmark are sold for consumers in the Benelux-countries, France, and in Germany especially the Rhineland. The 80% of the production is sold to consumer into supermarkets, packaged in 1 to 2 kg trays.

Figure 3.2.1.1: Development of economic performance for the EU mussel aquaculture: 2008-2018.



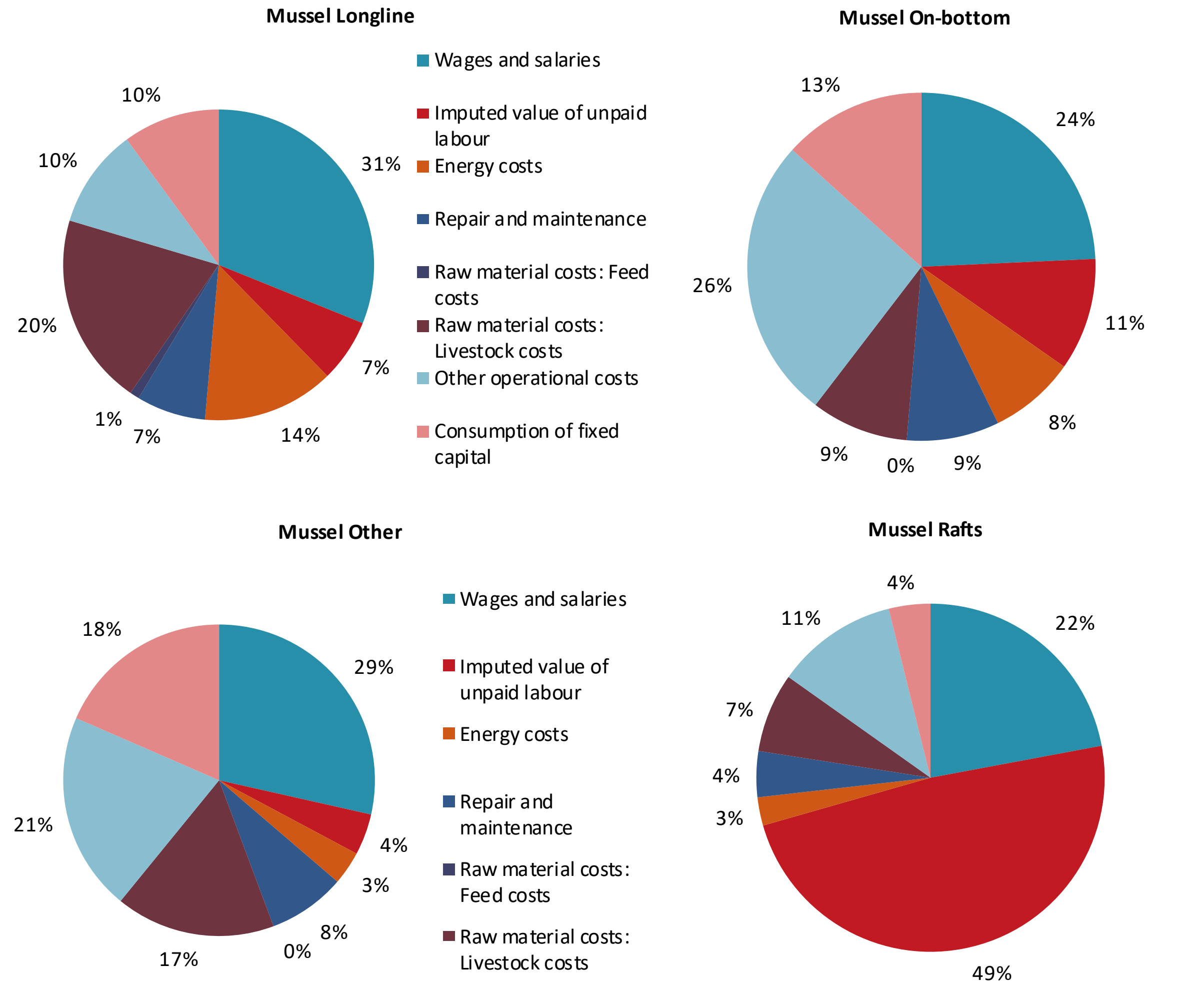
Source: EU Member States DCF data submission, 2021

The volume of seed mussels varies from year to year. In some years in the last decade, almost no seed fall could be noticed. With a time lag of one to two years, the volume of mussels for consumption varies accordingly. Predation by sea bream on the long lines, and by protected birds on the bouchots are observed with increased level year after year. Seed abundance and predation level are the two main reasons for the fluctuation of income in this sector. The employment is relatively stable.

All the techniques require the use of vessels, or tractor when the structure of the shore make it possible for the cultivation on poles, in order to collect the mussels and maintain the facilities. Whenever any Member State did not report the technique used for mussel culture, the data were allocated into the generic "mussel other" category. This is also the case when a mussel farmer is the owner of different licences making it possible for him to cultivate both on the bottom and on long lines. The figures for this category should be considered cautiously since different techniques could thus be mixed together.

The evolution of operating costs in Figure 3.2.1.1 shows different trends in the mussel segments. For mussel rafts, we have seen fairly stable figures in gross value added relative to income since 2009. In comparison to 2016, a strong increase in total operating costs and total income is recorded. In the Mussel On-Bottom segment, there is a strong increase in income noticeable and operating costs remain stable. Of all segments, the mussel long line has the highest profit margin of on average 27% in 2018, more than three times higher than the other segments. In the segment mussel other, the net profit margin was again positive in 2018 (9%), compared to 2016, when the net profit margin was negative at -10%.

Figure 3.2.1.2: Costs breakdown for the EU mussel aquaculture: 2018.



Source: EU Member States DCF data submission, 2021

As it may be expected, the important technical differences across the three techniques results in significantly different cost structures in terms of what are the relevant items and their magnitudes, as shown in figure 3.2.1.2.

One of the cost categories setting differences across techniques is the imputed value of unpaid labor. This has to do with the legal form of the enterprise. Raft and bottom culture records a large number of personal and family owned business in which other members of the family random or periodically contribute to the activity without a formal contract or salary. In contrast, the long line segment is mainly composed by cooperatives and consortia and such kind of informal labor is rarely present. Unpaid labor represents 49% of the total raft costs and 10% in bottom culture, but only 7% in long line. This is also reflected in the importance of the formal wages and salaries which are 31% in long line, 24% in bottom culture and 22% in raft culture. The energy costs are significantly higher for mussel longline (14%) compared to 8% in the on-bottom segment and 3% for rafts. The on-bottom segment has the highest other operational costs of all segments (26%) compared to the other segments.

A shown in Table 3.2.1.2, for most mussel farmers, the total costs of production are almost fixed, given the absence of feed and livestock costs. With production, and thereby turnover, varying significantly per year, labour productivity shows high variation as well from year to year for a specific country. This, however, is not explained by changes in the workforce, instead reflecting natural variation in production and the level of predation. The differences in labour productivity across countries show the different capital intensity in the reported countries. In Denmark, Germany and the Netherland production is based on a high input of physical capital, while in other countries the production is more labour intensive.

Table 3.2.1.2: Economic Performance indicators for the EU mussel aquaculture: 2017-18.

Country	GVA		EBIT		ROI		Labour productivity		Capital productivity	
	million €		million €		%		thousand €		%	
	2017	2018	2017	2018	2017	2018	2017	2018	2017	2018
Bulgaria	1.3	1.2	-0.2	0.8	-2.9	9.4	16.9	27.7	16.3	13.4
Croatia	1.2	0.9	0.2	-0.8	7.4	-11.5	19.3	11.2	54.9	13.6
Denmark	0.7	1.5	-0.1	0.5	-3.0	13.9	61.2	95.4	27.6	42.0
France	87.3	97.0	44.0	46.9	19.8	18.5	66.0	73.3	39.3	38.3
Germany	9.6	17.5	2.2	10.4	4.9	57.6	99.8	168.5	20.9	97.3
Greece	5.7	5.8	-1.3	0.8	-121.8	65.8	28.6	29.4	546.5	481.0
Ireland	9.3	8.0	2.2	1.7	5.9	3.7	43.6	38.0	25.0	17.6
Italy	23.8	20.7	8.3	5.4	14.3	8.9	24.3	25.3	40.9	34.2
Netherlands	23.1	29.9	4.7	11.8	4.9	11.3	125.1	165.1	23.7	28.7
Portugal	0.3	-0.2	-0.9	-1.5	-14.8	-78.7	14.4	-8.5	4.6	-9.9
Slovenia	0.7	0.6	-0.3	-0.3	-7.1	-6.5	51.8	43.4	14.2	14.0
Spain	100.2	105.1	13.9	16.5	11.6	26.0	37.3	33.5	83.0	165.3
Sweden	1.1	0.8	-0.5	-0.2	-11.5	-4.7	45.9	39.9	22.9	21.0
United Kingdom	26.7	14.6	12.3	4.1	17.8	5.2	104.8	61.3	38.7	18.5
Total EU	290.9	303.4	84.6	96.1	12.4	14.7	47.4	47.4	42.8	46.4

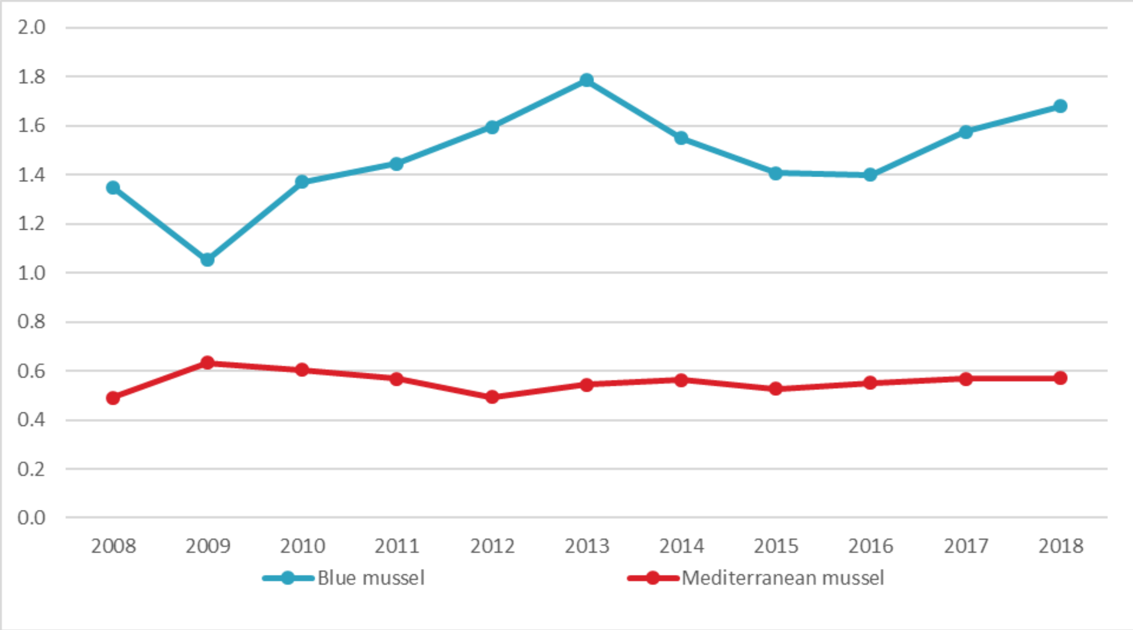
Source: EU Member States DCF data submission, 2021

The EU mussel aquaculture gross value added reached more than €303 million, which is an increase of 30% compared to 2016. EBIT reached almost €96 million, also 30% higher than 2016. The ROI remained stable at 14.7%. Labour productivity reached around €36 thousand per year, stable compared to 2016. A capital productivity of 46.4% in 2018 brings it back on the 2015 level after a decrease in 2016.

Since the financial crises in 2008, the income, GVA and net profit margin has improved again in the sector. However, the turnover and total operational cost has declined until 2012, indicating a lower activity in the sector. GVA to revenue and net profit margins continued their steady increase and are now almost back at 2013 levels.

Figure 3.21 shows the market price for a kilo of blue mussels was more than €0.6 more expensive than for Mediterranean mussels in 2009. Since that date, the gap between the price of Mediterranean mussels and blue mussels is increasing to €1.1 in 2018. Mediterranean mussels had an average price around 56 cents per kilo along the period observed, and had a stable evolution. The price for blue mussel increased 60% per kilo from 2009 until reaching almost €1.8 per kg during the 2013. In 2016, prices for blue mussel have fallen down to almost €1.4 per kg, and then rose to € 1.7 per kg in 2018. The average growth from 2009 to 2018 is therefore 55%.

Figure 3.2.1.3: Price (€/kg) evolution of the main species of mussel group: 2008-2018.



Source: EU Member States DCF data submission, 2021

Outlook

Mussel production can be considered as an environmental friendly business, as no feed is necessary and the mussels take nutrients from the water column. It should also be noted that mussels provide ecosystem services to the environment: they sequester carbon, eliminate excess nitrogen and clarify water while feeding to produce a food recommended by dieticians. Mussels are therefore a food in harmony with the Green Deal of the European Union and the "Farm to Fork (F2F)" and Biodiversity Strategies: Kim et al. (2020)[3] compared greenhouse gas (GHG) and water footprints of various diets in 140 countries and concludes that in relation to exclusively plant-based (vegan) diets, those diets consisting basically of plant foods supplemented with low-food chain animals, like mussels, have comparatively small GHG and water footprints and offer greater flexibilility, so these is a healthy and sustainable diet. Several recent publications describe the ecosystem services provided by both the natural beds of bivalves and by the aquaculture of molluscs[4]. Clear level of carbon sequestration by shells is still in discussion in the scientific

[3] Kim, B.F.; R.E. Santo, A.P. Scatterday, J.P. Fry, C.M. Synk, S.R. Cebron, M.M. Mekonnen, A.Y. Hoekstra, S.de Pee, M.W. Bloem, R.A. Neff and K.E. Nachman. (2020). Country-specific dietary shifts to mitigate climate and water crisis. Global Environmental Change 62: 101926.

[4] Northern Economics, Inc. Valuation of Ecosystem Services from Shellfish Restoration, Enhancement: A Review of the Literature. Prepared for NOAA National Ocean Services: EPA RESErv Program. May, 2012.

Smaal, A. C., Ferreira, J. G., Grant, J., Petersen, J. K., & Strand, Ø. (Eds.) (2018). Goods and services of marine bivalves. Springer International Publishing. https://doi.org/10.1007/978-3-319-96776-9.

Van der Schatte Olivier, A.; L. Jones, L. Le Vay, M. Christie, J. Wilson, S.K. Malham (2018). A global review of the ecosystem services provided by bivalve aquaculture. Reviews in Aquaculture 2020, 12: 3–25 https://doi.org/10.1111/raq.12301

McLeod, D.A. & C. McLeod (2019). Review of the contribution of cultivated bivalve shellfish to ecosystem services. A review of the scientific literature commissioned by Crown Estate Scotland. 49 pp.

Pouliquen, A. (2019). Les services écosystémiques de la conchyliculture. 72pp.

community on this service[5], but Joël Aubin[6] analysed in 2017 the Life Cycle Assessment of blue mussel in the Bay of Mont-Saint-Michel in the Channel, and concluded to have a very limited environmental impact.

The principle "filter feeding" of mussels does include stable production costs for the producers as the variation of seed and energy costs does not affect the business so much as in finfish aquaculture and recirculation systems. On the other hand, it is an environmental depending production, which in some cases hinders a stable supply of seafood products from year to year. In some areas, like Spain and France, the problem of red tides is very relevant. In the Netherlands and Germany the problem of lacking seed mussels are an obstacle for stable and growing production. Bird and fish predation becomes significant in Greece, Italy and France. Bottom culture depends on the supply of mussel seed, either from the market or by own collection. There is natural variation in the amount of mussel seed available. Concerns about the ecological impact of mussel seed collection in the Wadden Sea have led to harvest restrictions. The environmental aspect leaved to important impacts on mussel farming. Some producer organizations in Italy and in France have obtained the recognition of "Protected Designation of Origin (PDO)" product", another valorized the "bouchot" cultivation system through a "Traditional Specificity Guaranteed (TSG)", but environmental conditions continue damaging production expectations. In the case of mussels, it is important to enhance the offer with attributes such as certifications and organic. The latter is an individual company certification, unlike collective certification such as DPO and TSG. It is in danger due to recent European regulatory developments governing it: shellfish waters where a product would be "organic" shall now be classified A, within the meaning of the Hygiene Package for microbiological criteria and shall be in "good ecological condition". The microbiological criterion is new and was not included in the previous version of the regulation. Given that 50% of European shellfish waters are classified as B, half of the certified "organic" mussel farming companies risk losing this accreditation in 2021. The quality of the water is, remains and will continue to remain, the sole responsibility of the Member States and their regions, not under that of the mussel growers. In this context, the European mussel farming sector thus may face some tensions between the willingness of F2F Strategy to develop organic productions and the organic production regulation, which spatially limits this possibility.

Recent developments in offshore long lines, often linked to offshore wind farms (Belgium, France) are at the study or pilot project stage. Others (Netherlands, Italy, and Ireland) are unrelated to wind farms. But, they are all part of a vision shared between the Industry, Member States and the Commission in the Green Deal: to ensure the development of a sustainable activity and food security for Europe. This trend will be followed in future reports.

The analysis of mussels still lacks from the data quality. Segmentation by species and technique cannot clearly be differentiated due to different understanding by MS when submitting data and due to different dominant technique in different countries. Some countries did not report data for all of the years covered by DCF data collection scheme (e.g. UK and Greece) and some joined EU later than 2008. This means, that all analysis of the European mussel sector must be taken with caution. The mussel business differs between MS by technique and capital intensity. In all cases, it contributes to rural development, either by direct employment, linkages to other industries or by providing positive external effects on tourism and regional gastronomy. More than this, mussels as an environmental friendly business contributes to food supply by providing valuable animal proteins and other nutrients, and the production itself improves the environmental conditions by taking nutrients from the water column.

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[5] Filgueira, R.; T.Strohmeier & Ø. Strand (2019). Regulating Services of Bivalve Molluscs in the Context of the Carbon Cycle and Implications for Ecosystem Valuation In: Goods and Services of Marine Bivalves (ed. Smaal, A., Ferreira, J., Grant, J., Petersen, J. K., & Strand, Ø.) pp 231-251. Springer Nature. Cham, Switzerland.

Moore, D. (2020). A biotechnological expansión of shellfish cultivation could permanently remove carbón dioxide from the atmosphere. Mexican Journal of Biotechnology 5 (1): 1-10. Https://doi.org/10.29267/mxjb.2020.5.1.1

[6] Aubin, J. ; Fontaine C., Callier M., Roque d'Orbcastel E (2017). Blue mussel (Mytilus edulis) bouchot culture in Mont-St Michel Bay : potential mitigation effects on climate change and eutrophication. Springer 2017 https://doi.org/10.1007/s11367-017-1403-y

Regarding the impact of the COVID-19 pandemic, the European mussel farming sector has suffered relatively less than all other aquaculture sectors. In fact, the first confinement in March and April 2020 corresponded to a period when mussels were growing on their supports (rafts, long lines, poles, tables, on the seabed) and required little or no maintenance on site. The reopening of social activities during the summer of 2020, with that of restaurants, travel authorizations and holidaymakers corresponded to the usual period of main marketing of mussels in Europe. Those sold later in autumn, when restrictive pandemic control measures were put in place, are usually done through supermarkets (self-service sales) which have remained open and accessible to consumers. The sales volume and the corresponding turnover should therefore be affected to a lesser extent than the trends announced in the specific COVID chapter of this report. The two only causes announced for a decrease in production on the market come from producers who have suffered significant predations and some summer mortalities, which have been recurring since 2014 mainly in France.

The impacts of COVID-19 will have to be analysed over time, especially when state aid ends and guaranteed loans granted by certain Member States must be repaid.

The desire of certain mussel growers to develop, within their own company, a transformation of their product, in particular by extracting the flesh and using it as ready-made meals, should be given special attention. The integration of product processing is potentially a significant change, including keeping processed products to market at the most opportune time.

Finally, recent political, regulatory and societal developments will have consequences for shellfish farming companies: the Single-use plastic Directive establishes the principle of extended producer responsibility, making it necessary to recycle plastics. The nets used in European mussel farming are intended only to protect the farms against predation (sea bream and birds). A significant R&D effort is underway to supply nets made from bio-based materials. The cost of such materials is higher than that of plastics currently in use. The Biodiversity Strategy also requires, particularly in the context of a circular economy, that shellfish waste must be recycled. Professionals have tested and developed techniques for recovering this waste at company level during handling. The immense amount of waste that remains untreated today is that rejected by consumers of mussels. These purchases could be valued in a similar way but the establishment of a specific collection requires action from the regions concerned. This may end up implying an additional tax for mussel aquaculture companies. It will be interesting to analyse the behaviour of consumers in the face of these developments, which will logically result in an increase in the prices of products on the shelves of retailers.

3.2.2 Oyster

The different species of oysters produced in aquaculture include: Pacific cupped oyster, American cupped oyster, Slipper cupped oyster, Sydney cupped oyster, Indian backwater oyster, European flat oyster, Mangrove cupped oyster, Cortez oyster, Chilean flat oyster, etc. The main species of oysters produced in the world are Pacific cupped oyster (*Crassostrea gigas*) and European flat oyster (*Ostrea edulis*).

The oyster species produced in aquaculture include Pacific cupped oyster, Cupped oysters nei, European flat oyster, Flat and cupped oysters nei. According to FAO (2018), the EU oyster production for 2018 was 102.3 thousand tonnes and had a value of €508.3 million. For 2017, the respective values were 95.45 thousand tonnes and €465.4 million.

The reported data under the EUMAP demonstrates an oyster aquaculture total sales volume of 143.6 thousand tonnes, which is a 7% increase compared to 2017. The respective value is €626.9 million in 2018, a 7% increase compared to 2017. France represents 86% of the total oyster volume and 85% of the total value. Ireland is the second largest European producer representing 7.3% of volume and value.

The number of enterprises of oyster aquaculture farming in EU amounted to 2 455, in 2018. Eighty three percent of the enterprises are in France, followed by Ireland (6%), UK (4%) and Portugal (3%). The oyster farming enterprises employ 8 139 FTEs with an average wage of €25.4

thousand. France demonstrated increase in total sales volume (7%) and value (6%) and a raise in the average wage of 10%. Ireland, Portugal and Spain also showed increases in total sales volume, sales value and employment. Portugal had a significant increase in companies (16%), a 60% increase in sales volume and 68% increase in sales value. Croatia on the other hand demonstrated decrease in most indicators.

Table 3.2.2.1: Economic indicators for the EU oyster aquaculture: 2017-2018.

Country	Number of enterprise		Total sales volume		Turnover		Employment		FTE		Average wage	
	number		thousand tonnes		million €		number		number		thousand €	
	2017	2018	2017	2018	2017	2018	2017	2018	2017	2018	2017	2018
Croatia	19	17	0.0	0.0	0.2	0.1	22	19	7	8	19.8	20.0
France	2,043	2,043	115.2	123.5	502.6	534.1	11,574	11,574	6,992	6,992	23.2	25.5
Ireland	159	158	10.1	10.4	45.0	45.9	1303	1338	603	655	22.3	27.8
Netherlands	21	21	2.6	2.6	12.9	13.7	50	50	50	50		
Portugal	62	72	2.0	3.2	12.4	20.8	199	200	138	129	11.9	19.0
Spain	48	51	1.1	1.7	3.6	4.2	432	569	91	108	18.4	15.4
United Kingdom	89	93	2.3	2.2	8.9	8.0	280	273	197	192		
Other none DCF			0.0	0.0	0.0	0.0						
Total DCF reported	**2,441**	**2,455**	**133.3**	**143.6**	**585.6**	**626.9**	**13,860**	**14,023**	**8,078**	**8,135**	**22.9**	**25.4**
Total EU			**133.3**	**143.6**	**585.6**	**626.9**						

Source: EU Member States DCF data submission, 2021

Table 3.2.2.2 presents the economic performance indicators for EU oyster aquaculture in 2018. France, as the main contributor to the oyster sector, demonstrates an increase of 13% in GVA with €291 million and a 28% increase in EBIT with €59.9 million. Ireland and Spain demonstrate decreases in all economic indicators while Portugal demonstrated over 90% increase in both GVA and EBIT.

In general, the EU oyster aquaculture sector demonstrated an 11% increase in both GVA and EBIT in 2018, and also a rise in labour productivity while the indicators ROI and Capital productivity a deteriorated slightly.

Table 3.2.2.2: Economic Performance indicators for the EU oyster aquaculture: 2017-2018.

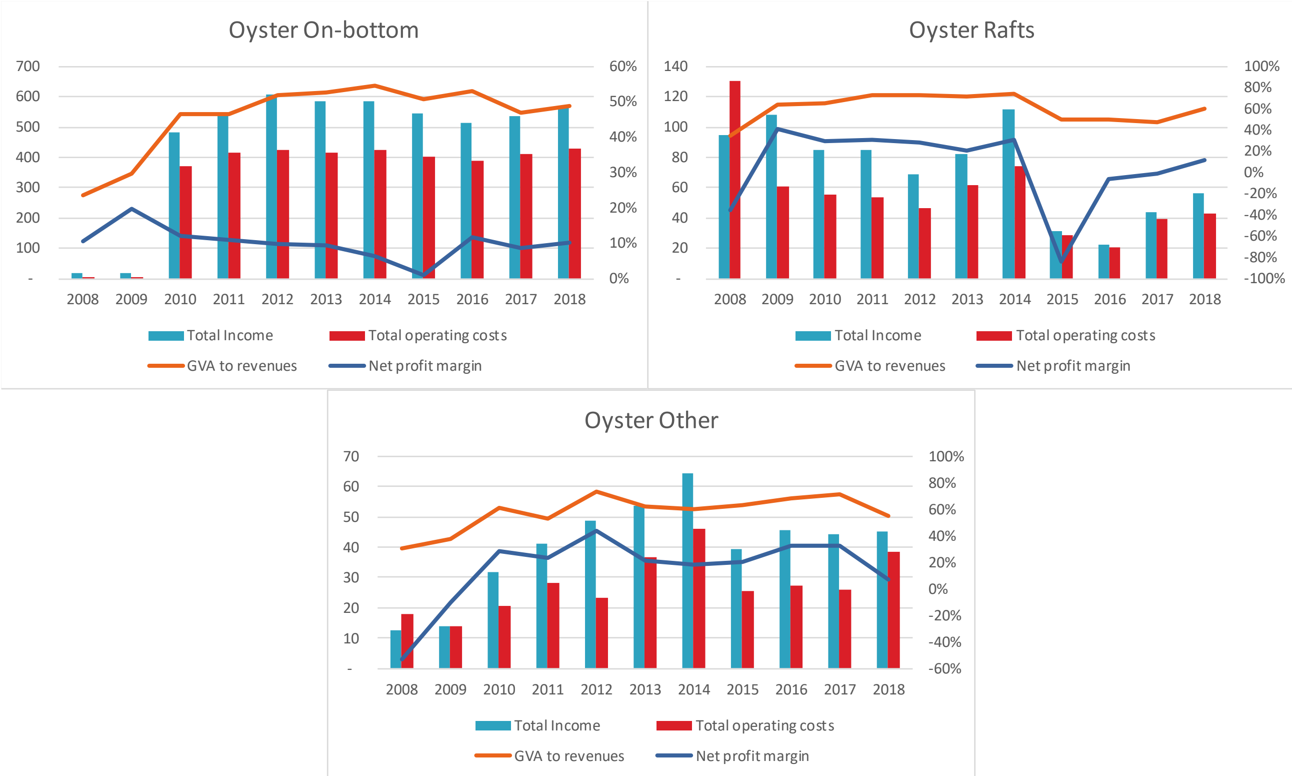
Country	GVA		EBIT		ROI		Labour productivity		Capital productivity	
	million €		million €		%		thousand €		%	
	2017	2018	2017	2018	2017	2018	2017	2018	2017	2018
Croatia	0.1	0.2	0.0	0.0	-26.4	15.0	18.3	20.3	181.2	87.9
France	258.1	290.6	46.9	59.9	6.3	7.1	36.9	41.6	34.5	34.4
Ireland	32.6	26.1	16.0	4.1	22.3	5.1	54.1	39.8	45.4	32.9
Portugal	8.8	16.9	6.9	13.8	67.5	78.1	63.5	130.4	85.5	95.8
Spain	2.9	2.7	1.1	0.9	75.8	35.1	31.6	24.8	197.1	104.2
Total EU	302.5	336.4	70.9	78.6	8.5	8.3	37.4	41.4	36.4	35.7

Source: EU Member States DCF data submission, 2021

In 2017 and 2018, total operating costs increased significantly compared to 2016 (as can be seen that it happened for on-bottom and rafts cultures), but the increase of turnover in 2018 led to a 10% increase of net profit as well. After 2010, GVA to revenues exceeds 50% and net profit margin reaches 10% for 2017 and 2018.

The oyster on-bottom segment represents 85% of total income in the oyster aquaculture sector and 86% of net profit. The segment's GVA to revenues reached 49% and the respective net profit margin reached 10% in 2018. The segment oyster rafts demonstrated in 2018 a positive value of net profit margin (11%) after seven years of financial losses and GVA to revenue increased to 61%. On the other hand, the oyster other segment, after demonstrating the highest net profit margins in 2016 and 2017 with 33% and the highest GVA to revenue with 72% in 2017, in 2018 decreased to 7% in net profit margin and 55% in GVA to revenue.

Figure 3.2.2.1: Development of economic performance for the EU oyster aquaculture: 2008-2018.



Source: EU Member States DCF data submission, 2021

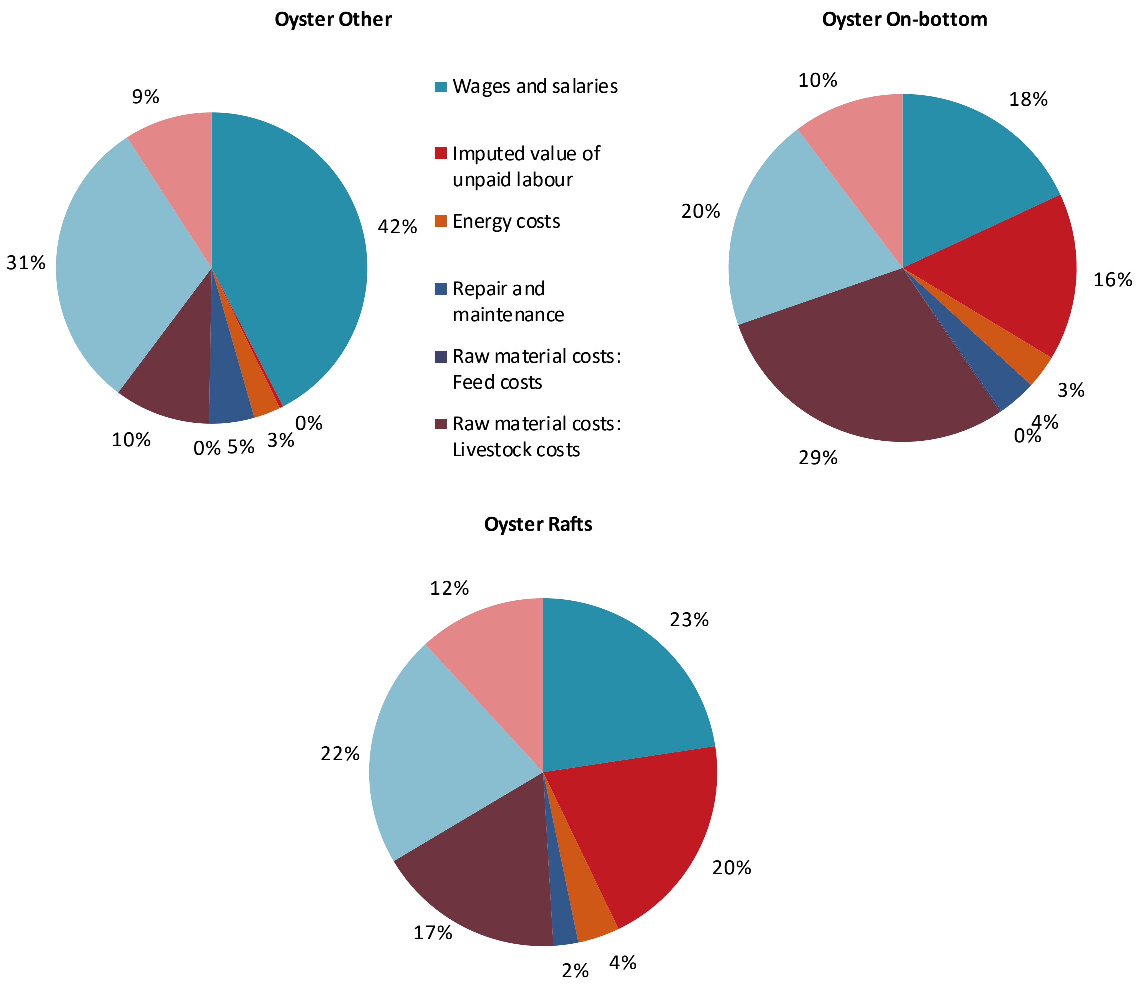
The costs breakdown is very different from one segment to another. It highlights the different techniques used by oyster farmers and the different types of equipment used to raise oysters. The distances to be covered (offshore, on the foreshore, in the marshes) according to the different type of vehicles (tractors, boats of different sizes with different engines) explain the variability of the different costs according to the different segments.

The type of workforce (employed or unpaid labour) is also very different from one country to another. For example, in France (2 297 FTE), Portugal and Croatia, most of workforce are unpaid labour, whereas in Ireland, for the segment "Oyster other", workforce is paid labour.

Finally, depending on the supply in wild oyster or in spat purchase from the hatchery, the livestock costs can be very heterogeneous from oyster farmers to another (inside the different segments but also inside a segment).

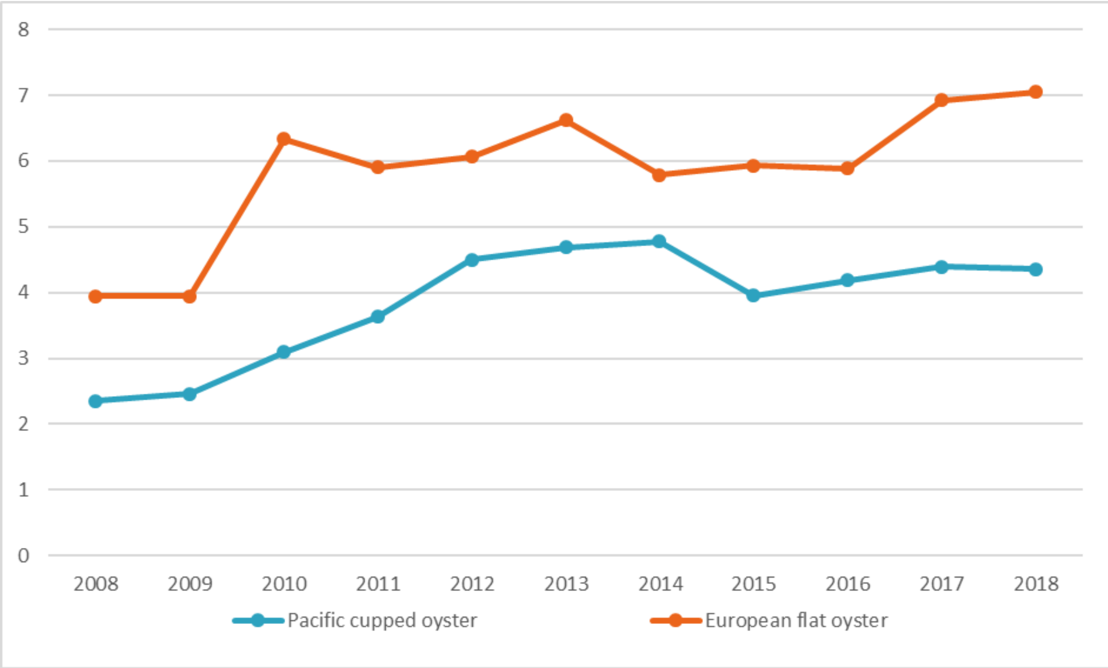
From 2008 to 2018, EU prices of reared Pacific cupped oyster and European flat oyster show a common increasing trend. Concerning Pacific cupped oysters, the decrease in production translates into an increase in the sales price of 54% between 2010 and 2014. Before 2010, the data concerning the EU price of the European flat oyster must be used with caution do to the lack of data.

Figure 3.2.2.2: Costs breakdown for the EU oyster aquaculture: 2018.



Source: EU Member States DCF data submission, 2021

Figure 3.2.2.3: Price evolution of the main species of oyster group: 2008-2018.



Source: EU Member States DCF data submission, 2021

From one year to the next, price changes partly reflect the level of oyster supply (prices increase when volumes decrease). The availability of different sizes of oysters and ranges of oysters (refined or not) that make up the average price influences the price level each year. Price variations can also result from the relationship between the types of suppliers (shellfish farmers, shippers) and customers (wholesalers, restaurants, fishmongers, supermarkets, etc.).

Pacific cupped oyster price is stable between 2017 and 2018 (€4.4 per kg). With a price over €7 per kg, European flat oyster prices increased in 2018 with 2% compared to 2017. The scarcity of flat oysters results in a price that is €2.7 per kg higher than Pacific cupped oyster.

3.2.3 Clams

There are different species of clams and cockles produced in aquaculture: Japanese carpet shell, blood cockle, Japanese hard clam, Northern quahog, grooved carpet shell, common edible cockle, etc. The main clam species cultured in the EU are Japanese carpet shell (*Ruditapes philippinarum*) and grooved carpet shell (*Ruditapes decussatus*) (FAO, 2020).

Global clam production reached 5.45 million tonnes in 2018, which is a -1% decrease from 2017. The estimated corresponding value was USD 9.1 billion. China is the world leading producer of clams covering 97% (5.3 million tonnes) of the weight and 95% of the value produced (FAO, 2020).

The three most important species of clams produced globally are Japanese carpet shell (*Ruditapes philippinarum*), Constricted tagelus (*Sinonovacula constricta*), and Blood clocke (*Anadara granosa*). Total production of Japanese carpet shell in 2018 was 4.4 million tonnes, valued USD 6.9 billion (FAO, 2020).

In 2017, European sales of clams were almost 45 thousand tonnes, with a turnover of €205 million. In 2018, the production decreased compared to 2017 with 14% in volume, with a corresponding turnover of €181 million, corresponding to 12% reduction.

Four EU countries produce clams, Italy (81% of the EU production), Portugal (9%), France (7%) and Spain (3%). Unfortunately, France did not submit specific data for the clam segment.

The production originates from 1 530 enterprises, which mainly use two types of technologies: on-bottom (especially widespread in Italy and Portugal) and raft. Almost 48% of these enterprises are located in Portugal and around 41% in Spain.

Furthermore, in Portugal, the most important segment (in terms of production weight and sales value), is the clam based on-bottom farms producing Grooved Carpet Shell, in small areas of land in intertidal zone, usually with less than 1 hectare. In Portugal, the economic and social data for production was collected per production unit until 2016. From 2017[7], the collection of data is done at the enterprise level, but also maintaining the collection of the production per production unit. That is the explanation for the reduction in the number of enterprises reported between 2016 and 2018. Although that production decreased 16% from 2017 to 2018, the turnover increased with 5% due to an increase in prices.

Overall, the number of enterprise has decreased from 1 601 in 2017 to 1 530 in 2018, corresponding to a decrease of 4%. The number of employees increased, from 7 996 in 2017 to 9 372 in 2018, corresponding to an increase of 17%. At the same time the number of FTE decreased 2 227 to 1 371, corresponding to a decrease of 38%. Part time workers make up an important part of this segment, since the number of FTEs only adds up to 15% of the numbers of employees in the segment, which also means that the specialization is very low compared to other sectors in the aquaculture industry.

Table 3.2.3.1: Economic indicators for the EU clam aquaculture: 2017-2018.

Country	Number of enterprises		Total sales volume		Turnover		Employment		FTE		Average wage	
	number		thousand tonnes		million €		number		number		thousand €	
	2017	2018	2017	2018	2017	2018	2017	2018	2017	2018	2017	2018
Italy	176	176	36.2	31.1	136.6	112.0	2560	2733	953	541	32.5	61.4
Portugal	767	729	4.1	3.4	40.5	42.7	1215	1069	696	318	4.2	11.1
Spain	658	625	1.6	1.3	13.7	12.4	4222	5570	579	512	29.9	37.8
Other none DCF			0.0	0.0	0.0	0.0						
Total DCF reported	**1601**	**1530**	**41.9**	**35.8**	**190.8**	**167.1**	**7996**	**9372**	**2227**	**1371**	**23.0**	**40.9**
Total EU			**41.9**	**35.8**	**190.8**	**167.1**						

Source: EU Member States DCF data submission, 2021

In Portugal, the average wage was €4.2 thousand in 2017 and €11.1 thousand in 2018. The legal enterprises are mostly small familiar units managed by the owner and their relatives. These micro farms have no organized accountant system and it can therefore be difficult to collect economic information from these units.

The average wage in Spain was €30 thousand in 2017, increasing to €38 thousand in 2018. This is higher than the €18 thousand of average wage in the EU shellfish production.

In Italy, wages and salaries was €32.5 thousand in 2017 and around the double €61 thousand in 2018. Italian wages are higher than the EU average wage. There workers are also motivated by other things than the salary, represented by payment in natural clam seed shoals. In Italy, the clam sector has an important social role. The most productive areas are in Northern Emilia Romagna and Veneto. In these areas, many families base their economy on clam farms. Many businesses are started and owned by female producers. The dynamic has allowed both the increase in the number of companies since the mid-1980s and the volume produced. Many women were first employed in the textile manufacturing sector, and then converted into the clam sector.

Figure 3.2.3.1 shows the economic performance of the segments analysed. The clams on-bottom segment shows a fluctuating turnover over the period. The succession of years with higher

[7] Note that employment and FTE estimates for 2017 may not be robust do to the change in methodology occurred that year.

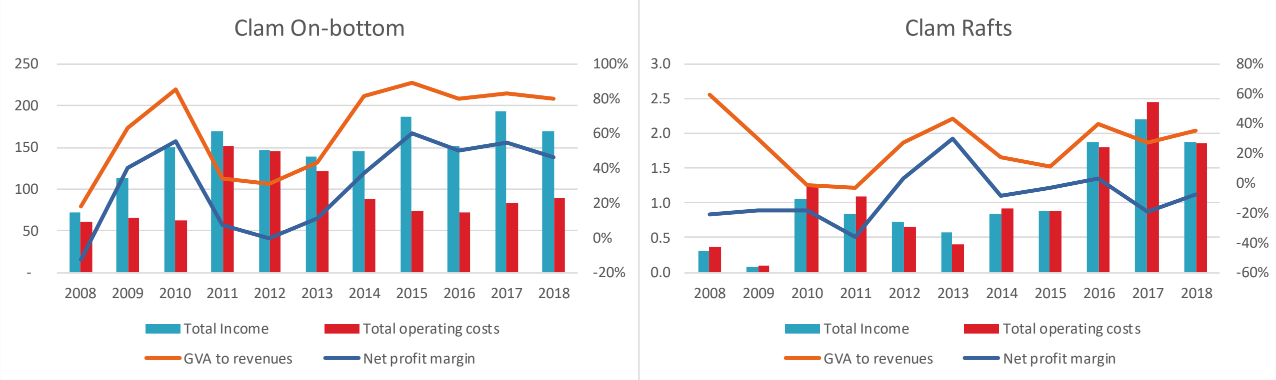
income and years in contraction is due to the non-alignment between the phases of growth and those of sales of the product. In addition, there are moments of more significant contraction due to natural events that influence production negatively. In 2018, for example, floods in Italy caused loss of biomass, as the waters quality declined which were harmful to the survival of the clams.

In 2018, the sector had a turnover of €165 million. The GVA and the net profit in the segment stays at a high level, even though that it declined between 2017 and 2018. This is caused by a lower turnover and higher cost in 2018 compared to 2017.

The clam rafts segment is much smaller than the clam on-bottom segments and the turnover only amount to €2 million. Turnover and operating costs was identical in 2018, resulting in a positive GVA but a negative profit. The Clam Rafts segment has not provided a positive result over a longer period, but it still contribute to local employment and the economy in local communities.

The EU clam aquaculture gross value added reached €160 million (2017) reduced to €136 million in 2018. The EBIT was €106 million in 2017, but decreased in 2018 to €78 million.

Figure 3.2.3.1: Economic indicators for the EU clam aquaculture: 2017-2018.



Source: EU Member States DCF data submission 2021

However, labour productivity increased from €72 thousand to €99 thousand, corresponding to an increase of 38%. Capital productivity on the other hand declined from 177% to 167% remaining still at high level due to low capital intensive production.

Table 3.2.3.2: Economic performance indicators for the EU clam aquaculture: 2017-2018.

Country	GVA		EBIT		ROI		Labour productivity		Capital productivity	
	million €		million €		%		thousand €		%	
	2017	2018	2017	2018	2017	2018	2017	2018	2017	2018
Italy	114.6	87.4	81.0	51.9	109.5	76.6	120.3	161.6	155.0	128.9
Portugal	36.3	41.5	32.9	38.0	357.4	388.0	52.2	130.4	394.3	424.5
Spain	9.0	7.0	-7.7	-12.2	-110.4	-324.4	15.5	13.7	127.7	186.3
Total EU	159.9	135.9	106.2	77.7	117.8	95.5	71.8	99.2	177.3	167.1

Source: EU Member States DCF data submission, 2021

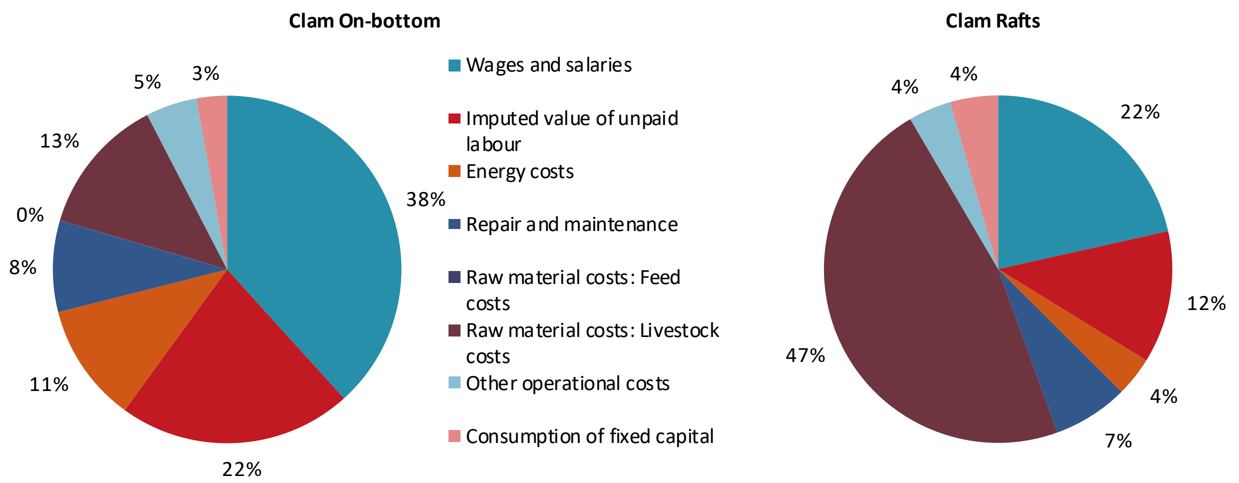
The analysis of the performances of the top three producing countries show different production and turnover pushes.

Portugal collected data up to 2016 on production units and shifted in 2017 and 2018 to enterprise units. This means that especially employment data and indicators based on employment cannot be compared between the different data collection methods.

Both Italy and Spain show a declining trend in most economic indicators which points towards an economic decline in the sector. Labour costs and labour productivity in Italy may appear inconsistent and excessive compared to data from similar sectors in other European countries. In reality, the data is consistent with respect to the working dynamics of producers directly involved in shellfish cooperatives. Part of their salary also compensates for their work to bring seed and other skills (commercial and different professionalism) within the predominantly work-based mutuality cooperatives. When interpreting the costs of the clam segment it is important to understand the dynamics within the sector. The clam farm often has the legal form of a cooperative, including both fishers fishing for seed (livestock) and the actual clam farmers. One part of the year fishers provide input in terms of seed (livestock) to the farms. This actually means that the purchase of seed is registered as a labour cost and not a purchase of livestock.

The cost structure in the clams on-bottom farms, underline the high share represented by wages and salaries plus the estimate of unpaid work. The percentage, taken as a whole, is 60%. This aspect, already noted previously, is due to the typical nature of the economic activity of clam organizations. The sector, populated above all by businesses and micro-enterprises, has an immense mix of workers and owners, so the salary, for example, tend to compensate for other ancillary jobs to the activity of breeder in *strictu sensu* (for example, administrator, but also administrative, commercial manager, but also a worker on the vessels to go to the installations every day). To this should be added, the activity similar to fishing, which is equivalent to the care of clam fields destined to reproduce seed, to the fishing of the seed to its transfer in nursery areas, and their "cultivation". This indicates that the clam production activity is very labour intensive with less use of capital equipment. For the clam rafts segment, it is replicated a similar structure of operating costs to the one already described for the segment clam on-bottom. The difference in the cost structure of the three aggregates was mainly found in the percentage of energy costs. The most energy-intensive segment has been, since the beginning of the collection of economic data, on-bottom clams (11%).

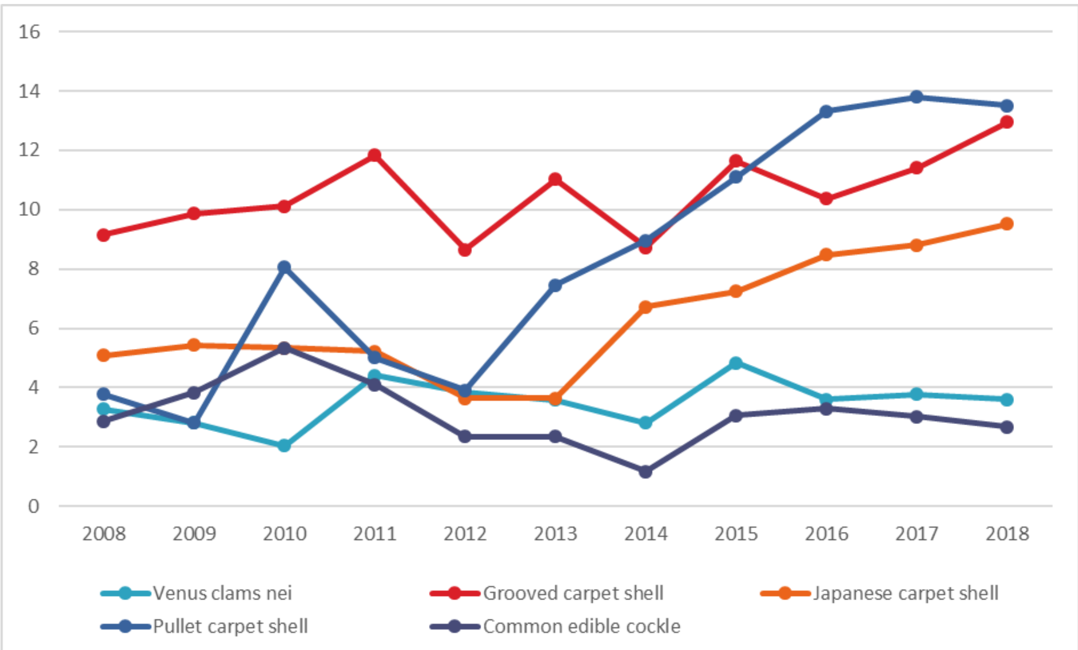
Figure 3.2.3.2: Costs breakdown for the EU clam aquaculture: 2018.



Source: EU Member States DCF data submission 2021

EU prices (and world prices) of grooved carpet shell showed an increase trend during the period 2008 to 2018. There has been some decreases in prices during 2011 and 2012and again in 2013 and 2014, but from there prices has increased from 2014 to 2018 to €12.9 per kg., which is the highest price reported during the whole period.

Figure 3.2.3.3: Price (€/kg) evolution of the main species of clam group: 2008-2018.



Source: EU Member States DCF data submission, 2021

The price for grooved carpet shell reflects the characteristics of production. This species is reared in protected areas and the timing of growth is very similar to that of the natural life cycle. This production is perceived of high quality because it follows a natural growth. Production of this species is labour intensive rather than capital intensive. On the other hand, the *venus* clams price show an opposite evolution than the carpet shell, with a price €3.6 per kg. In this case, the species prices are rather stable in nominal terms, suffering a slight reduction in its average prices since 2011 until the end of the period analysed. Both Pullet carpet shell and Japanese carpet shell experienced an increasing trend in prices, with the highest prices achieved in 2018 with €13.5 per kg and €9.5 per kg., respectively.

OUTLOOK

In the clam segment, important milestones have been reached to mitigate conflicts with other anthropic activities that are located in the same coastal areas. In Italy, the regions in which clam aquaculture is mainly concentrated, have been obtained exclusive areas of nursery for the reproduction of the seeds, but the areas allocated exclusively to aquaculture and to *veneri-culture* have not yet been defined. In the past, the criticality of clam farms in the Northern Adriatic regions (especially the Emilian area of Goro) in Italy was represented by the hydrodynamics of the water, a problem that was partially solved but always present because it is common for the waters to circulate in a regular way, risk anoxia, which leads to the death of clams on farms. Since last year, however, the main problem is linked to the availability of clam seed. For various reasons also linked to climate change, the reproductive cycle that allowed farmers to find juveniles in some areas declared by the Emilia Romagna region, Biological Protection Areas, was interrupted and slowed down. These nursery areas have been granted in concession to clam companies, on the basis of a specific regulation and under the supervision of a recognized scientific institute. The trend with respect to investments concerns the modernization of ground installations. There are few cooperative organizations that directly treat and purify the product. This represents a weak link on the generation of value to the offer and, in addition, greater shortening and control of the value chain. Investments have on average increased in Italy but in Spain and Portugal there are contracts. The Italian clam segment has been beneficiaries of EMFF subsidies starting from 2017/2018.

In Portugal, similarly to what is accessed in other EU MS, the investments in aquaculture are based on spatial planning, seeking not only to minimize possible conflicts with other users. They will favour environmental standards in the implementation of the physical structures, but mainly in the use of aquaculture production methods compatible with the protection and improvement of the environment. Investments to introduce improvements in management practices of production and marketing including through the intensification of new information and communication technologies are also encouraged. Structural modernisation is also being promoted within the current fisheries management plan.

3.2.4. Other shellfish segments

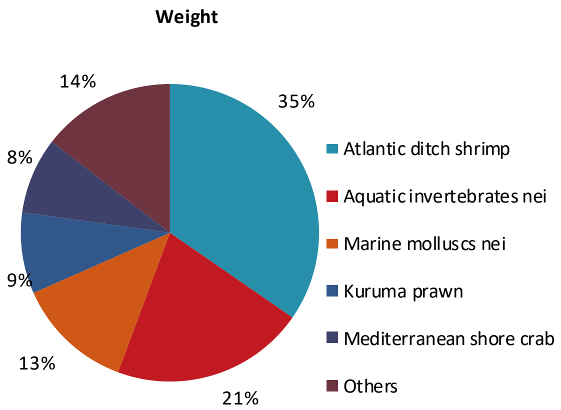
The distribution of weight and value of other shellfish species is based on FAO production data. According to the FAO data, shrimp production dominates the group of other shellfish species in weight and value in 2018.

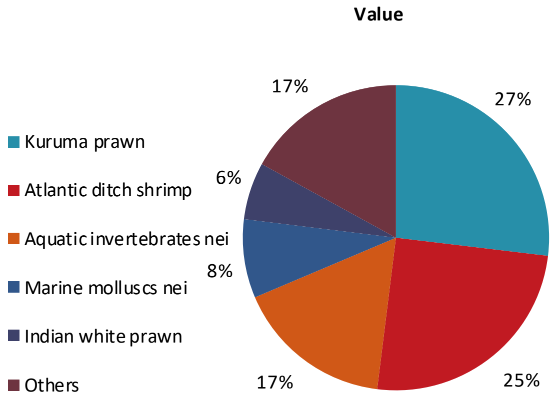
The other shellfish species (i.e., not considering mussels, oysters and clams) includes Atlantic ditch shrimp, Aquatic invertebrates nei, marine molluscs nei, Kuruma prawn, Mediterranean shore crab and other marine shellfish. While Atlantic ditch shrimp is biggest species in terms of production volume, Kuruma prawn is dominating the sales value.

In terms of weight, the most important species group are Atlantic ditch shrimp (35%) followed by Aquatic invertebrates nei (21%), marine molluscs nei (13%), Kuruma prawn (9%) and Mediterranean shore crab (8%). The segment of other marine shellfish covers 14% of other shellfish species in volume.

In terms of value, Kuruma prawn (27%) is the most important species, followed by Atlantic ditch shrimp (25%), Aquatic invertebrates nei (17%), marine molluscs nei (8%). In spite of the fact that Indian white prawn is not included among the most important species in terms of volume, it is one of the more important species in terms of value corresponding to 6% of total value. The reason is that it receives a relative high price per kilo. The other marine species account for the 17% of the total value.

Figure 3.2.4.1: Main species, produced in the other shellfish farming facilities: 2018.





Source: FAO (2021)

3.3 Freshwater aquaculture

The total volume of EU freshwater aquaculture sales was 319.0 thousand tonnes in 2018, generating a value of €1.1 billion (table 3.3.1). For the total volume of freshwater aquaculture this was an increase of 5% (from 2016) and 0.4% (from 2017). Regarding to the total value of freshwater aquaculture sales this was around an increase of 9% (from 2016) and 5% (from 2017).

Compared to the EU marine sector the volume of the total sales from the freshwater enterprises was almost three times lower with 38% (62% less) of the total marine volume. The turnover of freshwater finfish aquaculture was even smaller (five times). It was only 20% (80% less) in comparison to the total sales value of marine finfish aquaculture. In other words, the prices per kilogram tend to be much smaller for EU freshwater- than EU marine finfish aquaculture.

The top three largest producing countries for EU freshwater (in sales volume) were Poland (13.6%), Italy (12.9%) and Denmark (12.0%) in 2018. In terms of value of sales, France was the largest (13.5%) followed by Denmark (12.1%) and Italy (11.8%).

Table 3.3.7: Economic indicators for the EU aquaculture freshwater subsector: 2018.

Country	Number of enterprises		Total sales volume		Turnover		Employment		FTE		Average wage	
	number		thousand tonnes		million €		number		number		thousand €	
	2017	2018	2017	2018	2017	2018	2017	2018	2017	2018	2017	2018
Bulgaria	566	600	8.2	10.0	21.3	29.5	1,210	1,037	1,021	849	3.3	4.0
Croatia	40	38	3.3	2.9	7.0	6.7	421	345	361	296	8.5	9.7
Denmark	92	89	37.4	38.4	129.3	131.9	399	404	282	282	69.0	85.2
Finland	149	128	3.6	3.7	33.0	30.9	335	300	218	209	45.2	44.1
France	324	327	37.8	37.4	148.4	147.0	1,477	1,539	1,199	1,150	18.7	21.1
Germany	2,891	2,746	16.4	15.0	83.6	69.6	1,707	1,707	1,320	1,320	57.9	48.4
Greece	115	110	4.5	4.2	11.3	10.9	185	195	151	181	33.2	23.1
Ireland	5	6	0.6	0.6	2.0	1.6	14	20	12	16	24.8	9.0
Italy	146	146	33.0	41.1	104.1	128.9	531	683	95	139	119.5	122.3
Latvia	88	87	0.9	1.0	3.6	4.4	245	235	173	182	12.1	13.9
Portugal	8	7	0.7	0.7	1.9	1.9	39	-	36	-	19.7	
Romania	439	456	13.6	13.6	30.0	51.8	2,230	1,965	2,230	1,965	5.0	5.8
Spain	176	141	19.1	18.0	71.2	70.7	964	909	701	679	23.1	25.6
Sweden	87	79	13.8	11.8	61.8	62.9	389	375	485	263	20.6	40.0
United Kingdom	209	213	13.5	12.3	49.8	55.6	704	742	551	574	14.3	14.0
Other none DCF			90.7	95.8	250.1	267.1						
Total DCF reported	**5,335**	**5,173**	**206.4**	**210.7**	**758.4**	**804.4**	**10,850**	**10,456**	**8,834**	**8,106**	**20.3**	**22.3**
Total EU			**297.1**	**306.6**	**1,008.5**	**1,071.6**						

Source: EU Member States DCF data submission, 2021 & FAO, 2021.

*Note: Italian average wage is not reliable due to an insufficient number of FTE reported.

For the entrepreneurial activeness and competitiveness, 16 out of the 27 EU MS have reported via DCF. Unfortunately, therefore these 16 MS does not cover the entire EU freshwater segment but provides a first partly insight.

There were more than 5 400 enterprises in the EU freshwater sector. The sector employed around 12 600 people (Table 3.3.1), which approximately correspond to almost 9 400 FTEs. On average, each enterprise employed 4 persons and the average wage was around €22 thousand; however, the wage varies significantly across MS. Salaries are dependent on the technique used and the species produced. The highest salaries were reported in Italy, where intensive trout aquaculture dominates. The lowest salaries were paid in Bulgaria and Romania, where extensive carp production dominates.

Table 3.3.8: Economic Performance indicators for the EU aquaculture freshwater subsector: 2018.

Country	GVA		EBIT		ROI		Labour productivity		Capital productivity	
	million €		million €		%		thousand €		%	
	2017	2018	2017	2018	2017	2018	2017	2018	2017	2018
Bulgaria	9.2	12.4	2.4	6.8	5.5	21.3	9.0	14.6	20.7	38.8
Croatia	25.3	11.1	19.7	5.4	16.5	5.4	70.0	37.6	21.1	11.1
Denmark	36.2	34.3	9.8	2.6	5.9	1.3	128.5	121.8	21.7	16.7
Finland	6.8	1.8	-5.1	-10.6	-5.4	-12.4	31.0	8.5	7.2	2.1
France	57.6	54.3	31.5	25.4	23.7	22.1	48.1	47.2	43.4	47.3
Germany	33.1	62.2	-38.1	-6.9	-18.9	-14.0	25.1	47.1	16.4	126.0
Greece	-36.0	3.0	-42.1	-2.4	-283.4	-17.6	-238.1	16.5	-242.0	21.8
Hungary	179.8	275.4	157.1	253.8	112.1	338.6	111.8	202.2	128.4	367.4
Ireland	0.8	0.3	0.5	0.1	18.3	2.6	68.9	17.6	32.1	14.1
Italy	47.0	56.7	32.3	35.0	24.6	17.7	494.6	408.2	35.8	28.7
Latvia	0.9	1.4	-1.3	-1.5	-4.7	-5.2	5.0	7.4	3.1	4.8
Portugal	0.8		-0.5		-82.5		22.6		138.2	
Romania	9.2	20.1	-10.8	6.9	-8.8	3.3	4.1	10.2	7.6	9.5
Spain	19.5	22.5	1.6	3.4	1.6	3.4	27.8	33.2	19.3	22.6
Sweden	17.9	37.9	5.3	23.9	7.4	31.8	36.8	143.9	25.0	50.3
United Kingdom	8.6	10.5	-0.2	1.3	-1.2	8.9	15.6	18.3	51.6	71.2
Total EU	416.7	603.9	162.1	343.2	11.7	26.3	33.4	52.6	30.0	46.3

Source: EU Member States DCF data submission, 2021.

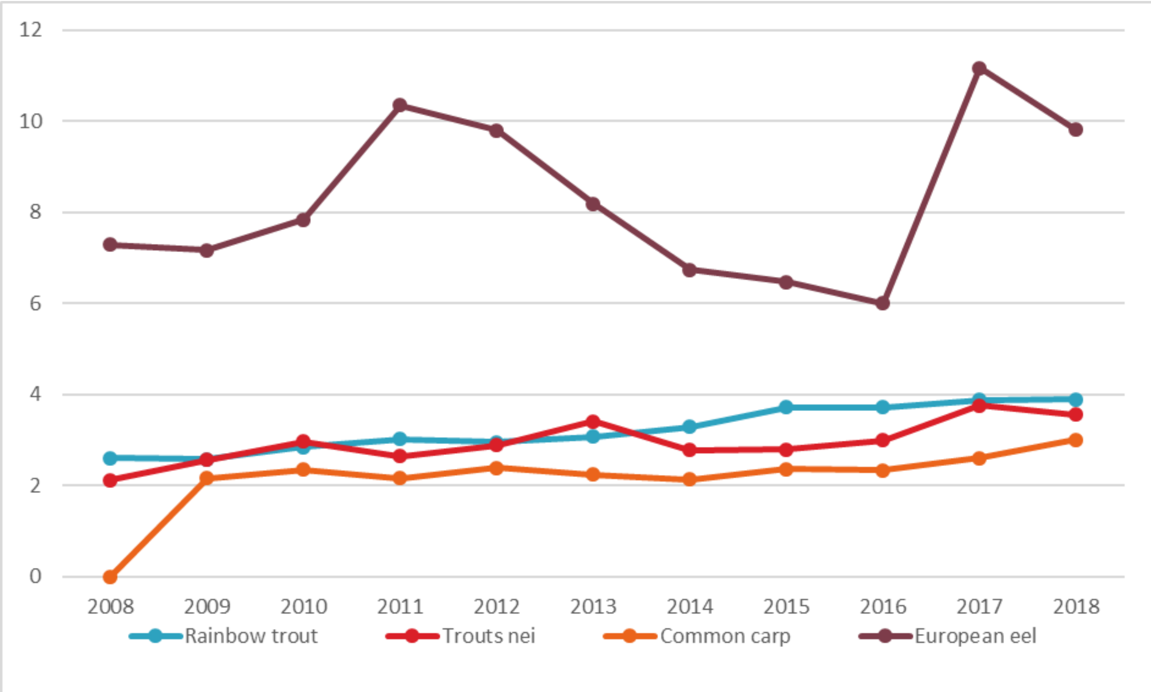
Based on data of 15 out of the 27 EU MS, the (partly) EU freshwater aquaculture sector generated €599 million in GVA in 2018, which corresponded to a 272% (almost three times more) increase from 2016. This is large increase could be clarified that in this DCF data of 2018 included one more MS compared to 2016. Hungary was this lacking MS in the data for 2016. With a GVA of €275 million, it declared the enormous growth in 2018. Measured in terms of EBIT, profitability reached €339 million. Overall profitability measured in terms of ROI reached 26.1%. Labour productivity was on average €52.2 thousand per FTE (Table 3.3.2).

Figure 3.3.5: Main species produced in the EU freshwater farming facilities: 2018.

Source: FAO, 2021

Rainbow trout dominates this segment with 53% of the volume and 56% of the value of total EU production. The common carp is the second most important species with volume and value of 27% and 19%, respectively; production of European eel generated 3% of the total volume and 5% of the total value. (See Figure 3.3.1). The farming of the two most important species (rainbow trout and common carp) has some distinct economic and employment characteristics. Trout aquaculture production is mostly obtained from more intensive technologies, whereas carp producers use more extensive technologies.

Figure 3.3.2: Price (€/kg) evolution of the main species, produced in the EU freshwater farming facilities: 2008-18.



Source: FAO, 2021

3.3.1 Trout

Global production of Rainbow trout (*Oncorhynchus mykiss*) increased during the 2008 - 2018 period from 518 thousand tonnes valued €1 952 million in 2008 to 848 thousand tonnes valued €2 608 million in 2018. Globally the leading producers are Iran, Turkey, Norway and Chile producing 21%, 13%, 9% and 8% of the total volume and 19%, 7%, 19% and 10% of the total value in 2018, respectively. The four leading countries covered 52% of the global volume and 55% of the global value (FAO, 2021).

The EU production of Rainbow Trout decreased from 2008 to 2018 from 204 thousand tonnes valued €590 million in 2008 to 187 thousand tonnes valued at €739 million in 2018. The leading EU producers are Denmark, Italy and France covering 25%, 21% and 20% of the total volume, respectively, and 24%, 17% and 20% of the total value, respectively, in 2018. The three countries covered 67% of the total volume and 61% of the total value.

In Europe, most rainbow trout are produced in freshwater and grown to a size between 300-500 grams. The flesh is white and compete on the large markets for whitefish in Europe. A few countries also produce rainbow trout in marine waters in cages, where the leading producer is Norway, however, Denmark and Finland also have smaller productions in the Baltic Sea. The trout grown at sea have red meat and is competing on the market for salmon. It should be noted that the primary product from Denmark is trout eggs, however, the meat is also sold for consumption. Within this chapter the total production of rainbow trout in EU is included. Furthermore, due to the change of segmentation between DCF and EU-MAP the rainbow trout are only showed as a combined segment for the economic variables, because there is only two years data available under the new segmentation. However, for the cost structures the new segmentation has been used showing cages, ponds, tanks and raceways and hatcheries and nurseries. In future reports, this is the segmentation that will be used for the rainbow trout production.

The global share of rainbow trout production weight covered by EU countries has decreased from 39% in 2008 to 21% in 2018. Accordingly, the global share of value for the EU countries has also decreased from 30% in 2008 to 18% in 2018.

Table 3.3.1.1. Economic indicators for the EU trout aquaculture: 2018.

Country	Number of enterprises		Total sales volume		Turnover		Employment		FTE		Average wage	
	number		thousand tonnes		million €		number		number		thousand €	
	2017	2018	2017	2018	2017	2018	2017	2018	2017	2018	2017	2018
Bulgaria	100	115	4.1	5.3	14.2	20.1	273	262	250	246	3.9	4.7
Croatia	20	18	0.4	0.4	1.4	1.4	49	44	40	41	9.9	9.6
Denmark	88	82	47.2	47.1	181.9	176.0	481	455	340	319	66.2	77.8
Finland	78	73	12.5	11.8	81.8	76.5	426	397	334	302	42.7	41.4
France	324	327	37.8	37.4	148.4	147.0	1,477	1,539	1,199	1,150	18.7	21.1
Germany	1,088	1,029	10.8	10.3	65.7	52.2	1,017	1,017	716	716	77.9	59.8
Greece	63	59	1.9	2.3	5.9	6.1	90	100	56	86	32.2	21.5
Ireland	5	6	0.6	0.6	2.0	1.6	14	20	12	16	24.8	9.0
Italy	146	146	33.0	41.1	104.1	128.9	531	683				
Portugal	7	6	0.7	0.7	1.8	1.8	32		29		16.7	
Romania	97	142	2.1	0.5	13.6	10.2	451	454	451	454	11.7	5.2
Spain	86	79	18.4	17.4	65.4	65.1	732	715	569	563	23.8	25.8
United Kingdom	139	136	13.3	12.1	46.4	52.5	544	557	437	439	18.0	18.3
Other none DCF			1.7	2.1	6.6	8.5						
Total DCF reported	***2,241***	***2,218***	***182.8***	***186.9***	***732.5***	***739.4***	***6,117***	***6,243***	***4,432***	***4,332***	***32.2***	***29.7***
Total EU			**184.5**	**189.1**	**739.1**	**747.9**						

*Note: Italian labour productivity is not reliable due to an insufficient number of FTE reported.
Portugal is excluded due to unreliable and missing data.
Source: EU Member States DCF data submission, 2021.

The numbers of enterprises engaged in trout production in the EU was 2 218, which was a slight reduction from 2 241 in 2017. The enterprises employed 6 243 people, increasing employment by 2% compared to 2017. The persons employed corresponding to 4 332 FTE, which was a decrease compared to 2017 of 2%. The freshwater trout sector has a significant component of part-time workers (0.71 ratio between FTE and employment). There is a large variation in the average wages between the countries. Countries with smaller productions experience large fluctuation in the average salary. The salaries varied from €4.7 thousand in Bulgaria to €77.8 thousand in Denmark.

In 2018, the GVA in the sector amounted to €270 million, which was an 8% increase compared to 2017. The reported EU-MAP data shows that the trout sector are doing well with an increase in the economic performance parameters in 2018. EBIT increased reaching more than €91 million, which was an increase of 23% from 2017. The positive economic performance is also confirmed by the ROI indicator increasing to 11.7% in 2018. Furthermore, both Labour productivity and capital productivity increased from 2017 to 2018, reaching €41.6 thousand and 34.6%, respectively.

The economic performance in the different Members States shows large variation in the economic performance indicators, because of the different sizes of the sectors and the use of different production techniques. The GVA varied from about €0.3 million in Ireland to €56.7 million in Italy. The EBIT varied from €-12.0 million in Romania to €35 million in Italy. Labour productivity varied from around €-18.4 thousand in Romania to €146.7 thousand in Denmark. Capital productivity varied from -29.4% for Romania to 225.7% for Germany.

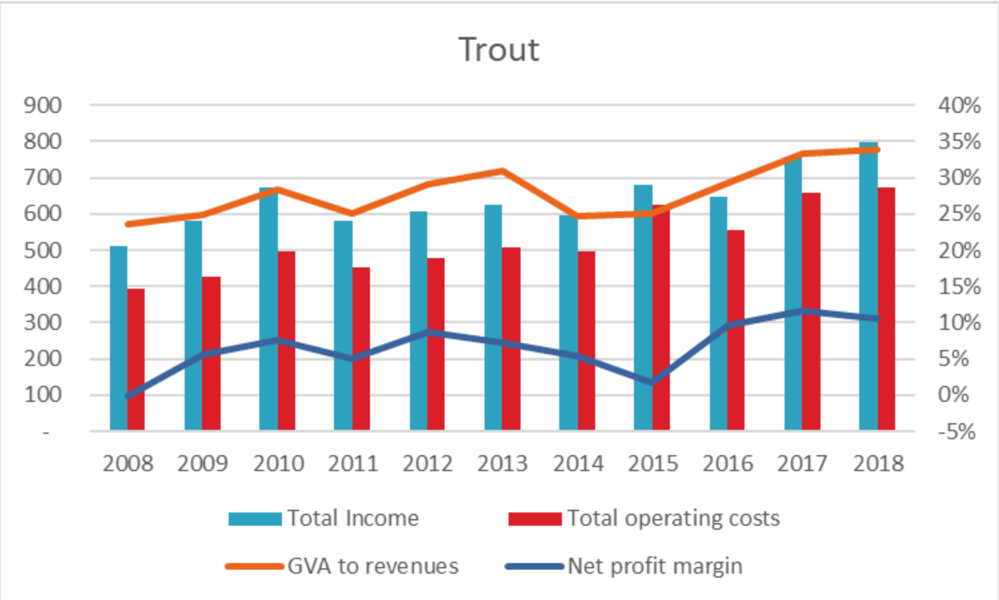
Table 3.3.1.2. Economic Performance indicators for the EU trout aquaculture: 2018.

Country	GVA		EBIT		ROI		Labour productivity		Capital productivity	
	million €		million €		%		thousand €		%	
	2017	2018	2017	2018	2017	2018	2017	2018	2017	2018
Bulgaria	7.7	10.9	5.5	8.9	34.8	85.4	30.7	44.2	48.8	104.1
Croatia	0.4	0.5	0.1	0.1	2.0	2.2	10.9	12.4	7.3	16.7
Denmark	49.1	46.8	19.5	16.0	10.5	9.4	144.3	146.7	26.4	27.3
Finland	24.1	20.6	6.4	3.8	4.4	3.0	72.3	68.1	16.6	16.2
France	57.6	54.3	31.5	25.4	23.7	22.1	48.1	47.2	43.4	47.3
Germany	25.9	54.4	-24.7	7.8	-15.8	32.5	36.2	76.0	16.6	225.7
Greece	2.5	1.3	0.5	-0.8	8.9	-17.1	44.3	15.2	43.2	29.1
Ireland	0.8	0.3	0.5	0.1	18.3	2.6	68.9	17.6	32.1	14.1
Italy	47.0	56.7	32.3	35.0	24.6	17.7			35.8	28.7
Romania	8.5	-8.3	-0.2	-12.0	-0.5	-42.3	19.0	-18.4	25.8	-29.4
Spain	18.7	22.2	3.2	5.8	3.5	7.0	32.8	39.5	20.7	27.2
United Kingdom	8.6	10.5	-0.2	1.3	-1.2	8.9	19.7	23.9	51.6	71.2
Total EU	250.9	270.2	74.3	91.4	8.1	11.7	31.8	33.6	27.2	34.6

*Note: Italian labour productivity is not reliable due to an insufficient number of FTE reported.
Portugal is excluded due to unreliable and missing data.
Source: EU Member States DCF data submission, 2021.

The figure below shows the economic performance indicators for trout aquaculture from 2008 to 2018, where all segments are combined to be able to trace the time series back more than 2 years (EU-MAP). In 2018, turnover increases by 1% to €739 million compared to 2017. Total operating costs increased by 2% compared to 2017 leading to a decrease of net profit margin from 11% in 2017 to 10% in 2018. However, the GVA to revenue increased from 34% in 2017 to 39% in 2018.

Figure 3.3.1.1. Economic performance indicators for trout aquaculture: 2008-2018.

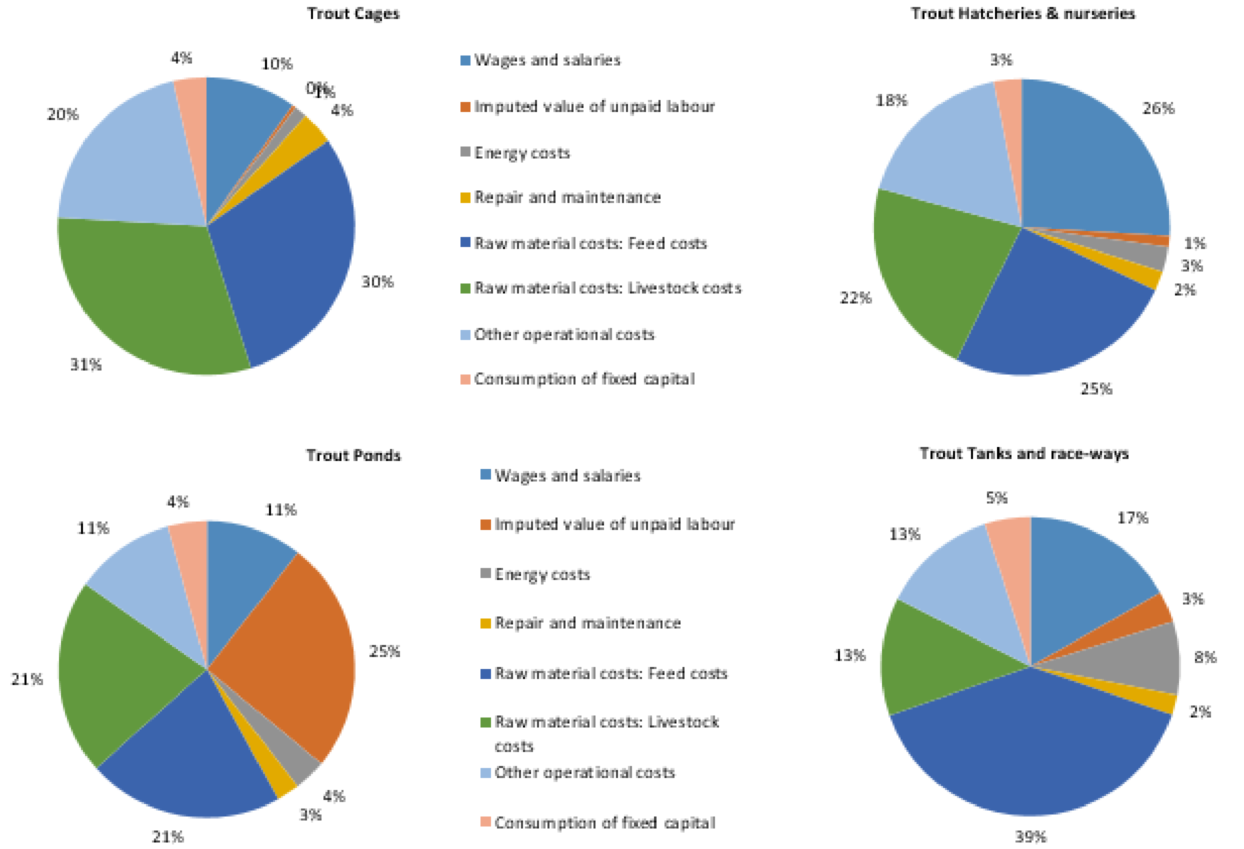


Source: EU Member States DCF data submission, 2021

The data submitted to EU-MAP, shows that the cost structure is different depending on the trout farming technique. The most dominant costs of the rainbow trout sector are raw material (feed and livestock costs), which represent 43% of the total costs in the ponds segment, 47% in hatcheries & nurseries, 52% in tanks, race-ways with recirculation systems (RAS) and 61% in the cages segment.

Wages and salaries represent the second-largest cost with 26% for hatcheries & nurseries segment. The imputed value of unpaid labour is high for ponds segment with 25% of the total. The highest share of energy cost has tanks and trace-ways, because the intensive production systems using recirculation technology (RAS) are located within this segment. Consumption of fixed capital is pretty much the same in all segments - representing 3-5% of the total costs. Repair and maintenance costs are very similar corresponding to 2-4% of total costs. Other operational costs are lowest in ponds segment (11%) and the highest in trout cages (20%), where boats and other equipment are used.

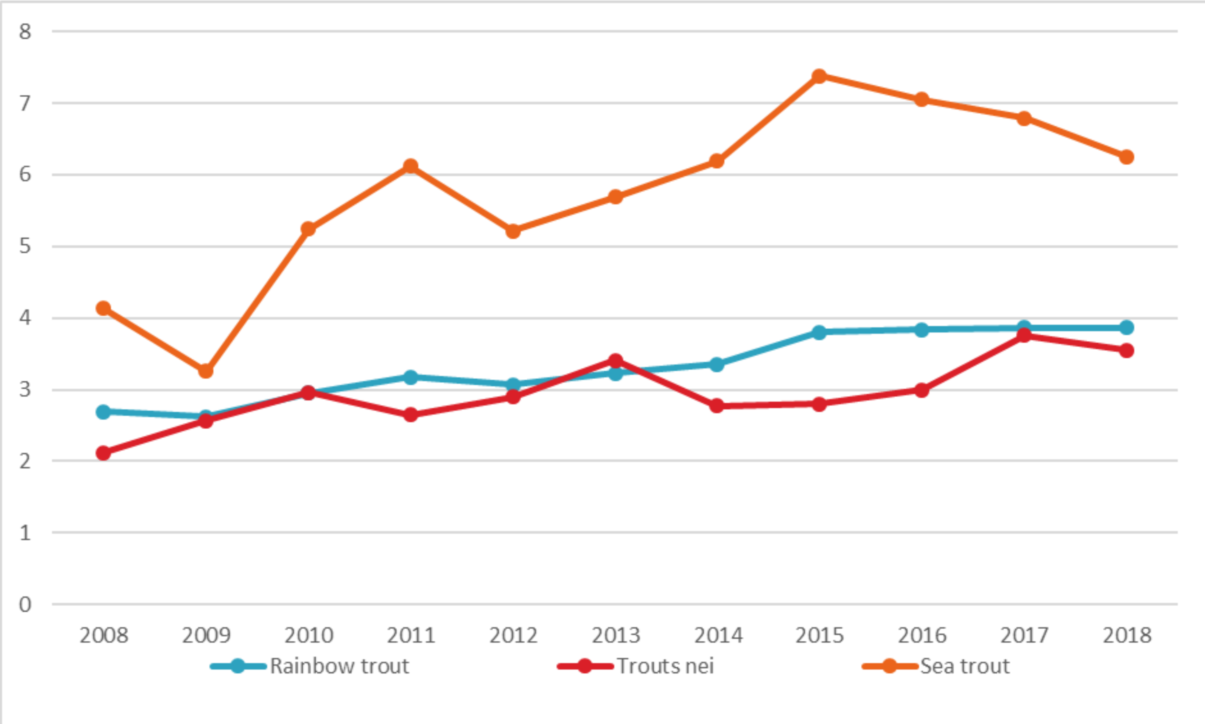
Figure 3.3.1.2. Costs breakdown for the EU trout aquaculture: 2018.



Source: EU Member States DCF data submission, 2021

The average prices of freshwater rainbow trout has shown an increasing trend for 2008-2015 and stagnation from 2016 at €3.9 per kg. Market prices for sea-based rainbow trout are higher than for freshwater rainbow trout, because this price follows the Atlantic salmon price. The average price for sea trout fluctuated but the overall trend is positive. From 2015, the price for sea trout decreased by 15% and in 2018 it was at €6.3 per kg. The trend for average price for trouts nei is positive, but in 2018 price declined by 5% to €3.6 per kg.

Figure 3.3.1.3. Price evolution of the main species of trout group: 2008-2018.



Source: EU Member States DCF data submission, 2021

3.3.2 Carp

Global production of cyprinids increased from 22.2 million tonnes in 2010 to 29.2 million tonnes in 2018. Thereof, the global production of common carp was 4.2 million tonnes in 2018. The world-leading producer of common carp is China, which is responsible for 70 % of global production (FAO 2020). With 0.08 million tonnes in 2018, production of cyprinids in Europe is comparable low and often dedicated for domestic markets.

The history of common carp (*Cyprinus carpio)*, dates back almost a thousand years in Europe. In fact, it is the longest farmed species in European freshwater aquaculture and the only culture (FAO, 2016), which knows different breeding lines. The Cistercian monastic order played a central role in the domestication of carp in Central and Eastern Europe in medieval times (cf. Lasner et al., 2020[8]). The traditional extensive polycultural techniques are still used by many present day carp farmers in Europe. Hence, carp farms are seen as low input aquaculture, providing both cultural and ecosystem services. In some countries like Germany, a societal debate has started, which argues to acknowledge carp cultures for their provided ecosystem services. Partly, carp farmers gain already public payments from contractual nature conservations under specific restrictions. Earthen carp ponds have similar construction and tend to differ only in scale and stocking density. Water supply derives from precipitation or surface water (e.g. stream). Annual carp production depends heavily on climate. A strength of carp is his high tolerance towards water temperature and low degrees of in water soluted oxygen. The robustness of carp is analogical strong and not susceptible to external impacts as other species. Nevertheless, climate change impacts are one of the greatest challenges of today's carp farming.

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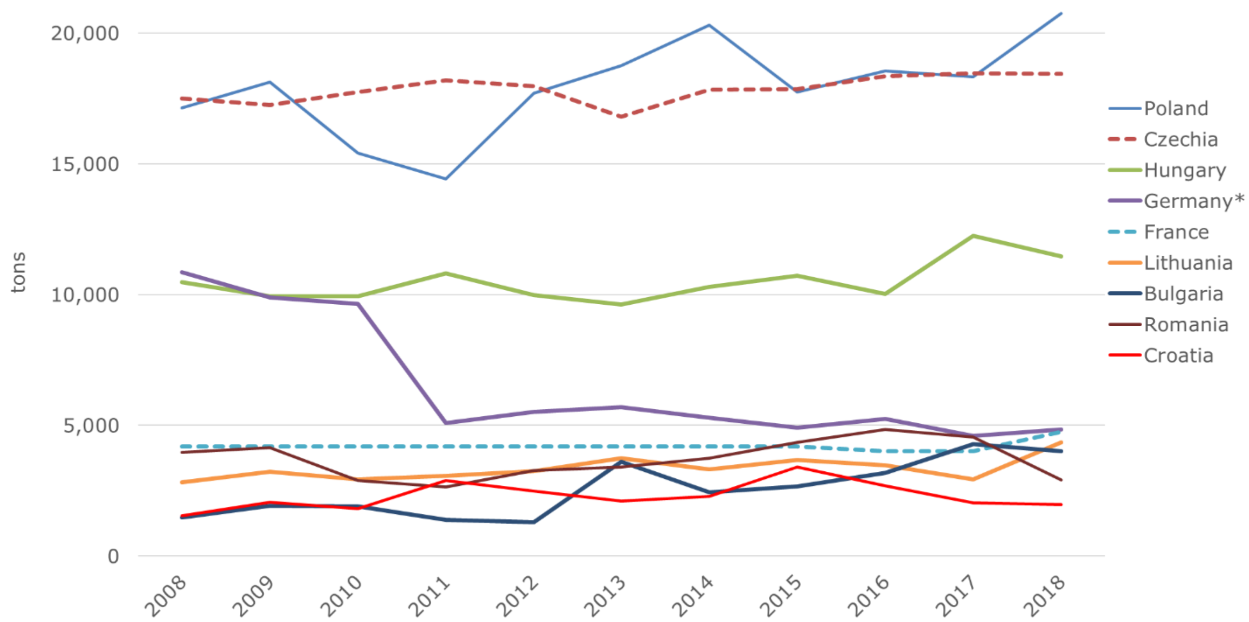
[8] Lasner T., Mytlewski A., Nourry M., Rakowski M. and Oberle M. (2020) Carp Land: Economics of Fish Farms and the Impact of Region-Marketing in the Aischgrund (DEU) and Barycz Valley (POL). Aquaculture 519, 734731.

Various cyprinid species are produced in the EU besides the common carp. After common carp, the main species produced by weight are bighead carp (*Hypophthalmichthys nobilis*), grass carp (*Ctenopharyngodon idellus*), and silver carp (*Hypophthalmichthys molitrix*) in 2018. Notwithstanding, common carp is by far the most important cyprinid species in the EU by volume and value. According to FAO data, EU member states (incl. the UK) produced 75 348 tonnes of common carp in 2018. Take into account, that Germany as the former third biggest producer changed its data collection method and reported around 5 000 tonnes per year less since 2011 in consequence. Bearing that fact in mind, the production has remained more or less stable in the last 10 years. Further and despite the German data collection, a slightly increasing trend from 2008 to 2018 of about 5% can be observed. Poland, Czechia, Hungary, Bulgaria, Germany, Romania, and France are responsible for more than 90% of EU carp production. Poland and Czechia alone have a share of more than 50 % of total EU production. The value of common carp sales was €175 million in 2018.

With the exception of Czechia, EU production of common carp is produced for domestic markets. Poland is the main consumer market for carp in Europe. Polish households consumed more than 7 500 tonnes netto weight in 2018, which had a value of almost €29 million (EUMOFA 2020). The domestic demand for carp has a strong seasonal peak at Christmas time in some MS due to catholic culture. Although there is a range of different processed carp products, the tradition is still to buy freshly slaughtered carp or even live carp that can be prepared at home. Also, Hungary is one of the biggest producers of cyprinids in the EU, and carp production in 2018 was 11 462 tonnes that amounted to a value of €25.8 million. Hungary exported 2 574 tonnes of carp (live) that amounted to a value of €5.6 million, 97% of exports went to the EU internal market (mainly to Romania, Germany, Poland, Chechia, and Italy). The amount of exported cyprinids fresh or chilled was 226.6 tonnes, with a value of €1 million, and the amount of the frozen cyprinids was 3.6 tonnes with a value of €15 thousand. Approximately 40% of the produced fish is sold in December due to the Christmas holidays, and there is also another peak in the sales near Eastern.

Figure 3.3.2.1: Quantities of common carp by main producers in EU (in tonnes) 2008-2018



Source: FAO (2021)
* The "decline" in German carp production is caused by changed survey methods in 2011.

As in many MS in Germany and Poland, two of the main EU consumer markets for carp consumers tend to switch to other fish species nowadays (Zander & Feucht, 2018[9]). But, carp producers have started, e.g. in Poland and Germany, to intensive investments in direct marketing of more processed carp products (Lasner et al., 2020) to meet the preferences of changing consumers preferences for more convenient fish food.

On the production side, some carp farmers suffer extremely under fish loss due to protected wildlife fish predators (e.g. cormorant, heron and otter), draughts, which cause water shortage (in particular in the years 2015, 2018, and 2019) and in some parts loss due to diseases (Koi herpes virus, KHV). Together these factors can have a significant impact on the profitability of carp farms.

Economic Performance

Due to the poor freshwater aquaculture data reported under the DCF, especially for landlocked countries, which are also the main carp producing countries, it is difficult to give a detailed picture of the economic performance of the EU cyprinid aquaculture sector. Based on the submitted information, it is only possible to analyse seven countries, which are included in Table 3.3.2.1. In 2018, the EU aquaculture sector consisted of 2 842 registered enterprises, with a total sales volume of 38.4 thousand tonnes according to reported DCF data, which do definitely not correspond to the real number of farms and sales (cf. FAO data above).

The majority of the enterprises were situated in Germany, Bulgaria, and Romania. In 2018, the carp segment employed 5 585 people corresponding to 4 302 FTEs (Table 3.20). DCF data show a total sales volume of 38.4 thousand tonnes. Total turnover was €105.7 million. In 2018, FAO data for the following countries: Austria, Bulgaria, Croatia, Czechia, France, Germany, Hungary, Italy, Latvia, Lithuania, Poland, Romania, Slovakia, Slovenia, Spain, and the United Kingdom shows that these countries generate a total sales volume of cyprinids of 92.9 thousand tonnes and turnover of €204.1 million.

Table 3.3.2.1: Economic indicators for the EU cyprinids aquaculture: 2018.

Country	Number of enterprises		Total sales volume		Turnover		Employment		FTE		Average wage	
	number		thousand tonnes		million €		number		number		thousand €	
	2017	2018	2017	2018	2017	2018	2017	2018	2017	2018	2017	2018
Bulgaria	414	434	3.9	4.4	6.2	7.9	775	658	627	500	3.1	3.5
Croatia	20	20	2.9	2.5	5.6	5.4	372	301	321	255	8.3	9.7
Germany	1,803	1,717	5.6	4.7	17.9	17.4	690	690	604	604	34.2	34.8
Hungary	321	325	23.3	15.1	45.5	31.3	2,687	2,260	1,608	1,362	6.1	8.3
Romania	195	236	8.7	11.3	9.6	41.1	1,578	1,439	1,578	1,439	1.4	3.4
Spain	77	54	0.1	0.2	0.4	0.4	133	101	52	48	7.7	12.8
United Kingdom	43	56	0.2	0.1	3.1	2.2	96	136	63	93		
Other none DCF			58.3	60.1	128.3	134.9						
Total DCF reported	**2,873**	**2,842**	**44.8**	**38.4**	**88.5**	**105.7**	**6,331**	**5,585**	**4,853**	**4,302**	**7.9**	**10.0**
Total EU			**103.1**	**98.5**	**216.9**	**240.6**						

Source: EU Member States DCF data submission, 2021

The Expert working group was not able to analyse and evaluate the overall performance of the carp sector by segments due to the limited data and due to differences in segmentation within DCF and EU MAP. Therefore, the situation for carp production is presented as one aggregated segment, which includes all cyprinids not only common carp. According to the data reported the average wage in the segment was €9.8 thousand in 2018 and increased compared to 2017 (€7.8 thousand) which is a 26% increase.

[9] Feucht Y. & Zander K. (2018) D2.4: Report on the potential of selected innovative products in European markets. Strategic Use of Competitiveness towards Consolidating the Economic Sustainability of the European Seafood sector (SUCCESS), final report, Grant Agreement no: 635188.

In terms of economic indicators, the amount of GVA, EBIT, and Labour productivity generated by the EU carp aquaculture sector in 2018 was €323.7 million, €266.7 million, and €52 thousand, respectively. ROI and Capital productivity achieved 68.9% and 83.7% in the same year. All of the indicators in 2018 increased compared to 2017. GVA, EBIT, and Labour productivity increased by 47%, 61%, and 60% respectively. ROI and Capital productivity increased by 49% and 36%.

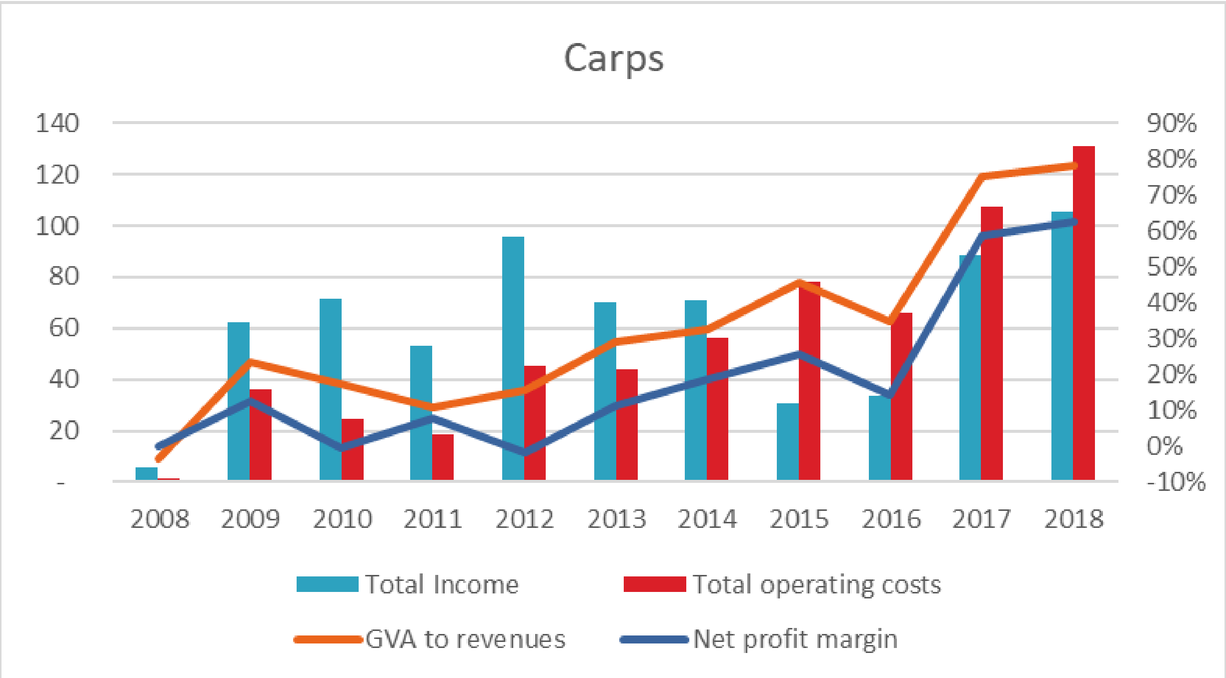
Other Economic indicators as total income, total operating costs, GVA to revenues, and net profit margin in 2018 also increased, not only compared to 2017 but also compared to the average for the period 2008-2017.

Table 3.3.2.2: Economic performance indicators for selected EU carp aquaculture: 2018.

Country	GVA		EBIT		ROI		Labour productivity		Capital productivity	
	million €		million €		%		thousand €		%	
	2017	2018	2017	2018	2017	2018	2017	2018	2017	2018
Bulgaria	2.6	2.0	-0.2	-0.7	-1.3	-4.4	4.2	3.9	17.9	13.1
Croatia	24.8	10.6	19.6	5.3	17.2	5.5	77.3	41.7	21.8	11.0
Germany	7.2	7.8	-13.5	-14.7	-29.4	-58.3	11.9	12.9	15.7	30.7
Hungary	179.8	275.4	157.1	253.8	112.1	338.6	111.8	202.2	128.4	367.4
Romania	6.8	28.4	2.6	23.6	6.1	13.5	4.3	19.7	15.9	16.3
Spain	-0.4	-0.4	-0.4	-0.7	-878.9	-882.7	-7.1	-9.3	-752.9	-569.1
Total EU	221.0	323.7	165.2	266.7	46.2	68.9	32.5	52.0	61.8	83.7

Source: EU Member States DCF data submission, 2028

Figure 6.3.2.2: Economic performance indicators for carp aquaculture: 2008-2018.



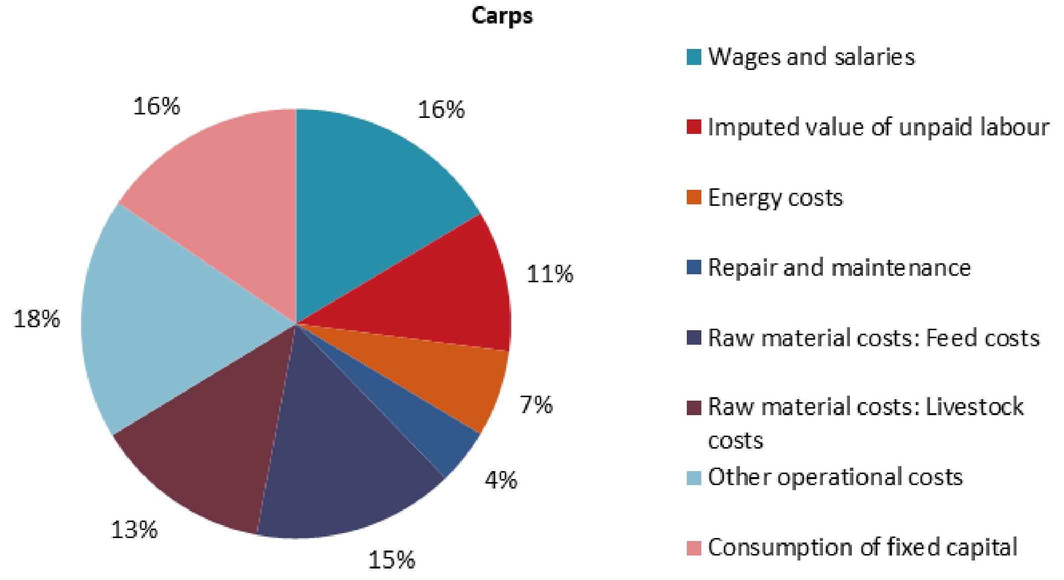
Source: EU Member States DCF data submission, 2021

From the data provided to DCF, it could be stated, that carp aquaculture is very extensive as feed cost in the segment were only 15% of the total cost structure but this indicator has a positive trend compared to 2016 data which is a sign for shifting to semi-intensive production technology. This sign is supported by livestock cost which represents 13% of the total. The largest part of costs according to the provided data was other operational costs, which covered 18% of the total costs. Wages and salaries represented the second largest cost with 16% of the total cost.

Consumption of fixed capital also represented 16% of the total. The imputed value of unpaid labour also increased compared to 2016 and represents 11% of the costs, which actually is net income to family farms.

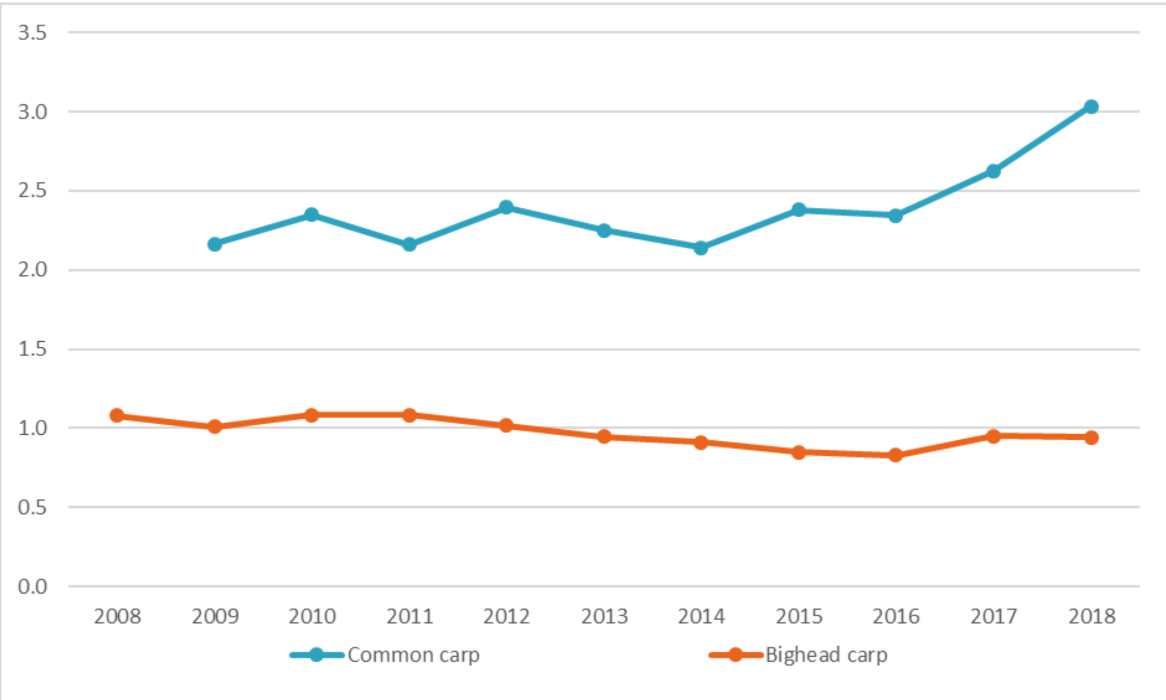
The price for cultured common carp shows an increasing trend, as illustrated in Figure 3.40. This is in line with world prices for carp (FAO). The price of common carp in the EU is almost one and a half as high as the price on the world market. This price difference is likely to reflect the difference between European and Asian consumer income, and the incorporation of lower value cyprinid species (big head carp and silver carp) within the world price for carp.

Figure 3.39: Costs breakdown for the EU carp aquaculture: 2018.



Source: EU Member States DCF data submission, 2021

Figure 3.40: Price evolution of the main species of carp group: 2008-2018.



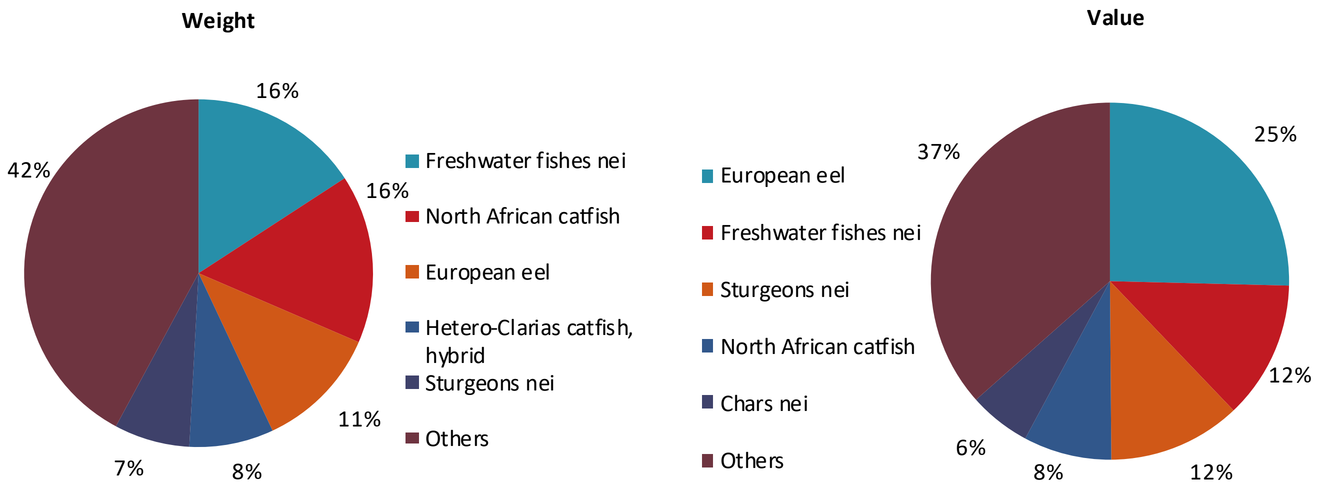
Source: EU Member States DCF data submission, 2021

3.3.3 Other freshwater species

Figure 3.3.1 shows the most important remaining fresh water species produced in the EU. Freshwater fish nei and North African catfish are the most important in terms of weight contributing both with 16%. In terms of value, European eel represents the highest value at 25%, Sturgeons and Freshwater fish nei both represent 12% each.

In total, the production was 36.3 thousand tonnes, valued €164.9 million in 2018. The main contributors to the other fresh water species segment were The Netherlands, Germany and Poland with reported weights of 6.5, 5.1, and 5.1 thousand tonnes, respectively. The main contributors in terms of turnover were Germany, The Netherlands and Poland with the produced value €32.9, €29.2 and €19.2 million, respectively.

Figure 3.3.1: Main species produced in the EU Member States for Other freshwater species group: 2018.



Source: FAO 2021

3.4 Algae

General overview

Macroalgae has been utilised by coastal communities in Europe for centuries as food and fertilisers which was, and in most of the cases still is derived from wild-harvesting in the inter and subtidal zone. The number of companies collecting macroalgae species by wild harvesting in Europe accounts for 68% of the overall macroalgae production with the remaining 32% derived solely from aquaculture (Araújo et al., 2021) However, according to the official statistics aquaculture represents less than 1% of the total produced volume (Araujo et. al., 2019, FAO, 2018).

The macroalgae industry and its value-chain ranges from wild-harvested which the end products are primarily utilised as feed ingredients and fertilisers, where farmed macroalgae are normally valorised into high value food, cosmetics and value added bio-based compounds.

This industry surrounding the cultivation of macroalgae biomass is of growing importance and opportunity to rural and remote regions due to the peripheral nature of aquaculture production practices where in some cases these regions are devoid of other industries. The development of this emerging aquaculture industry which is growing in critical mass still requires rapid implementation of knowledge transfer and innovation for the full realisation of sustainable production capacity.

Macroalgae is an extractive low trophic species and is utilised both in Integrated multi-trophic aquaculture (IMTA), mono- and polyculture operations which aims to enhance both the ecological and economic performance of the commercial operations.

Structure of the EU algae production sector

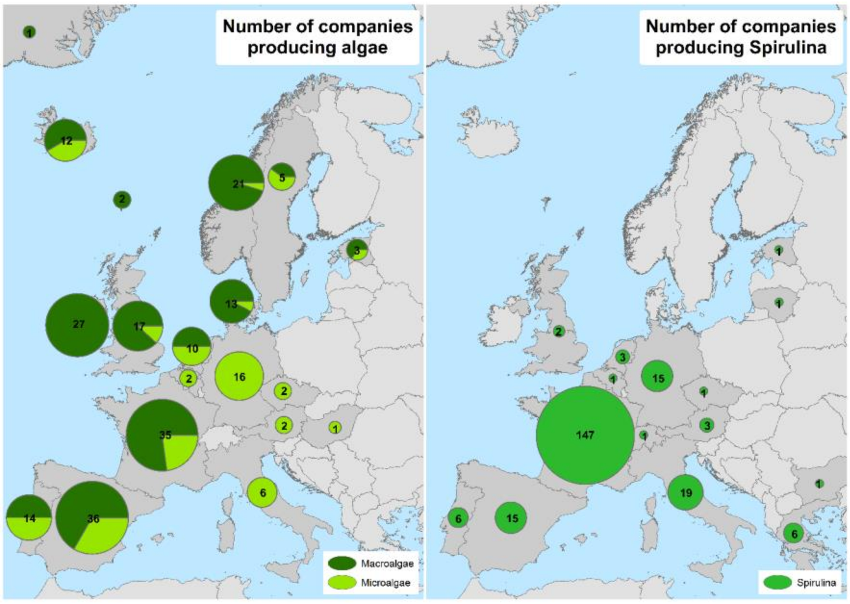
Macroalgae production involves the cultivation of juvenile seedlings in hatchery facilities where the seedlings are further on-grown in land-based facilities, open ponds or transferred to sea-based coastal or offshore environments. Microalgae and *Spirulina* Spp. production is a solely land-based operation utilising photobioreactors, fermenters and open ponds.

A mapping of the algae and *Spirulina* Spp. production industry showed that the sector is well implemented in Europe with more than 400 operating companies spread between 23 countries (including 19 EU Member states (MS)) (Figure 1).

Figure 1: Number and relative distribution between macro- and microalgae (A) and Spirulina (B) production companies by country (from Araujo et. al., 2021).

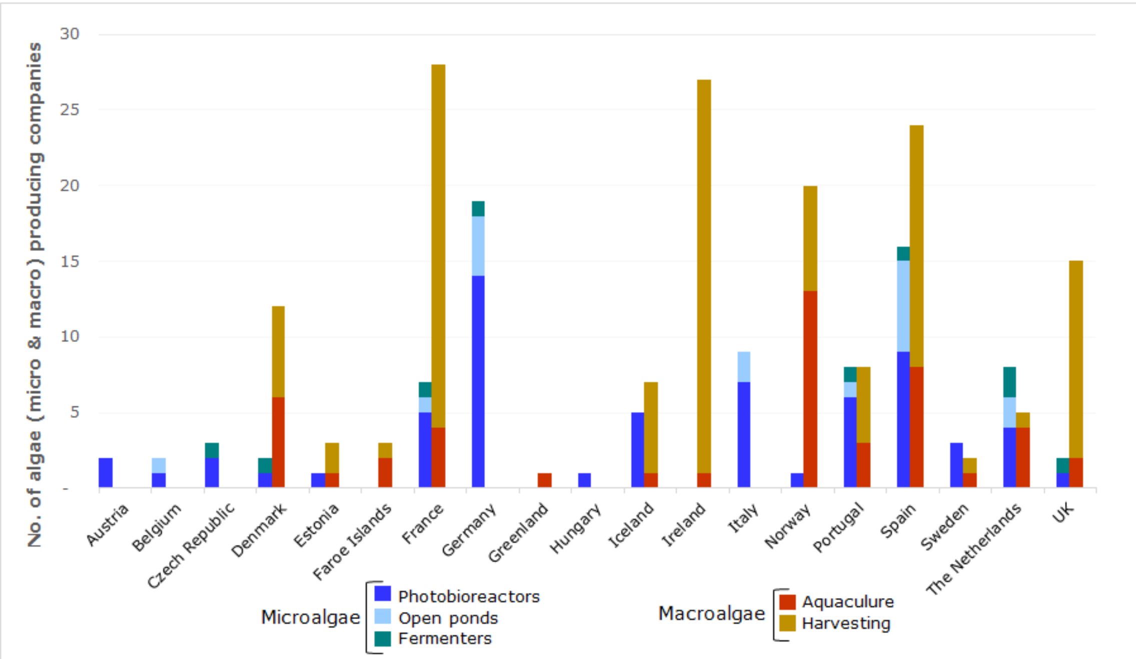
a

b



All these MS have aquaculture production of macroalgae, microalgae, *Spirulina* Spp. or all (as is the case for example of France) (Figure 2). The main aquaculture producers considering the number of companies in the EU, are Denmark, France, Spain and the Netherlands for seaweeds and France, Germany, Spain, Italy, Portugal and the Netherlands for microalgae and *Spirulina* Spp. (Figure 2, Araujo et. al., 2021).

Figure 2: Numbers of macro- and microalgae producing companies in Europe broken down by production technology and country (from Araujo et. al., 2021).

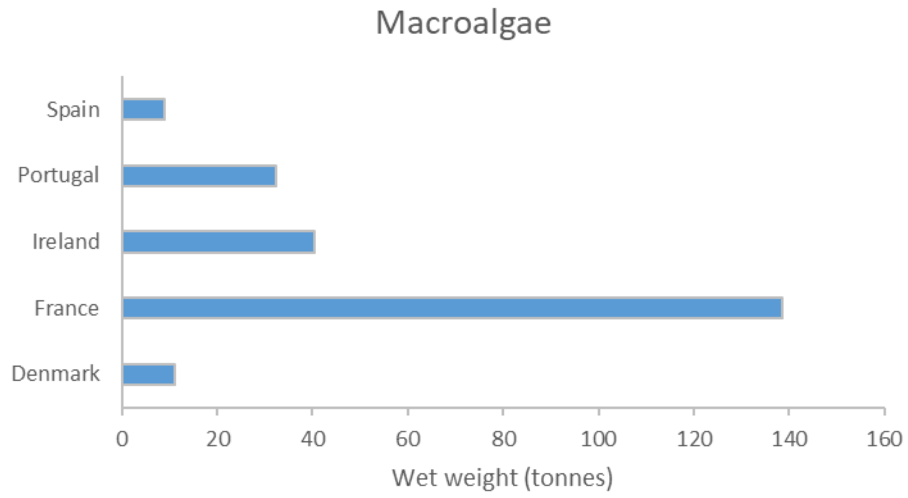


Information available on production volumes in the EU-27

Although widespread in a significant number of EU countries, algae and *Spirulina* Spp. aquaculture is still an emerging sector representing a small share of the total aquaculture production. Thus the reported data available is fragmented and of poor quality for most of the MS.

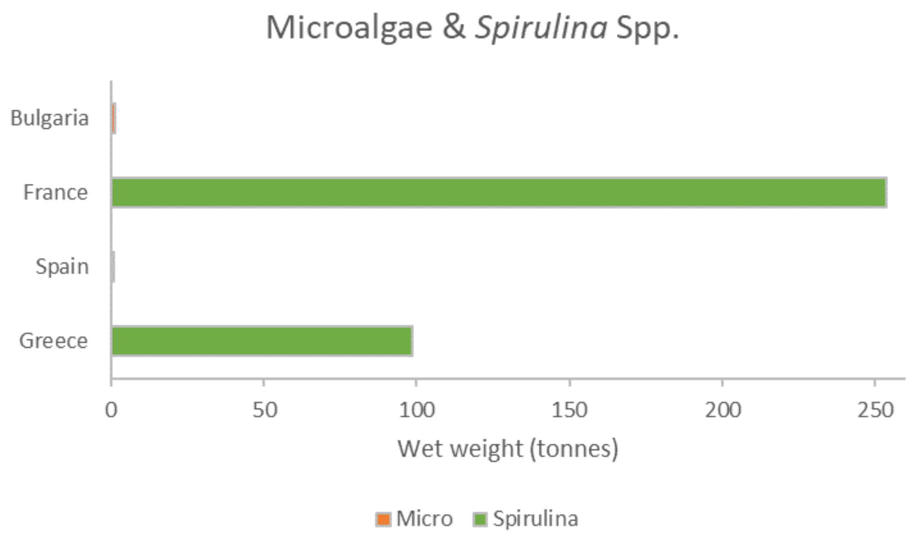
For macroalgae, a total of 231 tonnes are reported at the EU level with France leading the production and accounting for 60% of the total biomass volume produced (Figure 3).

Figure 3: Production volume (tonnes wet-weight) for seaweeds in the EU-27 countries (FAO + EUROSTAT data).



Very little reported data is available for the microalgae production with only Bulgaria and Spain reporting on volumes smaller than 1.5 tonnes (wet-weight). *Spirulina* Spp. production is reported by France, Spain and Greece. France accounts to 72% of the total biomass production and Spain to less than 0.2% (Figure 4).

Figure 4: Production volume (tonnes wet weight) for microalgae and *Spirulina* Spp. in the EU-27 countries (FAO + EUROSTAT data).



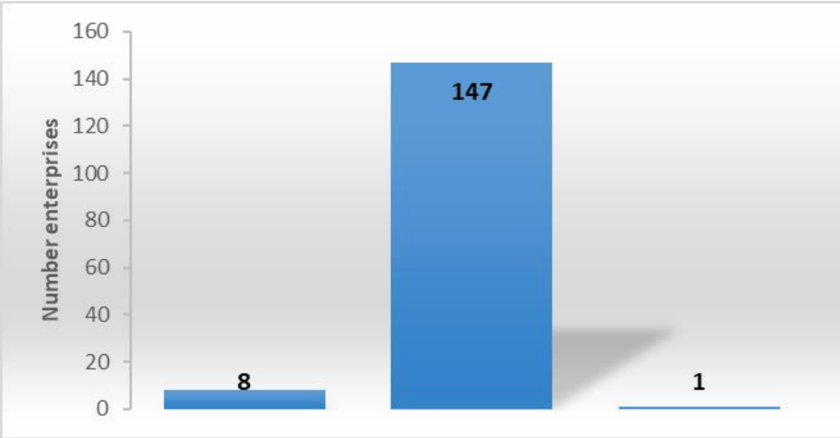
Socio-economic data reported under DCF

Reported socio-economic data was analysed for Portugal and Spain for the period 2017-2018 and for France for the period 2018-2019.

Number of enterprises

A total number of 156 enterprises were reported in the EU by France, Spain and Portugal (Figure 5). Portugal reported only on macroalgae companies. For France *Spirulina* Spp. production companies represent 92% of the total number of enterprises. From the total number of enterprises 87% are micro-enterprises with less than five employees.

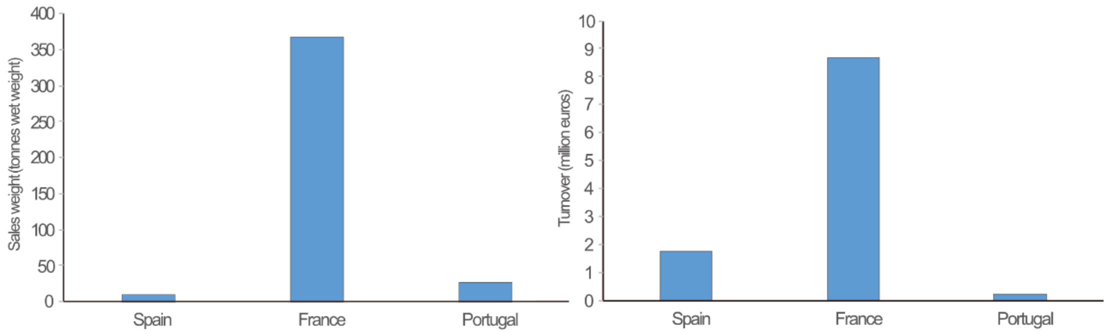
Figure 5: Total number of enterprises by EU-27 country



Sales weight and turnover

The total EU-27 production is estimated to be 405 tonnes (total sales weight) for the average of the two last years of reporting. The main producer is France while Spain and Portugal have much smaller production volumes (Figure 6). These values correspond to a very fragmented picture of the real situation since several countries are not reporting their production data and even for some of the reporting countries only a sub-segment of the production is reported. Additionally, these data are difficult to interpret since they refer to the aggregated algae (macro and microalgae) and *Spirulina* spp. biomass.

Figure 6: Total sales weight and total turnover per MS for the average of the last two years of reporting.

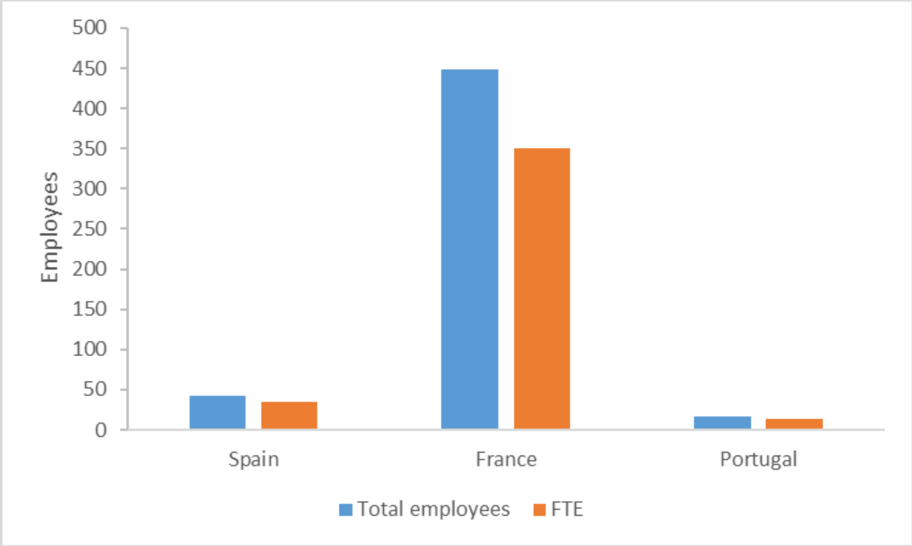


The major producer, France, has a total reported turnover of €8.7 million and Spain of €1.8 million. There is an inverse relationship between the values of sales weight and turnover for Spain and Portugal that is related to the nature of the segments reported (Figure 6). The data reported from Spain refers to all segments while data from Portugal are only for macroalgae, which has a lower value per unit of produced biomass.

Employment

According to the collected data the EU aquaculture employs a total of 509 persons for 399 full time equivalent jobs (FTE) (Figure 7). The distribution of employees between MS reflects the share in the number of companies.

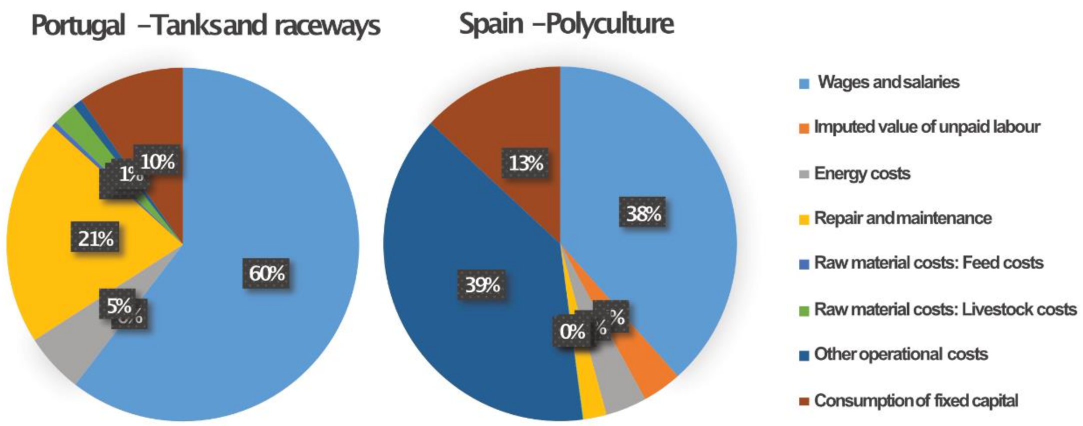
Figure 7: Total number of employees and FTEs in the EU-27 algae aquaculture per MS for the average of the last two years of reporting



Costs

Total operating costs reached €3.2 million for polyculture in Spain and €0.5 million for tanks and raceways in Portugal (Figure 8). The distribution of costs between these two aquaculture models differs with tanks and raceways allocating most of the costs (60%) to wages and salaries against the 38% reported by polyculture while 21% of costs are directed to repair and maintenance. For polyculture 39% of the costs are related to feed costs (Figure 8).

Figure 8: Total costs for Portuguese aquaculture in tanks and raceways and Spanish polyculture. Data for France not available.



Business constraints, knowledge gaps and future trends

Key knowledge and technology gaps still remain in the production of macroalgae in Europe where there is the direct need for innovation and knowledge transfer from research to direct implementation at an appropriate industry level. Production barriers exist along the whole value chain from hatchery production, on-growing on land or at sea site and the bio-based processing for food and other high value compounds. Due to the developing phase of the macroalgae production industry from research, innovation and implementation, the industry is constrained by legislative, licencing, governance and economic issues, which differ across all EU producing countries.

The production of macroalgae is of growing opportunity and the EU funded Horizon 2020 projects AquaVitae, Astral and GENIALG aim to address aspects surrounding the production of macroalgae in Europe and the Atlantic as a whole.

The available production and socio-economic data of algae from aquaculture in Europe is fragmented and in some cases lacking reporting and information which does not reflect the current status of the industry in Europe. This general lack of quality reporting data on algae is related to existing reporting thresholds, confidentiality issues and the emerging nature and small size of the sector. Given the increasing interest at an EU level to boost the development of algae aquaculture it is strongly recommended to increase the quality of data reporting. This knowledge is key to support informed policies and initiatives for the sustainable development of the sector addressing the needed social, economic and environmental challenges.

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4 NATIONAL CHAPTERS

4.1 Austria

Overview of Austrian aquaculture

Austria is a landlocked country producing only freshwater aquaculture products. The data collection of freshwater aquaculture is not mandatory. Since no data were submitted in the related data call, FAO data were used instead.

Total Production and sales

The Austrian aquaculture sector produced 4.0 thousand tonnes in 2018 and the estimated production value was €26.4 million (FAO, 2021). Austria does not have marine or shellfish aquaculture production.

The total weight of production has doubled during the analysed period from 2008 to 2018. In 2018, the total weight increased slightly from the year before but increased by 33% compared over the period 2008-2017. The value of the production in 2018 increased by 4% compared to 2017 and 40% compared over the period 2008-2017. The development over the last 11 years shows an increase in production, and the value of production has increased together with increased production but also due to a slight increase in recent years.

Table 4.1.1 Production and sales for Austria: 2008-2018.

Variable	2008	2010	2012	2014	2016	2017	2018	Change 17-18	Develop. 2018/(08-17)
Production weight (thousand tonnes)	**2.1**	**2.2**	**3.1**	**3.4**	**3.5**	**3.9**	**4.0**	***3%***	***33%***
Marine	0	0	0	0	0	0	0	0%	0%
Shellfish	0	0	0	0	0	0	0	0%	0%
Freshwater	2.1	2.2	3.1	3.4	3.5	3.9	4.0	3%	33%
Production value (million €)	**12.7**	**20.4**	**17.9**	**20.2**	**22.5**	**25.3**	**26.4**	***4%***	***40%***
Marine	0	0	0	0	0	0	0	0%	0%
Shellfish	0	0	0	0	0	0	0	0%	0%
Freshwater	12.7	20.4	17.9	20.2	22.5	25.3	26.4	4%	40%

SOURCE: FAO (2021)

Main species produced

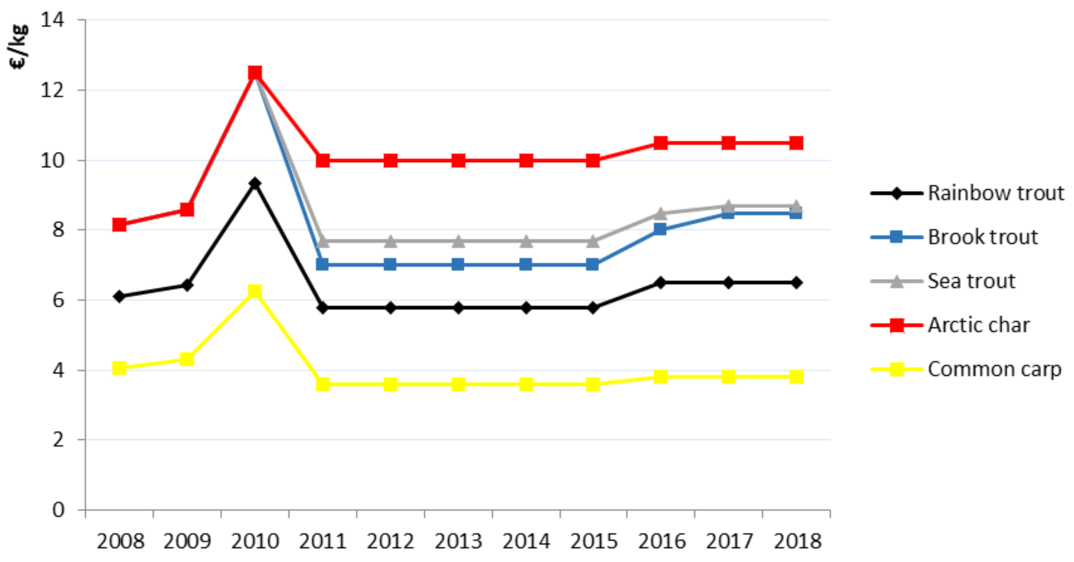
Rainbow trout remain the main species produced by the Austrian aquaculture sector representing 34% of the total weight and 33% of the total value of production in 2018. Other important species are brook trout covering 13% of the weight and 17% of the value, sea trout (also known as brown trout) accounting for 12% of the weight and 15% of the value, and common carp with 16% of the weight and 9% of the value.

Almost all aquaculture prices have had a similar trend over the period 2008 to 2018. Prices peaked in 2010 and after a drop in 2011, they were stable with a slight increase since 2016. Arctic char is the most valuable species while common carp has the lowest price.

Figure 4.1.1 Main species in terms of weight and value in Austrian production: 2018.

Source: FAO (2021)

Figure 4.1.2 Average prices for the main species produced in Austria: 2008-2018.



Source: FAO (2021)

COVID-19 impact

According to reports from producer organisations, aquaculture production itself was basically not affected by Covid-19. Regarding sales, the lockdown of restaurants and hotels first caused a major decline; fortunately, this could be compensated by the increased household demand for regional fish, which resulted in increases in farm-gate sales, sales at farmers‘ markets, and sales through domestic retailers, preventing serious overall losses. According to producer organisations as well as to statistical data, no employment effects were identified so far. It should be noted that the overall number of employees in the Austrian aquaculture sector is very low in general.

Data Coverage and Data Quality

The data collection of freshwater aquaculture is not mandatory under the DCF and EU-MAP programmes of the EU data collection. So landlocked countries are not obliged to provide economic data for this report. The analysis of the Austrian aquaculture sector is therefore based on data extracted from FAO.

4.2 Belgium

Overview of Belgian aquaculture

Although Belgium is not landlocked, it has only freshwater aquaculture. Furthermore, the data collection of freshwater aquaculture is not mandatory under the DCF. Considering no data were submitted in the related data call, FAO data were used instead.

Production volume and value

The total Belgian annual production in marine aquaculture was, according to Eurostat, 128 tonnes in 2007 (last year with reported data). This production did not increase since 2007, therefore the Belgian Federal Department of Economics, which is still monitoring the volume and value of this sector, did not publish actualised data in Eurostat. Until the end of 2019, Belgium had a derogation for collecting data on aquaculture activities.

According to FAO data, total freshwater aquaculture production in 2018 was 111 tonnes valued at €840 thousand.

Table 4.2.1 Production and sales for Belgium: 2008-2018.

Variable	2008	2010	2012	2014	2016	2017	2018	Change 17-18	Develop. 2018/(08-17)
Production weight (thousand tonnes)	**0.1**	**0.2**	**0.3**	**0.2**	**0.0**	**0.1**	**0.1**	***48%***	***-22%***
Marine	0	0	0	0	0	0	0	0%	0%
Shellfish	0	0	0	0	0	0	0	0%	0%
Freshwater	0.1	0.2	0.3	0.2	0.0	0.1	0.1	48%	-22%
Production value (million €)	**0.3**	**1.4**	**2.2**	**1.0**	**0.4**	**0.7**	**0.8**	***23%***	***-15%***
Marine	0	0	0	0	0	0	0	0%	0%
Shellfish	0	0	0	0	0	0	0	0%	0%
Freshwater	0.3	1.4	2.2	1.0	0.4	0.7	0.8	23%	-15%

SOURCE: FAO (2021)

Only production of rainbow trout is specified by FAO for some years. The rainbow trout (*Oncorhynchus mykiss*) is mostly cultured in Wallonia.

The generic "freshwater fishes" and "aquatic invertebrates" are reported for the whole period and just few years, respectively.

Regarding the aquatic invertebrates nei: In the period 2007-2011, two farmers were active in the production of blue mussels. Both were located in the same shellfish production area: D1 – Noordpas, offshore in front of Nieuwpoort. The mussel production ended in 2011 because of technical and legal problems.

Industry structure and total employment

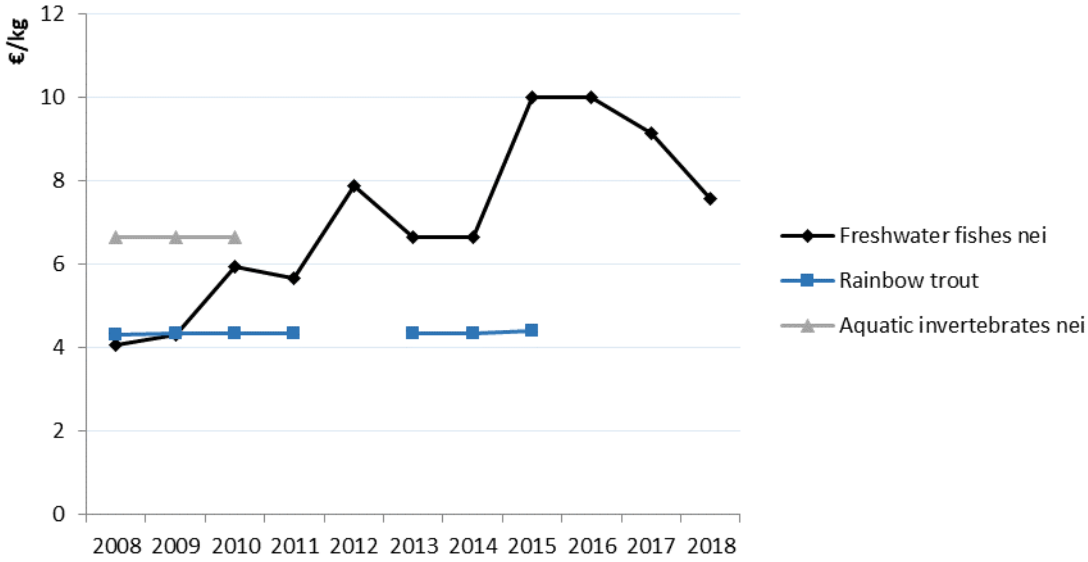
The Belgian fresh water aquaculture sector is mainly characterized by small-scale, extensive production units, with low employment rate. Only a limited number of farms form an exception to this rule of thumb. In the northern part of Belgium (Flanders) the companies can be identified, in the southern part of Belgium (Wallonia) the situation is more complicated.

The biggest production is situated in Wallonia, where mostly rainbow trout (Oncorhynchus mykiss) and to a lesser extent brown trout (Salmo trutta fario) and brook trout (Salvelinus fontinalis) are cultured. These farms are mostly family-based operations that often have no further personnel on the payroll and subsequently, do not have significant alternative employment opportunities. Hence, farmers are prepared to accept incomes, which would not be acceptable to publically limited liability companies and keep producing trout under non-profitable conditions. In addition, leaving and getting back into business is fairly easy, because the infrastructure is not expensive to maintain. Nowadays, big producers of trout, import large size of trout (from Italy, Greece and Turkey) and keep them in outdoor ponds until there is a demand for trout. To our knowledge there is no full cycle production (from broodstock via eggs to market sized product) of trout in Belgium.

In Flanders, several fish farms are active in the production of ornamental fish (koi, goldfish, shubunkins, sarasa's), game fish (e.g. bream, carp, catfish, ide, minnow, pike, tench) and consumption fish (carp and tilapia) in fish ponds.

Mariculture is very rare in Belgium and is limited to the production of oyster, blue mussel and tropical shrimps.

Figure 4.2.1 Average prices for the main species produced in Belgium: 2008-2018.



SOURCE: FAO (2021)

Outlook

A Belgian national strategic plan for aquaculture has been developed that focuses on sustainability and production with high added value. In Belgium, regional differences are noticeable. In Flanders, the focus lies on starting up and perfecting production systems that offer an ecological and economic performance. In Wallonia, the emphasis is placed on improving the economic performance of small businesses. Recently, both domestic and foreign investors have announced major initiatives for land and sea based aquaculture.

Data Coverage and Data Quality

The data collection of freshwater aquaculture is not mandatory under the DCF and EU-MAP programmes of the EU data collection. As Belgium only produces freshwater aquaculture products, it was not obliged to provide economic data for this report. The analysis of the Belgian aquaculture sector is therefore only based on data extracted from FAO.

4.3 Bulgaria

Overview of Bulgarian aquaculture

The overall performance of the Bulgarian aquaculture sector has improved significantly in the last five years as the total income, generated mainly from turnover, in 2018 increased by 65% compared to the average value for the period 2012-2017. Other positive trends are increasing in net profit and gross value added/capital productivity.

The most important species in the country are trout and carp. In terms of the value of the sales, the biggest turnover was generated by the segments trout ponds followed by trout cages and carp ponds.

4.3.1 Total Production and sales

The aquaculture sector in Bulgaria had stable performance over the period 2008-2012 and after 2013, the sales volume increased rapidly. In 2018, the total sales weight and value were tripled compared to 2008 or 2012.

In 2012, the turnover from sales was €11.0 million and in 2018 the turnover has increased by 77% compared to the period 2012-2017 and amounted €30.5 million. Compared to 2017, the turnover in 2018 increased by 36%. The total sales volume in 2018 increased by 38% over the period 2012-2017 and was 11.4 thousand tonnes. Compared to 2017, the total sales volume in 2018 decreased 3%.

Table 4.7.1 shows that the number of enterprises, volume of total sales and turnover are growing gradually during the period 2012-2018. There has been an increase in the sales volume and value in both freshwater and shellfish sectors.

4.3.2 Industry structure and total employment

In 2018, Bulgaria had 627 registered aquaculture enterprises. A total of 369 farms from the total population have sales, turnover and employees, the rest of 228 registered enterprises have declared that they have no sales. There were 584 enterprises with 5 or less employees, 30 enterprises with 6-10 employees and 13 enterprises with more than 10 employees. Total employment in 2018 was 1 082 jobs, corresponding to 892 FTEs. The level of employment decreased between 2009 and 2012, but increased in the period 2013 – 2017, followed by a 17% decrease in 2018. Among the possible reasons for these fluctuations is the unstable economic situation in the country. The number of enterprises in 2018 with less than five employees and enterprises with 6-10 employees has increased by 6% and 11% respectively, compared with 2017, while the number of enterprises with more than 10 employees decreased by 27% compared to 2017. The average wage in 2018 increased by 17% compared to 2017.

For 2017 and 2018, the social variables like gender, age classes, education, nationality and employment status were collected together with the economic variables. Due to the type of the table that was used for the collection of the social variables, it was also possible to provide combined variables like: education by gender, age distribution by gender, nationality by gender and employment status by gender.

The mean wage in the sector decreased in 2015 and 2016, but in 2017 and 2018 it was gradually increasing, probably due to the increase of the minimum salary in the country. Total FTEs in 2018 decreased with 19% compared to 2017 but increased by 13% compared to the average for the period 2012-2017. The changes regarding the total employees are similar – there was a 17%

decrease compared to 2017, but 18% increase compared to the average for the period 2012-2017.

Table 4.3.1 Production and sales, industry structure and employment for Bulgaria: 2012-2018.

Variable	2012	2013	2014	2015	2016	2017	2018	Change 2017-18	Develop. 2018/(12-17)
Sales weight (thousand tonnes)	**4.3**	**6.2**	**6.8**	**8.6**	**11.6**	**11.7**	**11.4**	-3%	38%
Shellfish	0.8	1.0	1.3	3.0	3.7	3.5	1.3	-62%	-40%
Freshwater	3.5	5.2	5.5	5.6	7.9	8.2	10.0	22%	68%
Sales value (million €)	**11.0**	**14.7**	**17.2**	**17.3**	**21.0**	**22.4**	**30.5**	36%	77%
Shellfish	0.6	0.9	1.0	1.3	1.2	1.1	1.0	-2%	0%
Freshwater	10.3	13.8	16.1	16.0	19.8	21.3	29.5	38%	81%
Number of enterprises	**163**	**317**	**354**	**575**	**588**	**597**	**627**	5%	45%
Shellfish	11	26	23	30	33	31	27	-13%	5%
Freshwater	152	291	331	545	555	566	600	6%	48%
Employment	**454**	**777**	**924**	**1013**	**1046**	**1297**	**1082**	-17%	18%
Shellfish	37	92	77	104	90	87	45	-48%	-45%
Freshwater	417	685	847	909	956	1210	1037	-14%	24%
FTE	**454**	**756**	**679**	**830**	**923**	**1096**	**892**	-19%	13%
Shellfish	37	92	60	96	82	75	43	-43%	-42%
Freshwater	417	664	620	734	841	1021	849	-17%	19%

Source: EU Member States DCF data submission

The total income in 2018 has increased compared to 2017 and to the average for 2008-2017. The total operating costs have importantly decreased between 2009 and 2010, but after 2010 their value is increasing proportionally to the increase of the total income and in 2018 their value is 24% higher than in 2017. Labour productivity is rather unstable for the whole period 2008-2018.

4.3.3 Overall Economic performance

The economic performance of Bulgarian aquaculture sector has deteriorated between 2008 and 2010, but in the five years, the situation significantly improves. The amount of total income generated by the Bulgarian aquaculture sector in 2018 was €33.3 million. The Total income value in 2018 increased by 32% compared to 2017, and it is 65% higher than the average value for the period 2012-2017. The largest part of the income remained from the turnover from sales, which represented 91%, followed by other income, which was 4%. The income from subsidies in 2018 increased compared to 2017. Unlike the turnover for 2018, which was 36% higher than in 2017, the other income decreased by 28%.

The total operating costs by the Bulgarian aquaculture sector in 2018 were €21.9 million and represented 65% of the total income. The total operating costs in 2018 increased by 113% compared to the average of the period 2008-2017. The largest expenditure item in 2018 was raw material: feed costs with €10.7 million, followed by other operational costs €3.3 million and wages and salaries with €3.3 million. Expenditures for other operational costs, raw material: livestock costs and raw material: feed costs in 2018 increased by 109%, 31% and 17% compared to 2017, respectively.

According to capital cost, depreciation of capital is the main cost with the amount of €3.8 million. In 2018, the depreciation of capital decreased by 29% compared to 2017, the financial costs decreased by 57% and the financial expenditures also decreased by 33%. In regards to capital value, the total value of assets and debt amounted €40.7 million and €15.9 million, respectively.

The total value of assets in 2018 decreased by 22% compared to 2017, but it should be noted that there was a significant increase in the variable in 2017. The debt remained stable in the period 2014-2016, but in 2017 increased by 88% compared to 2016 and decreased by 8% in 2018.

Table 4.3.2 Economic performance of the Bulgarian aquaculture sector: 2008-2018.

Variable	2012	2013	2014	2015	2016	2017	2018	Change 2017-18	Develop. 2018/(12-17)
Total income	12.7	20.1	21.1	19.5	22.8	25.2	33.3	32%	65%
Total operating costs	4.3	8.7	8.6	9.4	13.0	17.6	21.9	24%	113%
Total wages	1.0	1.7	2.3	2.5	2.5	3.7	3.5	-5%	55%
Gross Value Added	8.9	9.2	11.6	12.5	11.5	10.5	13.5	29%	27%
Depreciation of capital	0.8	0.9	2.6	4.3	4.7	5.4	3.8	-29%	22%
Earning before interest and taxes	7.6	10.6	9.8	5.7	5.1	2.2	7.6	245%	12%
Financial costs, net	0.3	0.3	0.5	0.0	3.0	0.6	0.2	-57%	-70%
Net profit	7.3	10.2	9.3	5.7	2.1	1.7	7.4	345%	22%
Total value of assets	15.8	19.6	26.3	40.8	42.1	52.3	40.7	-22%	24%
Capital productivity (%)	56.4	46.9	44.0	30.6	27.4	20.0	33.3	66%	-11%
Return on Investment (%)	48.0	53.9	37.4	14.0	12.0	4.2	18.7	343%	-34%

Source: own elaboration from EU Member States DCF data submission

The amount of raw material volume: feed and raw material volume: livestock in 2018 were 13.8 thousand tonnes and 0.9 thousand tonnes respectively. Raw material volume: feed in 2018 increased by 24% compared to 2017, and raw material volume: livestock in 2018 decreased by 15% compared to 2017.

The GVA generated by the Bulgarian aquaculture sector was €13.5 million in 2018, representing 40% of the total income. The GVA in 2018 increased by 29% compared to 2017 and by 27% compared to the period 2008-2017. The operating cash flow amounted, in 2018, to €11.4 million, increased by 50% compared to 2017 and by 171% compared to the average for the period 2008-2017. EBIT was equal to €7.6 million in 2018 and increased by 245% compared to 2017. The net profit generated by the Bulgarian aquaculture sector in 2018 was €7.4 million and increased by 345% compared to 2017.

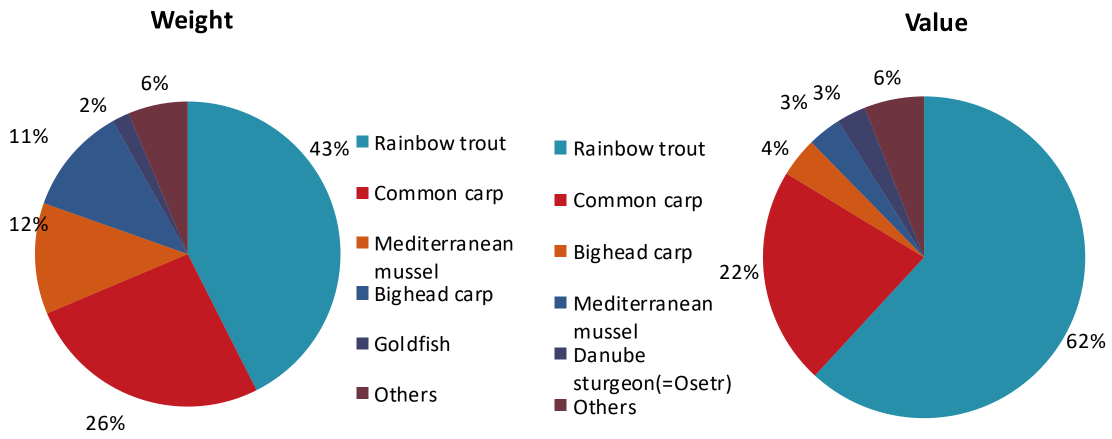
4.3.4 Main species produced and economic performance by segment

The segments with highest economic and social importance in 2018 were trout ponds, trout cages, carp on-growing and mussel long line. In terms of net profit, the most valuable one was the trout cages segment, followed by the trout ponds. The largest segment, regarding the number of enterprises and number of employees and FTE was carp ponds. In terms of value of the sales, the one that generated the biggest turnover was the trout ponds followed by trout cages and carp ponds.

In terms of sales volume, the volume of the rainbow trout represented 43% of the total sales volume of Bulgarian aquaculture sector in 2018, followed by common carp (26%) and Mediterranean mussel (12%). Turnover from rainbow trout represents 62% of the total turnover in the same year, followed by common carp with 22%.

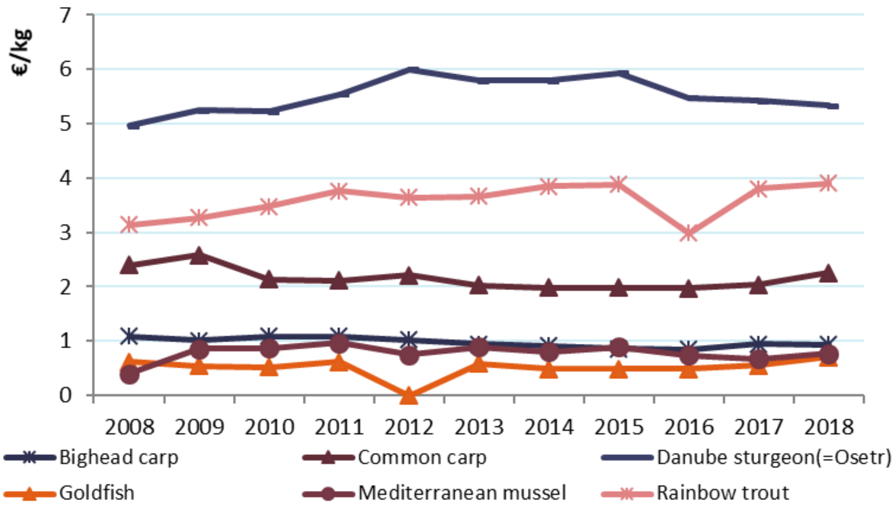
The average prices for the period 2008-2018 of the most important species for the Bulgarian aquaculture sector are presented in Figure 4.7.2. The average price of rainbow trout was €3.9 per kg in 2018, which was similar to the price from 2017 of €3.8 per kg. The average price of common carp was stable at €2 per kg in the period 2013-2017 with 20% increase in 2018 up to €2.3 per kg. The average price of Mediterranean mussel was €0.7 per kg in 2017 and increased by 10%, so in 2018 it was €0.8/kg, which is also the average price of the Mediterranean mussel for the period 2008-2017.

Figure 4.3.1 Main species in terms of weight and value in Bulgarian production: 2018.



Source: EU Member States DCF data submission

Figure 4.3.2 Average prices €/kg for the main species produced in Bulgaria: 2008-2018.



Source: own elaboration from EU Member States DCF data submission

The most relevant segments in the Bulgarian aquaculture are presented below.

The economic performance of four Bulgarian segments is shown in Figure 4.7.3 and Table 4.7.3. The data provided the time series for the detailed economic data from 2012 to 2018, because before 2012 the questionnaires for data collection were anonymous and voluntary, so data could not be divided into segments.

Segment 1: Trout cages

The most important segment regarding the sales value and volume continues to remained trout cages. It should be mentioned that the segment is composited of almost the same 17 enterprises in the last 5 years. A good sign for the development of the segment is the establishment of few new farms, and with them, in 2018 the segment consists of 26 active enterprises, which production was 82% rainbow trout. The value of total income in 2018 was €8.9 million with the amount of total sales volume of 2.4 thousand tonnes. The value of the total income in 2018 increased by 38% compared to 2017, and 45% compared to the average of the period 2012-2017. Total sales volume in 2018 increased by 23% compared to 2017 and by 42% compared to the average of the period 2012-2017.

Table 4.3.3 Economic performance of main **Error! Reference source not found.** aquaculture segments: 2012-2018.

Variable	2012	2013	2014	2015	2016	2017	2018	Change 2017-18	Develop. 2018/(12-17)
Mussel Long line									
Number of enterprises	11	26	23	30	33	31	27	-13%	5%
FTE	37	92	60	96	82	75	43	-43%	-42%
Average wage (thousand €)	3.0	4.2	4.6	5.8	2.9	3.5	3.5	-1%	-12%
Labour productivity (thousand €)	15.0	11.0	14.4	12.4	12.3	14.6	26.4	81%	99%
Total sales volume (thousand tonnes)	0.8	1.0	1.3	1.5	1.6	1.6	1.3	-15%	2%
Total income (million €)	0.9	2.9	2.4	1.6	1.2	1.7	1.3	-24%	-27%
Total operating costs (million €)	0.2	0.5	0.5	0.8	0.4	0.7	0.2	-71%	-61%
Gross Value Added (million €)	0.6	1.0	0.9	1.3	1.1	1.3	1.2	-7%	17%
Net profit (million €)	0.4	1.8	0.7	-1.6	-0.1	-0.2	0.9	476%	521%
Total value of assets (million €)	3.5	6.9	6.3	10.6	6.2	7.8	8.9	14%	29%
Net investments (million €)	1.2	1.6	0.1	0.2	0.1	0.2	2.2	1183%	294%
Capital productivity (%)	15.9	14.6	13.6	12.2	17.7	16.3	13.4	-18%	-11%
Return on Investment (%)	12.3	27.3	12.2	-15.5	-1.8	-2.9	9.4	424%	80%
Future Expectation Indicator (%)	24.7	15.9	-15.8	-20.4	-13.9	-13.3	22.2	267%	686%
Trout cages									
Number of enterprises	3	14	17	15	17	23	26	13%	75%
FTE	28	27	69	28	67	69	64	-7%	33%
Average wage (thousand €)	2.3	1.1	3.8	2.2	2.9	4.1	4.2	4%	56%
Labour productivity (thousand €)	147.3	218.5	85.2	187.5	66.3	54.1	87.5	62%	-31%
Total sales volume (thousand tonnes)	1.2	1.7	1.6	1.5	2.1	1.9	2.4	23%	42%
Total income (million €)	5.1	6.2	6.8	5.9	6.3	6.5	8.9	38%	45%
Total operating costs (million €)	1.1	0.4	0.8	0.3	1.9	3.0	3.6	21%	188%
Gross Value Added (million €)	4.1	5.9	5.8	5.6	4.6	3.8	5.6	48%	13%
Net profit (million €)	3.6	5.9	5.4	5.4	3.6	2.7	4.8	82%	9%
Total value of assets (million €)	2.7	3.0	4.3	2.0	7.5	8.6	5.5	-36%	18%
Net investments (million €)	0.7	0.0	1.1	0.0	0.0	0.0	0.0		-100%
Capital productivity (%)	153.3	199.1	136.4	278.1	61.1	44.3	101.6	130%	-30%
Return on Investment (%)	140.0	198.0	127.0	266.4	47.8	31.9	88.0	176%	-35%
Future Expectation Indicator (%)	14.1	-0.1	14.5	-8.7	-10.3	-9.1	-8.5	6%	-13668%
Trout Ponds									
Number of enterprises	30	52	60	70	74	77	89	16%	47%
FTE	123	150	143	130	169	181	182	0%	22%
Average wage (thousand €)	2.1	2.4	3.8	2.7	2.8	3.6	4.6	30%	59%
Labour productivity (thousand €)	19.9	14.2	22.7	26.8	9.7	19.1	26.6	39%	42%
Total sales volume (thousand tonnes)	0.9	0.9	1.4	1.4	1.7	2.1	2.9	39%	110%
Total income (million €)	3.5	3.9	5.8	5.8	5.2	8.3	12.1	46%	123%
Total operating costs (million €)	1.2	1.6	2.9	2.1	3.9	5.1	7.4	47%	166%
Gross Value Added (million €)	2.4	2.1	3.2	4.1	1.7	3.9	5.3	36%	80%
Net profit (million €)	2.2	2.2	2.4	3.4	0.8	2.6	4.0	51%	73%
Total value of assets (million €)	3.6	3.4	6.4	3.1	7.1	7.1	4.9	-31%	-4%
Net investments (million €)	0.2	0.1	0.2	0.0	0.2	0.2	0.2	-3%	30%
Capital productivity (%)	67.6	61.8	50.4	130.2	24.6	54.2	106.9	97%	65%
Return on Investment (%)	60.9	64.1	39.4	110.1	12.4	38.4	82.5	115%	52%
Future Expectation Indicator (%)	4.0	0.6	-3.5	-7.5	-3.2	-4.1	-7.9	-93%	-245%
Carp Ponds									
Number of enterprises	109	197	207	399	403	396	414	5%	45%
FTE	231	385	274	376	417	559	440	-21%	18%
Average wage (thousand €)	2.0	1.8	3.0	2.5	2.4	2.2	2.9	36%	27%
Labour productivity (thousand €)	5.3	1.5	2.4	2.5	2.1	3.5	3.1	-10%	9%
Total sales volume (thousand tonnes)	1.0	2.0	1.7	1.9	3.0	3.5	4.1	16%	85%
Total income (million €)	2.2	4.8	2.8	3.4	5.0	6.8	8.2	21%	95%
Total operating costs (million €)	1.4	3.4	2.9	3.1	4.6	5.6	7.4	31%	110%
Gross Value Added (million €)	1.2	0.6	0.7	1.3	1.1	2.5	1.9	-24%	54%
Net profit (million €)	0.7	1.1	-0.4	0.0	-0.5	0.1	-0.1	-153%	-130%
Total value of assets (million €)	3.7	4.4	4.6	6.3	5.0	10.8	11.0	2%	90%
Net investments (million €)	0.1	3.2	0.5	0.1	1.4	1.5	1.8	23%	58%
Capital productivity (%)	33.4	13.1	14.4	20.4	21.0	22.8	16.9	-26%	-19%
Return on Investment (%)	21.0	29.3	-7.2	0.1	-10.1	2.2	-1.3	-159%	-122%
Future Expectation Indicator (%)	1.0	69.3	6.4	-2.6	10.4	4.9	7.8	59%	-48%

Source: own elaboration from EU Member States DCF data submission

The amount of GVA generated by the trout cages segment in 2018 was €5.6 million, which is 48% more than 2017 and increased by 13% over the period 2012-2017. Total operating costs in 2018 was €3.6 million and increased by 21% compared to 2017 and more than 100% over the period 2012-2017. The amount net profit in 2018 was €4.8 million and increased by 82% compared to 2017 and by 9% over the period 2012-2017.

The largest cost item of the trout cages segment in 2018 was the feed costs with 47% of all the total operational costs. The other operational costs made up 20% of all operational costs and consumption of fixed capital was 12%.

Figure 4.3.3 Economic performance in € million, indicators for the main Bulgarian segments: 2012-2018.

Source: own elaboration from EU Member States DCF data submission

Segment 2: Mussels long line

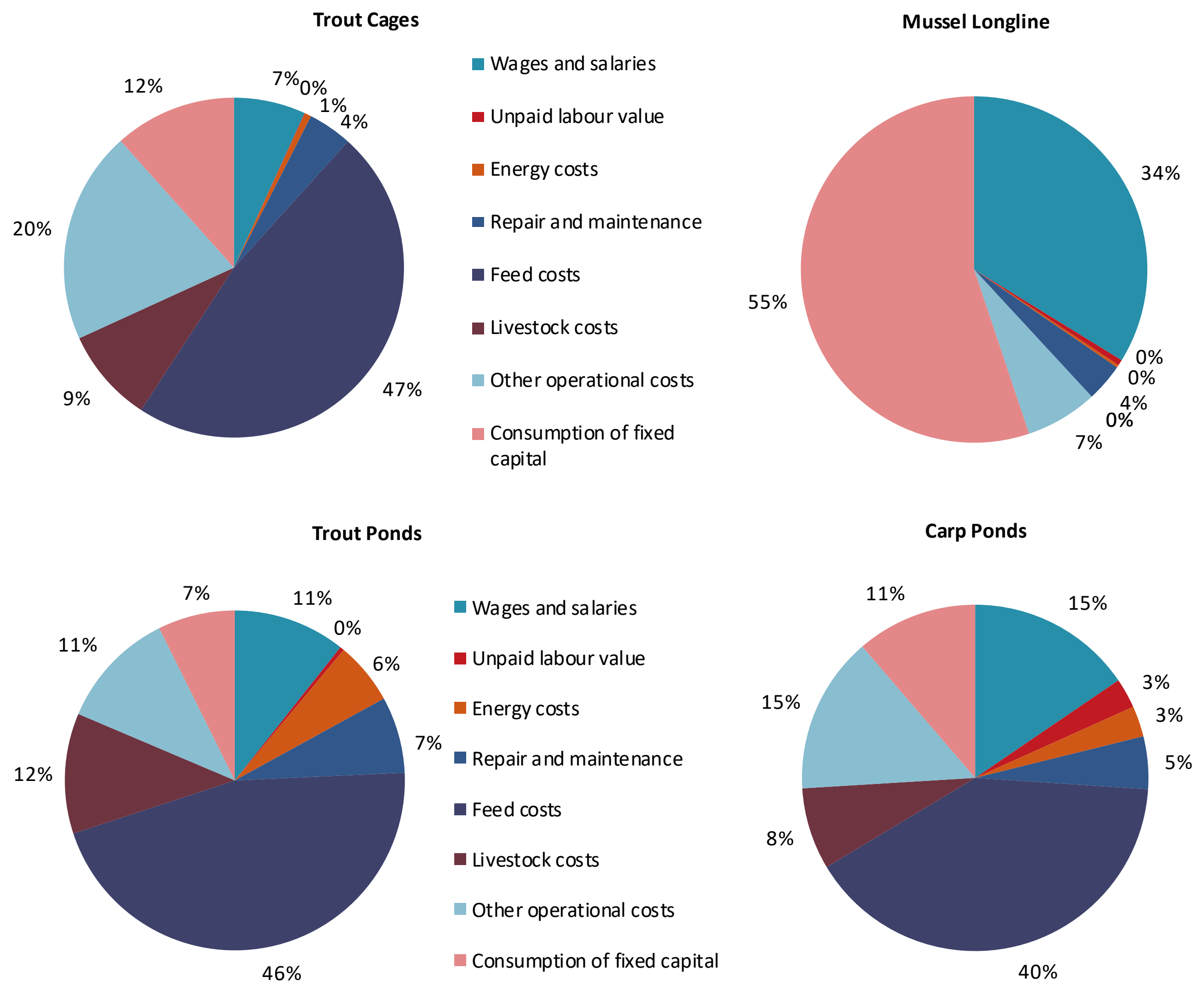
The segment is the only one representative of marine aquaculture, which unites 27 enterprises which decreased by 13% compared to 2017 but increased by 5% compared to the 2012-2017 period. The production from this segment is only Mediterranean mussel. The value of the total income in 2018 was €1.3 million, 80% of the income came from the sales, 16% is from other income. The total income in 2018 decreased by 24% compared to 2017 and by 27% to the 2012-2017 period. The amount of total sales volume was 1.3 thousand tonnes in 2018, which was 15% less than in 2017, and 2% less than the average value for 2012-2017.

In terms of economic indicators, the amount of GVA generated by the mussel long line segment in 2018 was €1.2 million and has decreased by 7% compared to 2017 and increased by 17% over the period 2012-2017. The amount of total operational costs in 2018 was €0.2 million and decreased by 71% compared to 2017 and 61% over the period 2012-2017. The net profit in 2018 was €0.9 million and increased significantly compared to 2017 and compared over the period 2012-2017, getting back near to the amount in 2014, which was last year with a generated profit.

The largest cost item of the mussel long line segment in 2018 was the consumption of fixed capital with 55%. Wages and salaries represented 34% of all operational costs and other operational costs were 7%.

Even with the decrease in sales and the low average price of the Mediterranean mussel the segment generated net profit for the first time in the last four years which might be because of the reduction of the costs and increase of net investments. A good sign is also the continuation of the increase in labour productivity during the same period.

Figure 4.3.4 Cost structure of the main segments in Bulgaria: 2018.



Source: EU Member States DCF data submission

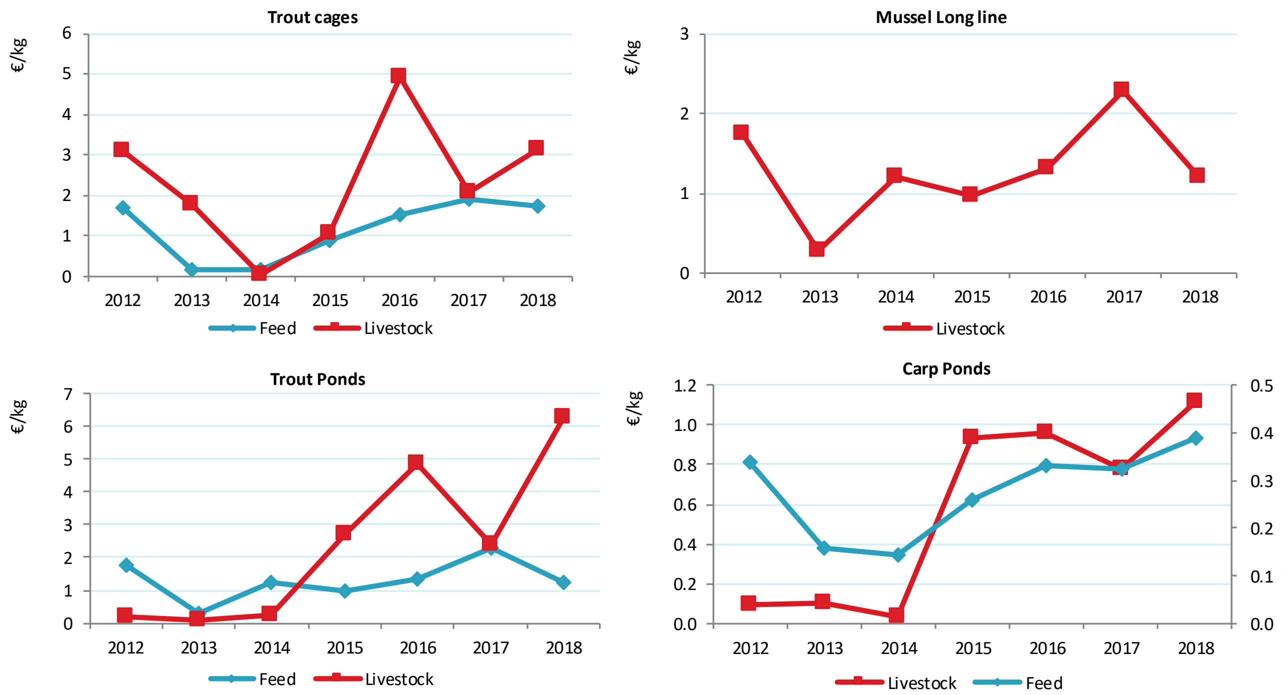
Segment 3: Carp ponds

This segment is the biggest one in terms of the number of enterprises in it - 414. It represented 66% of all the active enterprises in Bulgaria and it also employed 49% of the FTE in the sector. Most of the enterprises in this segment can be characterized as extensive. The value of total income in 2018 was €8.2 million, which was a 21% increase compared to 2017, and a 95% compared to the average for 2012-2017. The amount of total sales volume was 4.1 thousand tonnes in 2018, which represented a 16% increase compared to 2017 and 85% compared to the average value for 2012-2017.

In terms of economic indicators, the amount of GVA generated by the carp ponds segment in 2017 was €1.9 million and has decreased by 24% compared to 2017 but increased by 54% over the period 2012-2017. The amount total operational costs in 2018 were €7.4 million and increased by 31% compared to 2017 and 110% over the period 2012-2017. The amount of net profit in 2017 was €-0.1 million and significantly decreased compared to 2017 and over the period 2012-2017.

The largest cost item of carp ponds segment in 2017 was the raw material costs: feed cost with the 40%. Wages and salaries represented 15% of all operational costs and other operational costs were also 15%.

Figure 4.3.5 Feed and livestock average prices €/kg for the main Bulgarian segments: 2012-2018.



Source: own elaboration from EU Member States DCF data submission

Segment 4: Trout ponds

This segment consisted of 89 active enterprises, where, as in the trout cages segment, the main produced species is rainbow trout with 97%. The value of total income in 2018 was €12.1 million, which is 46% more than in 2017, and more than 100% compared to the average for the period 2012-2017. The amount of total sales volume in 2018 also increased, by 39% compared to 2017 and also by more than 100% compared to the period 2012-2017.

In terms of economic indicators, the amount of GVA generated by the trout ponds segment in 2018 was €5.3 million and has increased by 36% compared to 2017 and by 80% over the period 2012-2017. The amount of net profit in 2017 was €4 million and increased by 51% compared to 2017 and 73% over the period 2012-2017.

The largest cost item of trout ponds segment in 2018 remained the raw material costs: feed costs with the 46% and livestock costs with 12% of all operational costs. Wages and salaries represented 11% and other operational costs also with 11%.

For the proposes of this report and in order to have matching between DCF and EU-MAP segmentation the segment trout ponds represents two segments from DCF, which were reported separately in the previous years: trout combined and trout on growing. The same approach was followed for the segment carp ponds, reported in the past as carp combined and carp on growing. Bulgaria prepared the data based on the segments from EU-MAP, where the segments are more appropriate for the current situation in the sector. In order to continue the time series and to have reliable data despite the changes in the format of segments, combining historical data for both segments was the only possible solution.

4.3.5 Outlook

Nowcasts for 2019-20

The increase of aquaculture production could be supported through the production of species with high market prices, as well as additional investments in organic production. This goal from the Bulgarian national strategy on aquaculture seems achievable by the introduction of innovations and the development of market chains.

According to the data analysed for the 2008-2018 period, we can expect a better future for the Bulgarian aquaculture sector. According to 2019 data, the Bulgarian aquaculture production increased by 13% in terms of volume and by 17% of value when is compared to 2018. This positive sign with the applying of environmental measures and subsidies for new farms and innovations is expected to improve the situation in the sector.

Most of the expected results seem to be reachable and realistic but when we add Covid-19 impact the preliminary data for 2020 shows a decrease of 25% in total sales volume and 24% in turnover compared to 2019 but when we compared to the average for 2012-2019 period total sales increased by 5% and the turnover increased by 27%.

Trends and triggers

Current production trends and main drivers

A significant part of Bulgarian aquaculture consists of the production of rainbow trout, carp, and Mediterranean mussel. The production of carp is a positive trend in last years, due to the culture and traditions of the people. Compared to 2017 in 2018 the carp production marks growth by an increase of 15% in terms of volume and around 20% in terms of value. This growth continuation of the trend from 2015 and 2016 due to the export orientation of this sub-sector of the market, mainly for Romania. The cultivation of Mediterranean mussel drop down in 2018 as the demand but compared to the past the production of these species is stable because of the domestic market and also the export. The segments producing trout generated 63% of total income for 2018 and a net profit of €8.8 million. This indicated that the trout production is not only profitable and also quite sustainable compared to the other segments in the sector. In regards to the production trends during the last five years and the increasing interest in trout farming, the production gradually grows.

Market structure

The market structure in Bulgaria continue the slow process of development with a need for well organised and constructed chains of retail stores and wholesale distribution network of fish and fish products, including exchanges and specialized centres for purchasing fish not only near the seaside but also in the middle of the country. In some mountain and rural regions, the distribution of fresh fish is absent so that the consumption of fish in these regions is much lower than the average per capita in the country.

The main kinds of products produced for consumption are the chilled rainbow trout, the life species from the carp family from the freshwater, and frozen Mediterranean mussel from the marine species. The production is increasing in terms of volume and value year by year due to stable demand on the domestic market and increased export of processed products with added value and their good market price.

The main drivers are still the market with export-oriented products as well as the prices of the products with added value.

The production of sturgeon species still is not significant both in volume and value but continue to grow up and in 2018 the sector produced near 400 tonnes which is double compared to 2016. The slow growth of production can be explained by the fact that the main purpose of growing these species is reaching sexual maturity and the production of caviar, which takes a significant amount of time.

Despite the increasing interest in cage farming and recirculation system farming, only a few enterprises take the initiative to produce new species like an eel, coho salmon, and African catfish. For now, the result is visible only with African catfish where the reaching of market size is quite short.

COVID-19 impact

The main impacts suffered by the Bulgarian aquaculture industry during the pandemics' outbreaks were loss of market due to constraints for traveling at all, at the beginning of the period. The restrictions for traveling led to a reduction of the export to zero in the early stage of the pandemic. The reduction of export was crucial for the Bulgarian aquaculture industry because the sector, usually realise a bigger part of the production out of the country market.

The preliminary data shows that the sales for 2020 decreased by 25% compared to 2019, and turnover also decreased by 24%. The average prices in 2020 mark a slight increase by 4% compared to 2019. In mussels farming the decrease in sales, turnover, and the average price was more visible 27%, 35%, and 10%, respectively. The consequences for mussels farming were mainly due to the national market was not able to consume the big quantity which was not released for export and decrease in the price at the same time.

With the support of the EU and EMFF, 68 Bulgarian aquaculture farms were compensated under the measures due to COVID-19 with a total of 1 205 639 Euro.

The socio-economic situation could not be predicted for now because 2020 data is under collection until the end of March.

4.3.6 Data Coverage and Data Quality

Data quality and availability

Data quality: The achieved sample rate for economic data for 2018 was 100%, as in the last four years. This achieved sample rate has an impact on the quality of the data provided by the sector, which also understood the importance of data provision.

Data availability: Data for the aquaculture sector is published once a year. The aquaculture statistic is published on Agricultural Report and on the website of the Executive agency for fisheries and aquaculture approximately 12 months after the end of the reference year.

Confidentiality: In 2018, there was no confidentiality issue because the number of enterprises in each segment was more than five.

All segments are divided by species and technique. If an enterprise produces more than one species, then it is allocated to the segment of the species that represents the biggest volume of sales.

Some enterprises own more than one farm using different techniques, but these activities separated in the different segments, because the enterprise is used as a data collection unit. There are very few examples of enterprises using more than one production technique.

4.4 Croatia

Overview of Croatian aquaculture

Croatian aquaculture is, in terms of volume and value of production and employment, dominated by two segments – Seabass and seabream cages and Tuna cages. There were 177 enterprises in with aquaculture as main activity, producing 20.4 thousand tonnes in 2019 and creating 1 360 jobs totalling 1 138 FTEs. During period 2012-2019, Croatian aquaculture sector overall recorded steady growth in terms of sales volume and sales values.

4.4.1 Total Production and sales

Croatian aquaculture sector, altogether marine and freshwater, produced 17.1 thousand tonnes in 2017, 19.7 thousand tonnes in 2018 and 20.4 thousand tonnes in 2019, which is 50% of increase compared to 2012 and 19.3% increase compared to 2017. The total value of production was €120 million in 2018, which corresponds to an increase of 19.6% over the same period in 2017. During period 2012-2019, Croatian aquaculture sector overall recorded steady growth in terms of sales volume and sales values. Production and sales in marine aquaculture in total follows the objectives of the National Strategic Plan for Aquaculture 2014-2020. In earlier years, there was no data collection under DCF in Croatia as country joined the EU in July 2013.

The most important species, in this context, are European sea bass (*Dicentrarchus labrax*), Gilthead sea bream (*Sparus aurata*) and Atlantic Bluefin tuna (*Tunnus thynnus*) of fish species and Mediterranean mussel (*Mytilus galoprovincialis*) and European flat oyster (*Ostrea edulis*) of shellfish species. The most important species in freshwater farming are common carp (*Cyprinus carpio*) and rainbow trout (*Oncorhynchus mykiss*). Unlike marine aquaculture, production and sales in freshwater aquaculture is falling behind the objectives of the National Strategic Plan for Aquaculture 2014-2020. Still, concerning funds allocated for aquaculture and recent changes in diversity of production, it could be expected that production in this segment will be back on the track until the end of operational period (2023).

4.4.2 Industry structure and total employment

Majority of Croatian total number of enterprises are small family owned shellfish farms concentrated around several naturally suitable and protected areas for shellfish farming. Despite some signs of consolidations and important role they in sustainable regional development, most of these businesses are individually, in terms of sales volume and value and employment, insignificant. Many of these often have one only one family member working on a farm and selling products directly to customers or restaurants. On the other hand, large companies in Marine segment (Tuna and Seabass & Seabream) gather about 64% of total number of employees, 79% of total sales weight and 92% of total sales value which makes them convincingly the most important segment of aquaculture industry in Croatia. Number of freshwater aquaculture farms is steadily decreasing and they are also individually reducing production, sales and number of employees.

Although number of aquaculture companies remained steady in the last time series, there were some changes in structure of companies, which are the reflection of changes in administrative procedures and also new business openings. Namely, between 2018 and 2020, according to the regulations of the new Aquaculture Act, all the licences for aquaculture were revised and reissued which caused slight variation in number of enterprises, especially in the largest, shellfish segment.

The total number of persons employed in the Croatian aquaculture sector in 2017 was 1 367, corresponding to 1 116 FTEs and 1 360 in 2019, corresponding to 1 138 FTEs. The number of employees have variations primarily because lot of workers in aquaculture, especially in freshwater aquaculture, have temporary job, some of them are working as seasonal employees, part of employees with full time job are working partly in aquaculture and partially in other activities in the same enterprise. On the other hand, a strong trend of diversification – including processing industry and fisheries in marine aquaculture and other agricultural activities in freshwater aquaculture, variations in number of employees could be further expected.

Table 4.4.1 Production and sales, industry structure and employment for Croatia: 2012-2019.

Variable	2012	2014	2016	2017	2018	2019	Change 2018-19	Develop. 2019/(12-19)
Sales weight (thousand tonnes)	**13.6**	**13.8**	**17.3**	**17.1**	**19.7**	**20.4**	4%	29%
Marine	7.5	9.3	12.5	12.9	15.9	16.2	2%	46%
Shellfish	1.3	0.7	0.7	1.0	0.9	1.1	20%	31%
Freshwater	4.8	3.8	4.0	3.3	2.9	3.1	7%	-21%
Sales value (million €)	**77.7**	**77.5**	**108.6**	**101.0**	**120.0**	**120.8**	1%	26%
Marine	68.4	69.5	99.3	92.3	111.6	111.1	0%	28%
Shellfish	1.6	1.0	1.4	1.7	1.7	2.6	49%	88%
Freshwater	7.7	6.9	7.9	7.0	6.7	7.1	5%	-6%
Number of enterprises	**174**	**179**	**187**	**173**	**161**	**177**	10%	1%
Marine	26	36	27	30	26	27	4%	-5%
Shellfish	107	110	117	103	97	115	19%	6%
Freshwater	41	33	43	40	38	35	-8%	-11%
Employment	**1,882**	**2,371**	**2,196**	**1,367**	**1,289**	**1,360**	6%	-27%
Marine	871	1,052	1,029	792	766	789	3%	-14%
Shellfish	173	193	169	154	178	205	15%	17%
Freshwater	838	1,126	998	421	345	366	6%	-53%
FTE	**1,451**	**1,585**	**1,647**	**1,116**	**1,085**	**1,138**	5%	-20%
Marine	757	685	988	684	700	706	1%	-12%
Shellfish	76	67	100	71	88	94	7%	13%
Freshwater	618	833	559	361	296	337	14%	-38%

Source: EU Member States DCF data submission

4.4.3 Overall Economic performance

After recovery from general financial crises in period 2015-2016, period of 2017-2019 was favourable for investments, supported by funds from the EMFF. Growth in investments was followed by growth in total value of assets and increased revenue which finally resulted, despite high expenses, with positive economic indicators.

Other operational costs in 2019 shared larger share in costs from 2018, when investments from previous years have been realized and enabled diversification of activities, which is visible in strong increase of other income. From 2017, some companies have also turned to larger production, the purchase and development of existing generating units, which led to better results in reference period, and is expected to contribute to further optimization of performance indicators.

Total income rose from €182.9 million in 2017 to €223.6 million in 2019, or 22% respectively, and total operating costs made up for 77.8% of total income in 2019, compared to 78.2% in 2018. Turning back to previous time series, until 2014, certain costs have increased as a result of a weak performance in general which led to bad indicators, from net profit to return on investment. However, extraordinary costs, repairs and maintenance costs along with other operational costs in 2014 partly are the result of catastrophic floods that made damage to some number of companies. After two years of negative trend in all the performance indicators and turbulent 2014, during 2015 and 2016 most if the indicators significantly improved and continued growth 2017-2019.

The contribution of the sector to the economy was €67.2 million, which accounts for 30% of total income. Relatively high contribution of other income (40% in 2016, 43% in 2019) could be a sign of diversification of economic activities, especially for large aquaculture companies, often involved in other types of production besides aquaculture. Although all the companies in population were registered primarily for aquaculture as main activity, large part of income is generated from carrying out other diverse activities, from agriculture, processing, to tourism.

Some of these activities were financed through subsidies, through specific lines promoting processing and marketing of seafood products in the context of EMFF. Besides promoting processing and marketing of seafood products, a significant part accounted for investments in aquaculture. On the other hand, in case of some of the companies from freshwater aquaculture, investments in other agricultural activities completely took over fish production and caused major decrease in number of employees in aquaculture.

The economic indicators for 2017 showed significant improvement and then dropped in 2018 and 2019 but nevertheless resulted positive. The evolution of EBIT margin and Net profit margin shows trend of growth started in 2016 with highest net profit of the 2012-2019 period marked in 2017 and then returned to trend of moderate growth of €33.6 million in 2019 or 16% respectively. The evolution of GVA revealed the similar trend. The gross value added for the sector as a whole was €67.2 million in 2019, which is increase of 14% compared to 2018. The total value of assets increased by 22% during the period of analysis, reflecting large investments, mostly oriented to vertical integration towards hatcheries and processing industry. ROI turned positive at the end of the reference period with 7.5%, which is increase of 17% compared to 2018, and implies the efficient use of companies' asset base to generate sales.

Table 4.4.2 Economic performance of the Croatian aquaculture sector: 2012-2019.

Variable	2012	2014	2016	2017	2018	2019	Change 2018-19	Develop. 2019/(12-19)
Total income	123.3	117.8	192.5	182.9	198.2	223.6	13%	40%
Total operating costs	124.6	157.1	157.6	121.9	155.0	174.0	12%	24%
Total wages	25.7	25.0	22.3	16.6	17.7	20.5	16%	-2%
Gross Value Added	17.5	-19.5	49.5	76.4	59.2	67.2	14%	88%
Depreciation of capital	8.4	11.4	12.6	13.1	14.8	16.0	8%	44%
Earning before interest and taxes	-9.7	-50.7	22.4	47.9	28.4	33.6	19%	304%
Financial costs, net	5.0	4.8	3.0	-2.4	0.5	1.3	157%	-68%
Net profit	-14.7	-55.5	19.4	50.3	27.9	32.3	16%	647%
Total value of assets	309.4	418.1	274.9	416.4	441.4	447.5	1%	22%
Capital productivity (%)	5.7	-4.7	18.0	18.3	13.4	15.0	12%	53%
Return on Investment (%)	-3.1	-12.1	8.1	11.5	6.4	7.5	17%	239%

Source: own elaboration from EU Member States DCF data submission

4.4.4 Main species produced and economic performance by segment

There is only a few dominate species in Croatian aquaculture; Carp and Trout in freshwater; Blue fin tuna, Seabass and Seabream in marine aquaculture; mussel and oysters in shellfish production.

The most important species is seabass, which is most often farmed in combination with sea bream and together take for about 63% of volume and 62% of total value of Croatian aquaculture production. Most farms are located on the middle part of coast, on the Zadar area. Around 50% of seabass production has been exported on the EU market, and the rest is sold on the local market, with a significant share in HoReCa channel. Before Croatia joined the EU export was restricted by quotas. For that reason, as expected, there was an increase in production and export during last six years.

The second most important individual species in Croatian aquaculture is Bluefin tuna, covering the 26% of the total value and 13% of total volume. There were only 4 tuna farms in Croatia, and they are exporting most of their products to Japan, with only very small share (1.72%) of fresh products sold on Croatian market, starting from 2019. Since tuna farming is based on catching wild juveniles, and it is under the strict ICCAT surveillance, further increase of production is relying on the available quota.

These three species represent 88% of total Croatian aquaculture production in value and 76% in volume, arriving to 92% when considering also common carp.

Mediterranean mussel covers about 5% of total production volume and 4% of the total value and is almost completely (99.8%) sold on domestic market, mostly during tourist season, to restaurants and directly to the customers. Almost all shellfish farm are producing both oysters and mussels, but dominated by mussels in value and volume. As expected, shellfish production increased in the last period and due to new business openings and better legal regulation, a further growth is expected in following period.

The freshwater aquaculture production is mostly sold at the national market, and only a small fraction exported to the EU market. Main species in freshwater aquaculture is carp with 10% of total weight and only 4% of total value. All carp farms are located in inland part of Croatia, and most of enterprises have its own production of eggs and larva, as well as fish feed. Second most common species is trout, with decreasing production and struggle of the segment to increase the competitiveness with imported fresh products from Italy and other neighbouring countries.

In Croatia, the aquaculture production has been divided into 10 segments in 2013, and 9 segments in 2014 based on the species produced and the technique used. Regarding the new EUMAP segmentation and recent trends in aquaculture, the number of segments has been decreased to 5. Due to low activity of companies previously segmented in segments of hatcheries and nurseries (Carp, Trout) those segments have been removed and data from segment of Sea bass and Sea bream hatcheries and nurseries was not shown due to the confidentiality.

Beside carp and trout most farms are growing some other freshwater species, like grass carp, bighead carp, silver carp, wels catfish, pike and zander, but in smaller quantities.

Figure 4.4.1 Main species in terms of weight and value in Croatian production: 2019.

Source: EU Member States DCF data submission

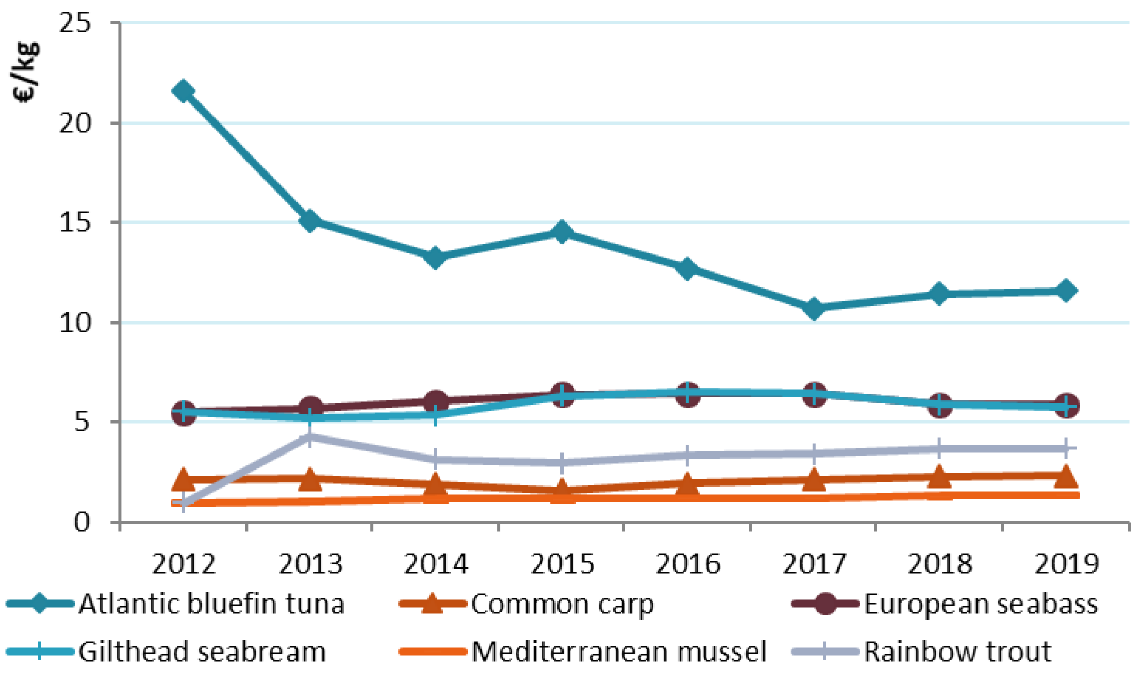
Average prices for all species stayed at the same level between 2017 and 2019, with a most significant increase of 7.63% for Bluefin tuna from 2017 to 2019 which follows the decrease in total volume of sales after reaching record of 3 227 tonnes in 2018. Bluefin tuna also reaches the highest average price on the market with amount of €11.4 per kg.

After reaching the highest price of €6.5 per kg in 2017 (regarding period 2012-2019), from 2017 to 2018 Sea bass decreased -8.5% and remain stable in 2019 with price of €5.9 per kg, similar as Sea bream which reached the highest price in 2016 and 2017 (€6.5 per kg) and then decreased for 8.8% in 2018 and additionally for 1.9% in 2019. Due to increase in production, it could be expected that this segment, in order to improve profitability also increase sale of products with added value to attract different target consumers.

The average prices of freshwater species increased in period 2017 to 2019 by 6.85%. The average price of Carp continued trend of increasing price to €2.3 per kg after reaching the lowest price in 2015 (€1.6 per kg). Similar trend could be noticed in trout prices, which are slowly increasing from 2015 to 2019.

The price of Mediterranean mussel rose from €1 per kg in 2012 to €1.3 per kg in 2019, due to increased sale during tourist season, directly to customers or to restaurants. Although is not the most important species in terms of volume and value, European flat oyster should be mentioned due to significant increase of average price, both in period 2012 (from €7.6 per kg to €11.8 per kg) and in period 2017-2019 (from €10.8 per kg to €11.8 per kg), overreaching the average price of tuna (although the price is calculated per kg is calculated based on price per piece). Increased demand for oyster is certainly connected with the process of protection of designation of origin called "Mali Ston oyster" which started in 2017 on national level and was completed in October 2020 on EU level.

Figure 4.4.2 Average prices €/kg for the main species produced in Croatia: 2008-2018.



Source: own elaboration from EU Member States DCF data submission

The most relevant segments in the Croatian aquaculture are:

- Other marine fish cages: Bluefin tuna
- Seabass and seabream cages
- Carp ponds
- Mussels long line

Table 4.4.3 Economic performance of main Croatian aquaculture segments: 2012-2019.

Variable	2012	2013	2014	2015	2016	2017	2018	2019	Change 2018-19	Develop. 2019/(12-19)
Tuna Cages										
Number of enterprises	3	3	4	4	4	4	4	4	0%	8%
FTE	394	433	217	488	484	260	269	274	2%	-25%
Average wage (thousand €)	15.4	14.4	32.9	14.7	16.0	17.4	19.5	21.7	11%	17%
Labour productivity (thousand €)	56.5	57.1	47.7	52.2	45.5	45.6	70.7	48.8	-31%	-9%
Total sales volume (thousand tonnes)	2.2	2.9	2.5	2.9	3.4	2.6	3.7	3.3	-13%	12%
Total income (million €)	52.7	52.4	40.2	52.6	53.3	37.0	51.2	49.6	-3%	2%
Total operating costs (million €)	36.0	33.6	36.7	33.4	37.0	27.1	35.8	40.5	13%	18%
Gross Value Added (million €)	22.3	24.7	10.4	25.5	22.0	14.2	20.1	14.7	-27%	-26%
Net profit (million €)	11.8	7.3	-2.7	15.4	11.7	8.1	10.6	4.1	-61%	-54%
Total value of assets (million €)	108.8	112.4	110.9	107.8	95.9	108.1	116.6	110.0	-6%	1%
Net investments (million €)	8.1	22.0	5.3	5.6	4.2	1.5	4.4	0.4	-91%	-94%
Capital productivity (%)	20.5	22.0	9.4	23.6	22.9	13.1	17.2	13.4	-22%	-27%
Return on Investment (%)	13.1	15.0	0.6	15.1	13.6	6.2	10.2	4.6	-55%	-56%
Future Expectation Indicator (%)	5.2	17.8	2.3	2.5	1.0	-1.6	0.8	-3.3	-501%	-182%
Sea bass & Sea bream cages										
Number of enterprises	19	19	28	23	23	25	21	22	5%	-3%
FTE	124	128	442	503	504	418	425	426	0%	17%
Average wage (thousand €)	16.1	9.5	24.3	14.3	16.3	18.8	19.6	22.9	16%	34%
Labour productivity (thousand €)	43.6	92.4	-89.4	27.8	27.1	76.7	58.3	79.8	37%	136%
Total sales volume (thousand tonnes)	3.0	2.2	6.6	8.4	9.1	10.3	12.1	13.0	7%	75%
Total income (million €)	22.5	20.7	41.0	71.5	83.8	101.0	114.9	131.1	14%	102%
Total operating costs (million €)	17.6	9.4	88.0	62.4	75.9	72.2	94.9	101.8	7%	69%
Gross Value Added (million €)	5.4	11.9	-39.5	14.0	13.7	36.3	27.6	38.3	39%	286%
Net profit (million €)	3.2	10.6	-52.5	5.6	1.7	23.1	12.9	21.0	63%	3064%
Total value of assets (million €)	34.8	11.6	202.7	139.1	166.0	183.7	215.6	224.8	4%	65%
Net investments (million €)	0.6	0.2	27.5	17.4	11.2	12.5	10.5	8.3	-21%	-27%
Capital productivity (%)	15.5	102.3	-19.5	10.1	8.2	19.8	12.8	17.0	33%	-20%
Return on Investment (%)	11.6	92.2	-25.8	3.6	1.5	12.1	5.9	9.5	62%	-34%
Future Expectation Indicator (%)	-0.5	-3.1	11.0	9.5	3.5	3.2	1.5	0.2	-87%	-95%
Mussel Long line										
Number of enterprises	107	107	110	112	112	84	80	98	23%	-21%
FTE	76	76	67	97	92	64	80	86	8%	2%
Average wage (thousand €)	11.1	7.8	14.0	10.4	12.3	11.4	10.0	10.4	4%	-9%
Labour productivity (thousand €)	21.7	17.6	19.9	16.0	17.9	9.4	5.7	5.1	-10%	-63%
Total sales volume (thousand tonnes)	1.3	0.7	0.7	0.6	0.7	0.9	0.9	1.1	20%	8%
Total income (million €)	2.9	2.6	3.0	4.0	5.2	3.2	2.8	3.7	30%	-17%
Total operating costs (million €)	2.0	1.7	2.4	3.3	4.0	2.7	2.6	3.7	43%	-3%
Gross Value Added (million €)	1.6	1.3	1.3	1.6	1.6	1.2	0.9	1.0	6%	-35%
Net profit (million €)	0.6	0.6	0.1	0.4	0.8	0.5	-0.8	-0.5	-37%	-330%
Total value of assets (million €)	5.6	4.5	3.2	3.5	5.5	2.3	6.6	7.4	11%	48%
Net investments (million €)	0.2	0.1	0.8	1.8	0.3	0.2	0.9	0.6	-33%	53%
Capital productivity (%)	29.5	29.5	40.8	43.7	29.6	54.9	13.6	12.9	-5%	-61%
Return on Investment (%)	9.6	10.5	3.7	12.3	16.8	7.4	-11.5	-6.3	-46%	-266%
Future Expectation Indicator (%)	-4.1	-6.3	11.0	42.0	-1.3	-1.9	-0.5	3.0	-679%	-109%
Carp ponds										
Number of enterprises	16	13	6	23	23	20	20	18	-10%	16%
FTE	488	444	74	479	511	321	255	297	16%	-31%
Average wage (thousand €)	12.8	13.4	9.2	9.3	9.4	8.2	9.5	10.1	6%	-7%
Labour productivity (thousand €)	10.9	8.5	-0.5	15.9	22.1	66.8	35.3	41.1	16%	56%
Total sales volume (thousand tonnes)	3.3	3.4	1.1	4.2	3.6	2.9	2.5	2.7	8%	-15%
Total income (million €)	18.5	16.2	2.7	46.7	47.4	39.9	27.4	37.3	36%	-3%
Total operating costs (million €)	16.7	16.1	3.3	41.9	38.7	17.6	19.3	25.7	34%	-12%
Gross Value Added (million €)	5.3	3.8	0.0	7.6	11.3	24.8	10.6	13.2	24%	17%
Net profit (million €)	-3.3	-5.0	0.5	0.8	3.9	20.7	5.9	8.3	41%	76%
Total value of assets (million €)	80.5	89.8	8.3	131.2	1.1	114.0	96.9	99.7	3%	30%
Net investments (million €)	1.3	4.8	0.9	4.3	5.6	6.4	5.4	4.2	-23%	31%
Capital productivity (%)	6.6	4.2	-0.5	5.8	991.2	21.8	11.0	13.2	21%	-93%
Return on Investment (%)	-0.9	-2.6	-15.7	2.2	465.6	17.2	5.5	8.2	49%	-92%
Future Expectation Indicator (%)	-1.4	2.6	2.0	1.8	187.3	3.2	2.6	0.7	-71%	-91%

Source: own elaboration from EU Member States DCF data submission

Segment 1: Other marine fish cages: Bluefin tuna

The most important segment in terms of value is tuna farming; however, it is not the largest segment measured in terms of quantity. Besides value, it is also important to point out that large part of small pelagic fishery is directly related to tuna farming, since tuna can be fed only with the small pelagic fish. The fact that all tuna production is being exported, gives additional importance to this segment. Limiting factor is the fact that this kind of production is based on the catch of wild juvenile tuna, and it is under the strict ICCAT surveillance and restricted by quota. In Croatia, there is large potential and interest for this production and it can be expected further growth of this sector in case ICCAT increase quota for Bluefin tuna fishing.

In 2019, there were 4 active tuna farms with 274 FTEs, and they had a production of 3 257 tonnes of tuna primarily (84%) and smaller quantities of Sea bass and Sea bream and mussels. Total value corresponded of more than €34 million. The production value of this segment corresponds to 26% of the total Croatian aquaculture production.

After reaching record in 2016 in terms of income, the overall performance in 2019 presented some weaknesses and decreasing trend in economic indicators. Increase of total operating costs still did not reach the value of total income, but affected net profit to drop from €11.7 million in 2016 to €4.1 in 2019. GVA, after increase in 2018, in 2019 marked a decrease to €14.7 million or 26% respectively. Although the investments decreased in last of the reference years, profitability was not optimized.

Labour productivity had a decrease of 31% compared to record 2018 and a decrease of 9% compared to average since 2012. Average wages in this segment amounted for €21.7 thousand, which is increase of 11% compared to 2018 and increase of 17% compared to 2012-2019 average.

Although the total sales volume improved during the period since 2012, overall performance in 2019 is marked with decline, with a most significant change in net investments, return on investments and net profit. Variations between reference years could imply dependency and limitation of one primary factor and need to diversify business activities.

The structure of cost in 2019 is similar to that for Sea bass & Sea bream cages, comprised mainly of feed costs (42%), other operational costs (26%) and wages and salaries (13%). Due to earlier investments, share of consumption of fixed capital is rather large, 9%.

The average price of fish feed reflects the average price of small pelagic fish on Croatian market, which makes the largest share of total fish feed used in this segment, while other costs together make for 11%.

Segment 2: Seabass and seabream cages

This is the segment with the largest production, which covers 63% of total sales volume in 2019, compared to 53% of total sales volume in 2016. All of these farms are growing both sea bass and sea bream, with a small quantity of other marine finfish species. It is remarkable, that this segment has a half of the value of the total value of assets, and greatest share in subsidies in investments.

An increase in production has been noted between 2017 and 2019 in terms of weight and value for this segment and the same trend is expected in the following years. During the period of investigation, total sales volume increased by 75% and total income rose from €22.5 million to €131.1 million or 102% respectively. A significant increase in production of other marine fish species in this segment should also be noticed. This segment consists of 22 enterprises in 2019, which produced 13 thousand tons of fish and employed on average 426 employees.

In general, enterprises in this sea bass and sea bream segment did not have production of eggs and larvae but some of them started their own production in reference period; therefore, buying juveniles partly from other Croatian hatcheries and import from other EU countries decreased, along with share of livestock costs in cost structure from 2017 (12%) to 2018 (9%) and 2019

(8%). The largest part of total costs are feed costs (51%), other operational costs (22%), wages and salaries (9%), and livestock costs (8%) while other costs make up for 10%.

GVA and net profit margin increased significantly in 2017 and dropped in 2018 and returned to €38.3 million in 2019. Since there have been changes in segmentation, values from previous time series are not completely comparable. Net profit reached the record in 2017 with €23.1 million and continued with positive trend in 2019. After reaching record values of net investments in 2017, investments in 2019 declined to €8.3 million or 34% respectively. Although marked with decline of 95% in 2019 compared to average of the whole period, Future Expectation Indicator resulted as positive.

To conclude, the production in this segment continues to expand, followed by investments in vertical integration, i.e. processing facilities, in order to maintain profitability, enhance the efficiency of business procedures and reach wide range of target customers through premiumisation – providing high valued innovative products and constantly expanding the product portfolio.

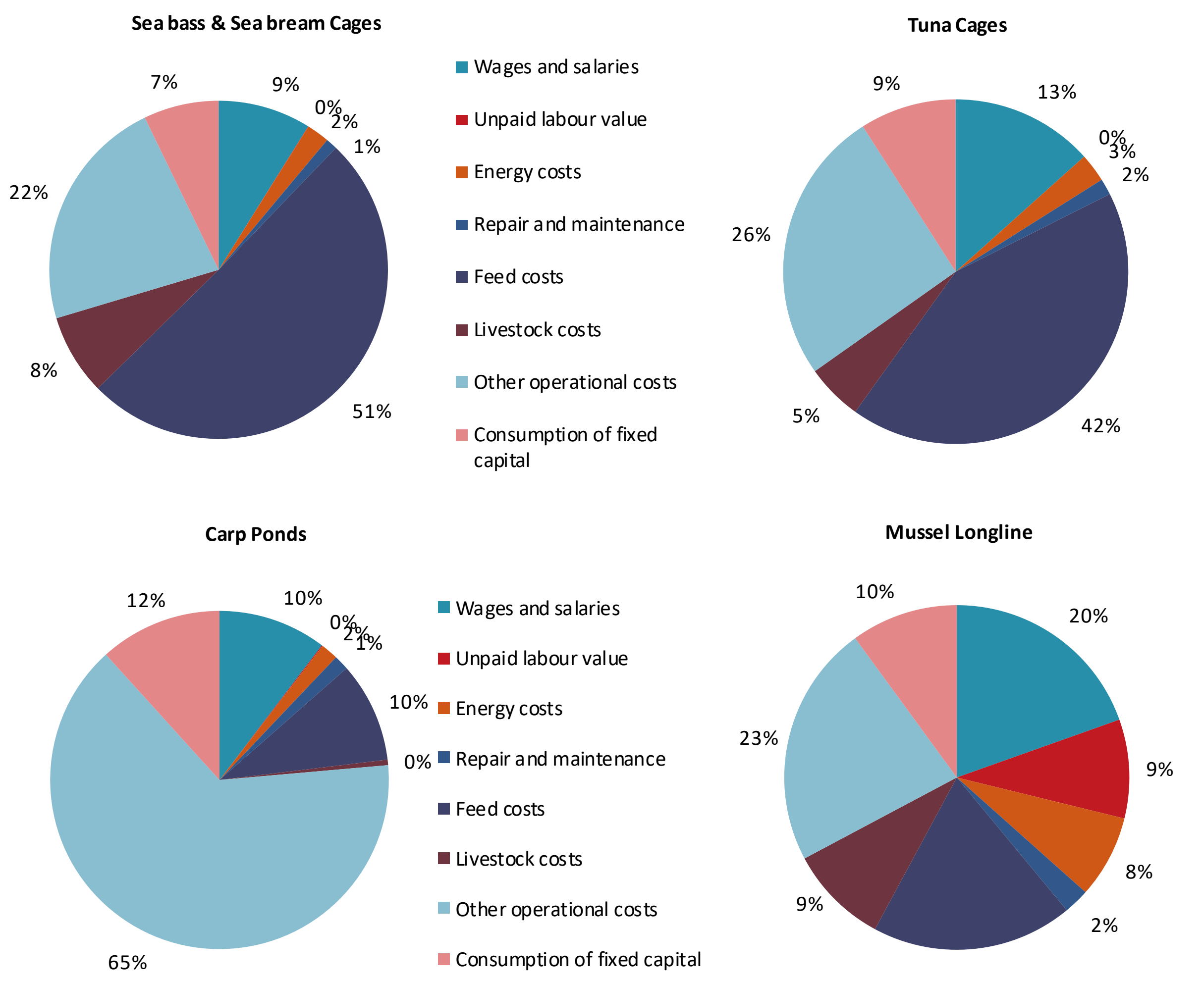
Figure 4.4.3 Economic performance in € million, indicators for the main Croatian segments: 2012-2019.

Source: own elaboration from EU Member States DCF data submission

Segment 3: Carp ponds

Similar as for Sea bass and sea bream segments, due to the recent changes in EUMAP segmentation and dominant farming techniques used at carp farms, but also due to stagnation in carp production, all companies with predominant production of carp were aggregated into a segment Carp combined from 2015 and to Carps ponds in 2017 which could explain some inconsistencies in time series. In total, about 75% of production in the segment accounts for carp. Still, from 2017 to 2019, volume of carp production, so as value, declined from 2 039 tonnes to 2 037 tonnes. Production of the other freshwater fishes decreased by 17.5% from 2017 to 2019 in volume and 18% in value. Although carp production in Croatia has over a 120 years tradition, currently is in a phase of stagnation and struggling to diversify activities. On the other hand, other inputs from the industry envisage the signs of technological recovery. Technological procedure of fish farming for recently renovated carp farms encompasses whole system of farming – from spawn and juveniles of all farming categories to market size commercial fish. According to National plan, results of diversification and investments in processing equipment should be even more visible in the next reporting period in terms of production volume and value and involving some new species in farming cycle.

Figure 4.4.4 Cost structure of the main segments in Croatia: 2019.



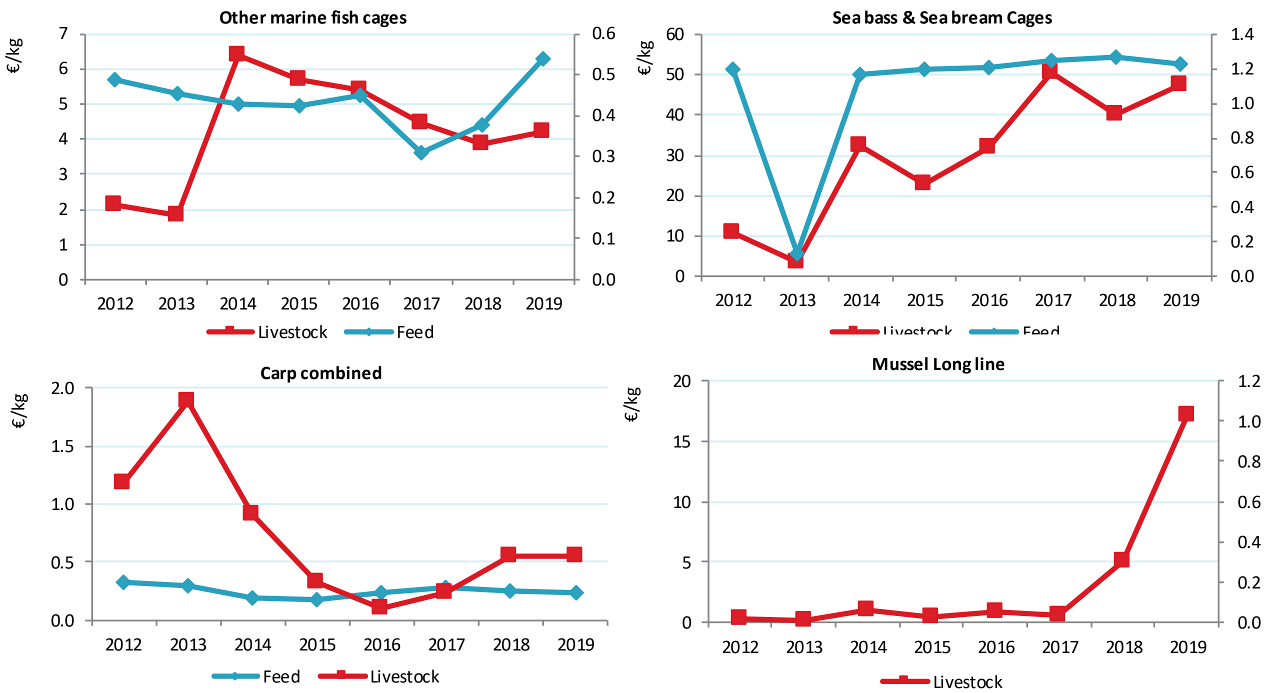
Source: EU Member States DCF data submission

Segment 4: Mussels long line

Although the mussel long line segment represents only 5% of the total weight, and less than 2% of the value, it is an important segment in terms of number of enterprises and employees. The segment contains around 100 enterprises between 2017 and 2019, but since almost all of these enterprises are small-scale families businesses, it can be assumed that more people are involved and dependent on this segment production. It has to be taken into account that most of these farmers carry aquaculture as an additional activity; they are often retired or have other income apart from mussel farm enterprise. Nevertheless, total income has been increasing steadily from 2012 until 2016 but decreased since.

Almost all enterprises in segment are producing mussels and oysters and some of them Sea bass and Sea bream, but about 84% of sales volume and 52% of sales value comes from mussel production. The production is based on the collecting of shellfish in early stages from the nature, but some of the producers are buying additional juvenile shellfish's from other farms in order to increase production. Volumes in this segment are probably underreported taking into account family character of enterprises but should be taken into account that latest regulation of Aquaculture Act should improve reporting. Also, indicators related to mussel farms are dependent on few larger companies which increased their investments and business in general in past two years. Following the Croatian accession to the EU, it was expected for shellfish export to the EU market to increase since restrictions have been removed. However, decrease of export to insignificant volume did not approve the expectations yet. Due to investments during 2014 and 2015, some improvements are visible in terms of production volume and production value. Due the significance of oysters in terms of tradition and possible organic production, so as following the National Plan, additional segment has been added for oysters. In 2017 and 2018, there were 17 farms with predominant oyster production, compared to 5 companies in 2015 and 2016, carrying on the family tradition and confirming a growing trend of increased demand of oysters. Added value of product, so as protected designations of origin and possibility of organic production with available financial instruments makes this segment also valuable for next reporting period.

Figure 4.4.5 Feed and livestock average prices €/kg for the main **Error! Reference source not found.** segments: 2008-2018.



Source: own elaboration from EU Member States DCF data submission

4.4.5 Outlook

Trends and triggers

Current production trends and main drivers

The production in Croatia continues to grow. The growth is not equally distributed among the sector, so the most significant improvement was recorded in marine aquaculture, especially in production of sea bass and sea bream. The investments in this segment in past few years encouraged growth in terms of production, but also in diversification of production, vertical integration with processing and overall process of qualitative improvement oriented to different target consumers and maintain high goals of production along with high profitability.

Production of Bluefin tuna is determined by ICCAT quotas and prices on the world market, so this production follows world market trends. It is expected development and recovery regarding economic performance in this area. These companies also have their own fishing fleet (purse seiners) which allows them to expand the production to processed products of small pelagic fish.

As expected in previous time series, in past two years market conditions improved, so about 52% of production is intended for the export. Improvements in technology of farming, so as in system of distribution enabled better availability of aquaculture products for consumers in foreign markets, which enabled flexibility in the situation of pandemics' outbreak.

Other marine aquaculture segments, Mussels long line and Oysters long line, after lot of investments expect return of investment in upcoming period, especially Mussels long line segment. Although Mussels production has been stable in past period, there is a rise in total income, which implies some returns on investments. Oysters' long line, as expected, moved towards protected designations of origin and the possibility of organic production to encourage growth towards export to EU market, which requires more attention on environmental indicators since oyster production strictly depends on environmental conditions.

Freshwater aquaculture, compared to improvements in marine aquaculture and to potential for growth is slightly falling behind. Until now was targeting most on domestic market, and now most enterprises are trying to break into to EU market as there is a growing market demand for freshwater aquaculture products. Also, some of the freshwater aquaculture companies focus on diversification of production and preparation of some new species which, for now, address only limited markets and could hardly stimulate a general growth of the sector. Additionally, process of vertical integration towards processors is present also in this sector but with less capital, smaller production and in general, more challenges. Major carp farms, in order to add value to the products, started processing aquaculture products and took over a challenging task of developing new technologies, investments and finally, introducing premium freshwater aquaculture products to end customers. On the other hand, in general smaller trout farming enterprises, although some of them have potential and know-how in processing, are less willing to risk and prefer direct and safe sale channels for fresh fish (preferably direct sale to the customers and farmers' markets) rather than to rely on middleman or uncertain contracts with processing companies. Investments in processing are for small producers often too complex in terms of capital, technology, market and branding. However, some trout farms during the reference period started cooperation with large processing companies, which took over development of innovative, locally-branded products in order to present freshwater aquaculture products to retail customers.

Market structure

The Croatian market went through period of intensive changes and improvements over the last several years. First, there has been improvement in public perception of aquaculture products, which is reflected on domestic consumption. Producers are making progress in marketing and production technologies, as well as in processing and placing aquaculture products. This is especially the case with large companies, resulting in increased investments. As the result, export of aquaculture products grew, especially in marine aquaculture production.

Still, the majority of Croatian aquaculture sector consists out of small-scale, family-owned companies, focused on domestic market. Although in last time series Croatian aquaculture has been increasingly concentrated where few large companies are covering the largest share in employment, production and total income, small businesses, often involved in different activities and encouraged by tourism as an important part of tourist offer, have a major role in economic growth and creating new jobs, especially in peripheral and rural areas. The need for joining a producers association has been recognized to raise the competitiveness when assessing the market and there are efforts for improvements of legal requirements in this issue.

Issues of special interest

According to Croatian National Strategic Plan for Aquaculture Development 2014-2020, development of organic and ecological fish growing is placed in square - Opportunities. Together with opportunities, increased aquaculture production created potential environmental issues, which could encourage the transition to organic aquaculture, strongly supported by EMFF funding.

In a part of general priorities, among other things, ensuring sustainable development and growth through coordinated regional planning and the providing of the necessary locations for farmers, also locations for supporting infrastructure, the use of environmentally friendly technologies are underline as main tasks.

Outlook for future production trends

Since Sea bass and sea bream production is representing more than 60% of total Croatian production value, there is strong interest in further development of this sector. Croatian coastline is suitable for further development of marine aquaculture in generally, but it is necessary to establish good practice in coastal zone management in order to ensure sustainable development of aquaculture production. This also applies for tuna production and shellfish farms. At the same time it is necessary to improve market organisation and legal framework to assure further development and control.

It is noticed that some marine aquaculture segments have increased their investment in new technologies, and start with introducing new species beside Sea bass and Sea bream. It can be expected that this trend of diversification will have further development.

In freshwater aquaculture development is restricted by available area, but with successful improvements in production technologies it can be expected to increase in production of cyprinid species in total, especially in some newly introduced species.

In aquaculture, especially in marine aquaculture, over recent years there has been a steady increase in the production of new species due to increased consumption in the domestic market, as well as the stabilization of prices in the EU market, but on the other hand, there is a low purchase price.

According to SWOT analysis of freshwater aquaculture, threats are transmission of disease and the damage from predators. General priorities are establishing and implementing protocols to prevent and control diseases and welfare of aquatic animals in farms, protection and compensation for damages caused by predators.

COVID-19 impact

The aquaculture industry in Croatia faced several challenges during the pandemics' outbreaks, including direct, short-term obstacles and long-term consequences. The sector and government reacted promptly after the initial shock and manage to mitigate the damage caused by closures, however, there is a great uncertainty regarding long term-consequences, due to long production cycles and on-going investments.

Regarding the first mentioned, the closure of the HoReCa channel had the greatest impact on the aquaculture market, since a significant share (around 30-50%) of fresh fish and especially shellfish consumption relies on this channel, particularly during tourist season. One smaller part of this decline in market demand has been compensated by growth in retail (especially of packed fish), but closure inevitably created surplus and problems with storage and logistics, increased costs and affected liquidity. Some larger companies managed to maintain export channels, mostly to Italy, and in very difficult conditions directly deliver fish to the international market. Positioning on the market, advanced technologies and recognizing the needs of the market were key factors in overcoming COVID-19 crisis. Where increased health risk occurred due to large number of employees, companies invested in equipment, such as additional vessels to provide safer work conditions.

Many producers adopted marketing strategy adaptations and started to sell directly to the customers and invested in selling spots and appropriate equipment, to get closer to the local customers. Change of customers’ habits also reflected on increased demand of primary processed products, packed fresh fish, which in return caused higher prices and alleviated short-term consequences of COVID-19 crises. On the opposite, as most companies reported, general surplus in production lowered the prices of fresh products compared to prices in 2019.

In a long-term period, problems are more complex, including disturbances in production cycles (1.5 - 3 years) where is not possible to react immediately and reduce production as market circumstances change. Despite the crises and increased risk in return on investments, the companies are aware that investments are indispensable in order to break on new markets and increase competitiveness.

4.4.6 Data Coverage and Data Quality

Data quality

Data for all segments have been collected by census, except shellfish farms, where collection has been based on the probability sampling survey.

Data collection was performed through questioners created for this purpose. To ensure data consistency for all segments, together with definition of each variable in guidelines, link was made to accounting code in balance sheets. Some of variables were collected from Croatian Directorate of Fishery (DoF) database and subsidies register, since it is mandatory for all aquaculture producers in Croatia to report the production in volume and value each year at the farm level. But some of the variables were taken from questioners although it was planned to use DoF data. It was detected that DoF register is not complete and that some information is not suitable for this purpose. Some other variables, e.g. subsidies, were collected through DoF register and questioner. One of the main problems was low response and cooperation. Since some changes regarding data collection have been implemented in legal framework, it is expected to improve results in data collection. This is especially important for some segments with small-scale companies where it will be necessary to put additional effort in future data collection.

Data availability

Data for the aquaculture sector is going to be published on the segment level approximately 12 months after the end of the reference year.

Confidentiality

All segments are distinguished both concerning the species and technique. If an enterprise produces more than one species, then it is allocated to the segment of the species that contributes the most to the turnover.

Some enterprises own more than one farm using different techniques, but these activities are grouped together, because the enterprise is used as data collection unit. There are very few examples of enterprises using more than one production technique.

Differences in DCF data compared with other official data sources

The Croatian data for DCF is, in most cases, in line with both value and production registered in FAO and EUROSTAT. Only in the shellfish production there is significant difference between the data sources. However, explanation for that is probably difference in methodology. While shellfish data delivered for EUROSTAT in 2012 and 2013 are result of Croatian Chamber of Economy and Chamber of Trades and Crafts estimates, on the other hand DCF data for shellfish farms are estimation based on the sample. Regarding marine and freshwater fish production, data between EUROSTAT and DCF are mostly in line. Differences that appear are again the result of different methodology. In 2019, 2018 and 2017, total quantity and volume by specie corresponds to quantity and volume reported by Eurostat.

4.5 Cyprus

Overview of Cypriot aquaculture

Cyprus produces only a small amount of aquaculture products (i.e., below a certain threshold). As a result, Cyprus was not obliged to provide economic data for this report. Since no data were submitted in the related data call, FAO data were used instead.

4.5.1 Total Production and sales

The Cyprus aquaculture industry is mainly based on marine fish. According to FAO data, total aquaculture production in 2018 were 7,347 tonnes valued almost €39 million. This corresponds to a small increase in weight of 1% in regards to previous year 2017 but a significant rise of around 50% if compared to the period 2008 – 2017. The same picture stands for the value of production where an increase of 4% is shown if compared to 2017 but a tremendous increase of 45% over the period 2008 -2017. This trend mainly follows the tendency of the major sector of the Cyprus aquaculture, the marine one.

Table 4.5.1 Production and sales for Cyprus: 2008-2018.

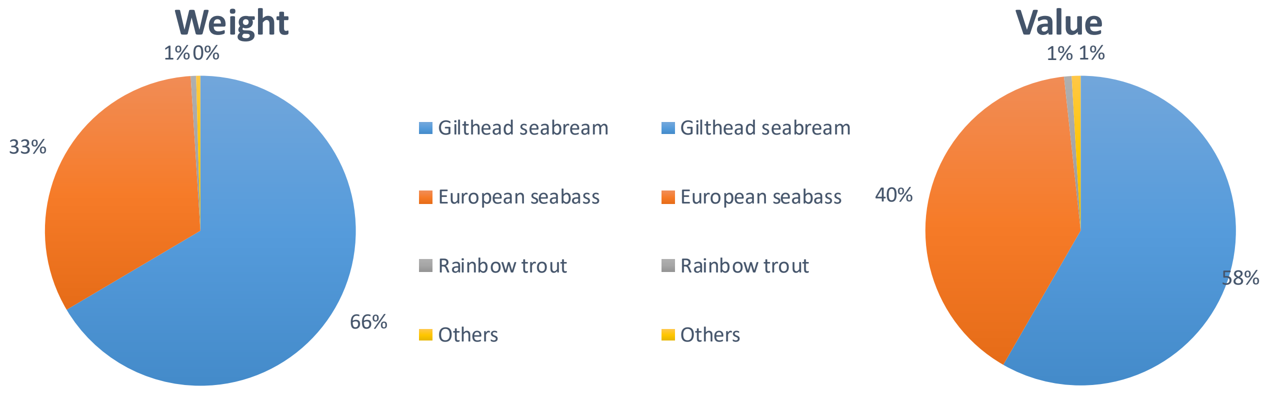
Variable	2008	2010	2012	2014	2016	2017	2018	Change 17-18	Develop. 2018/(08-17)
Production weight (thousand tonnes)	**2.9**	**4.1**	**4.3**	**4.8**	**6.6**	**7.3**	**7.3**	***1%***	***50%***
Marine	2.8	4.0	4.3	4.8	6.6	7.2	7.3	1%	51%
Shellfish	0.0	-	0.0	0.0	0.0	0.0	0.0	0%	79%
Freshwater	0.1	0.1	0.1	0.0	0.0	0.0	0.0	-1%	-21%
Production value (million €)	**16.4**	**20.5**	**23.5**	**27.8**	**36.3**	**37.5**	**39.0**	***4%***	***45%***
Marine	15.8	20.0	22.9	27.1	35.7	36.8	38.3	4%	46%
Shellfish	0.2	-	0.1	0.3	0.3	0.3	0.3	-3%	66%
Freshwater	0.4	0.5	0.5	0.4	0.3	0.3	0.4	6%	-17%

SOURCE: FAO (2021)

4.5.2 Main segments

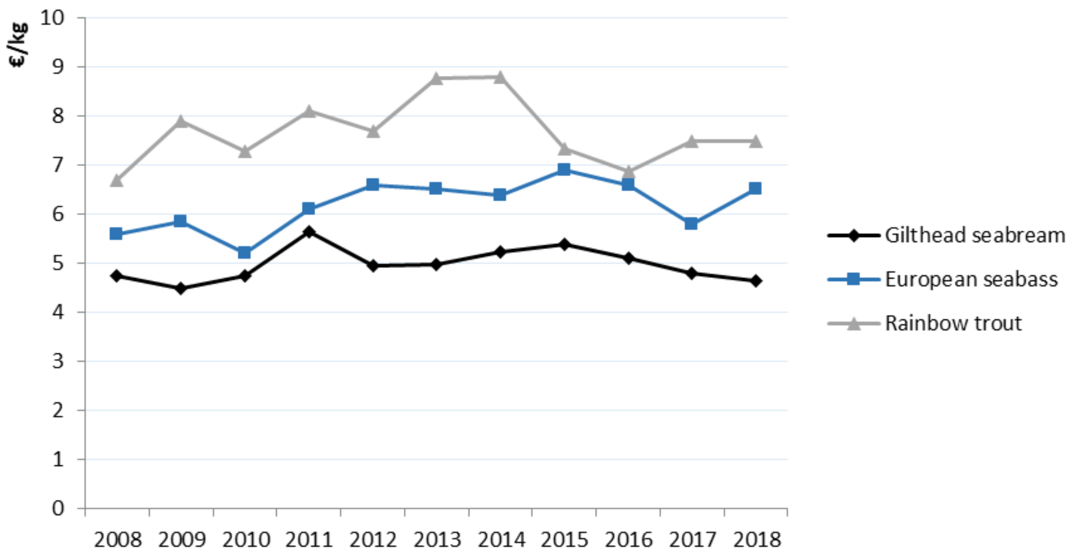
Gilthead seabream remains the main species produced by the Cypriot aquaculture sector representing 66% of the total weight and 58% of the total value of production in 2018. The other important species is European seabass accounted for 33% of the production volume and 40% of the total value. Freshwater fish and other species represent solely the 1% of total volume and around 2% of total value.

Figure 4.5.1 Main species in terms of weight and value in Cyprus production: 2018.



Source: FAO (2021)

Figure 4.5.2 Average prices for the main species produced in Cyprus: 2008-2018.



SOURCE: FAO (2021)

4.5.3 COVID-19 impact

Strict "lock down" measures on a national as well as international level were implemented in order to face COVID -19. These measures have had negative impact on the aquaculture industry. Sales and production have been decreased and aquaculture units are facing serious and increasing liquidity and working capital issues. The aquaculture sector has had a major reduction in sales resulting in great economic losses and creating a serious cash flow situation for all enterprises.

Cyprus submitted an amendment of the Operational program co-financed by the EMFF to add Measures for aquaculture Public health (Article 55) to support the sector.

4.5.4 Data Coverage and Data Quality

The data collection of freshwater aquaculture is not mandatory under the DCF and EU-MAP programmes of the EU data collection. Cyprus only produces a small amount of aquaculture products (i.e., below a certain threshold). Thus, Cyprus was not obliged to provide economic data for this report. The analysis of the Cypriot aquaculture sector is therefore based on data extracted from FAO.

4.6 Czechia

Overview of the Czech aquaculture

The Czech Republic is a country with a long tradition of fish farming. Being a landlocked country, only freshwater species can be bred in the country. Aquaculture production in Czechia is generally characterized by extensive and semi-intensive fish farming in ponds – about 20 000 tonnes annually.

Czechia is a landlocked country producing only freshwater aquaculture products. The data collection of freshwater aquaculture is not mandatory. Since no data were submitted in the related data call, FAO data were used instead.

4.6.1 Total production and sales

Annual fish production has been constant at approximately 20 thousand tonnes with a slight increase in recent years. In 2018, the production weight was 21.8 thousand tonnes accounting for €45.2 million - 12% higher than the 10 previous year average.

According to Eurostat data, in 2019, production from aquaculture excluding hatcheries and nurseries were 20 989 tonnes, of which 85.5% was common carp.

Table 4.6.1 Production and sales for Czechia: 2008-2018.

Variable	2008	2010	2012	2014	2016	2017	2018	Change 17-18	Develop. 2018/(08-17)
Production weight (thousand tonnes)	**20.4**	**20.4**	**20.8**	**20.1**	**21.0**	**21.7**	**21.8**	***0%***	***6%***
Marine	0	0	0	0	0	0	0	0%	0%
Shellfish	0	0	0	0	0	0	0	0%	0%
Freshwater	20.4	20.4	20.8	20.1	21.0	21.7	21.8	0%	6%
Production value (million €)	**41.5**	**40.3**	**41.8**	**37.5**	**39.4**	**42.7**	**45.2**	***6%***	***12%***
Marine	0	0	0	0	0	0	0	0%	0%
Shellfish	0	0	0	0	0	0	0	0%	0%
Freshwater	41.5	40.3	41.8	37.5	39.4	42.7	45.2	6%	12%

SOURCE: FAO (2021)

4.6.2 Industry structure and total employment

There are approximately 400 Czech aquaculture businesses, the majority of which are small and medium-sized enterprises (SMEs). A special feature of the sector is the existence of companies whose primary business activity is not aquaculture; they engage in fish farming alongside other activities. The main farmed fish is carp followed by salmonids (mainly rainbow trout) and other fish, such as pike, amur and tench.

The pond farming areas are located throughout Czechia, but most of the enterprises are situated in the South Bohemian Region. The aquaculture and fishery sector provided work for approximately 1 150 employees in 2019.

The carp aquaculture is based on seasonal demand, with the peek during the Christmas period and very low sale levels for the rest of the year. This activity results in an important seasonal employment demand and additional sources of income in rural areas. The quality of domestic products is high. Several products are trademarked (Czech carp) or carry the protected geographical indication or protected designation of origin labels.

The strengths of the Czech aquaculture sector include advanced and effective breeding know-how based on traditional carp farming and high-quality breeding material. Egg production is always difficult in extensive inland aquaculture. Despite the fact that the majority of farmers produce their own eggs, there is an active market for freshwater fish eggs in Eastern Europe which includes human consumption and other usages. In 2019, 25.6 million of the fertilized eggs of fish and 356.6 million of juveniles of fish and crustaceans were produced in Czechia.

4.6.3 Main species produced

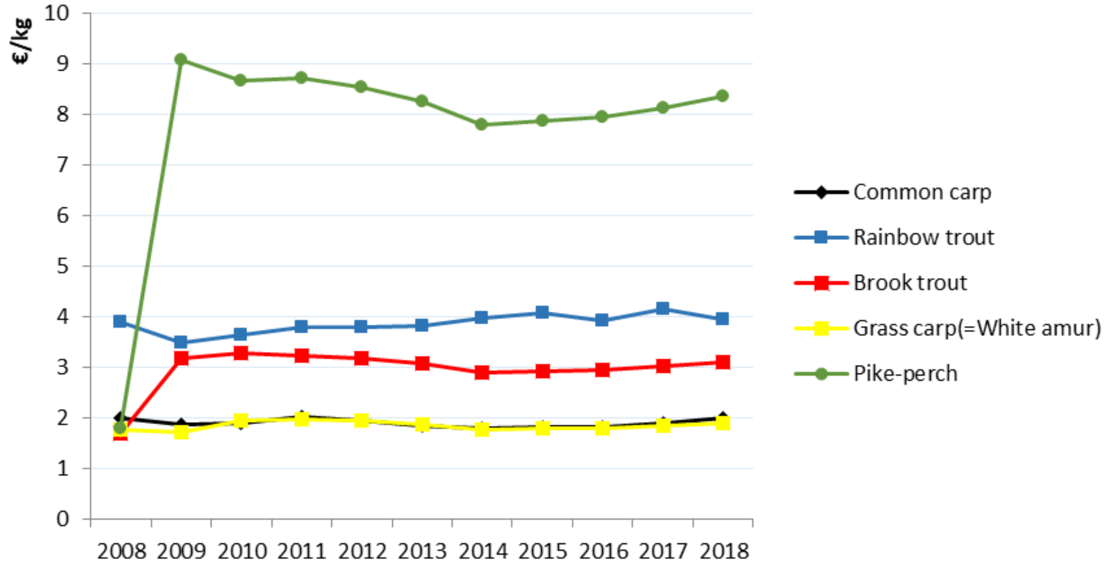
Common carp accounts for 85% of the total aquaculture production in weight and 82% in value. Other species farmed in the country include other carps, such as grass or silver carps, and rainbow and brook trout. Rainbow trout account for the second highest share of production value with 7% and 4% weight share.

Figure 4.6.1 Main species in terms of weight and value in Czechia production: 2018.

Source: FAO (2021)

Highest prices are observed for pike-perch, with €8.4 per kilo in 2018. The average price for rainbow trout in 2018 was €3.9 per kilo and €3.1 per kilo of brook trout. Common carp prices were on average €2.0 per kilo and €1.9 per kilo for grass carp.

Figure 4.6.2 Average prices for the main species produced in Czechia: 2008-2018.



Source: FAO (2021)

4.6.4 Outlook

COVID-19 impact

COVID-19 particularly influenced the fish farmers, mainly in terms of the exporting of live fish to other countries. Furthermore, the Czech Republic reported that COVID-19 negatively influenced the sale of market fish in the main seasons of Easter and Christmas.

4.6.5 Data coverage and data quality

The data collection of freshwater aquaculture is not mandatory under the DCF and EU-MAP programmes of the EU data collection. Thus, landlocked countries are not obliged to provide economic data for this report. The analysis of the Czechian aquaculture sector is therefore based on data extracted from FAO.

4.7 Denmark

Overview of Danish aquaculture

The Danish aquaculture sector mainly produces trout in cages, ponds and recirculation systems. In 2018, production of other species only accounted for 5% of total value and 7% of total weight. Total sales weight and sales value show a steady increase from 2008 to 2018.

4.7.1 Total Production and sales

In total, the Danish aquaculture sector produced 55 902 tonnes in 2018, which is an increase of 4% from 2017. The total value of production was €205.9 million in 2018, which is an increase of less than 1% from 2017. Compared to the average from 2008 to 2017, the total volume has increased 21%, and the total sales value increased 29% in 2018.

4.7.2 Industry structure and total employment

In 2018, the total population of commercial aquaculture farms was 209, distributed amongst 99 enterprises. The sector is dominated by small enterprises with less than 5 employees, which amounted to 70% of the enterprises in 2018.

Table 4.7.1 Production and sales, industry structure and employment for Denmark: 2008-2018.

Variable	2008	2010	2012	2014	2016	2017	2018	Change 2017-18	Develop. 2018/(08-17)
Sales weight (thousand tonnes)	**44.1**	**42.6**	**44.2**	**46.4**	**48.2**	**53.6**	**55.9**	4%	21%
Marine	7.9	11.0	14.0	14.1	12.6	13.8	14.4	4%	16%
Shellfish	1.5	1.1	1.1	1.6	1.7	2.4	3.1	32%	105%
Freshwater	34.7	30.4	29.1	30.8	33.9	37.4	38.4	3%	19%
Sales value (million €)	**130.0**	**136.1**	**155.0**	**159.8**	**185.0**	**205.1**	**205.9**	0%	29%
Marine	36.2	45.9	57.2	57.4	62.4	74.3	71.8	-3%	31%
Shellfish	1.3	0.7	0.9	1.3	1.3	1.4	2.3	60%	105%
Freshwater	92.5	89.5	96.9	101.0	121.3	129.3	131.9	2%	27%
Number of enterprises	**162**	**154**	**130**	**115**	**107**	**100**	**99**	-1%	-24%
Marine	6	6	6	7	5	4	4	0%	-31%
Shellfish	10	13	10	6	5	4	6	50%	-29%
Freshwater	146	135	114	102	97	92	89	-3%	-23%
Employment	**606**	**468**	**490**	**506**	**549**	**549**	**568**	3%	10%
Marine	106	91	125	155	150	133	142	7%	14%
Shellfish	20	13	10	6	10	17	22	29%	77%
Freshwater	480	364	355	345	389	399	404	1%	7%
FTE	**349**	**282**	**304**	**336**	**366**	**388**	**399**	3%	21%
Marine	61	56	79	103	100	94	101	7%	26%
Shellfish	12	5	1	4	7	12	16	33%	150%
Freshwater	276	222	224	230	259	282	282	0%	16%

Source: EU Member States DCF data submission

The total number of persons employed in 2018 was 568, corresponding to 399 FTE. From 2017 to 2018, both the number of employees and the number of FTE increased by 3%. Compared to the average from 2008 to 2017, the number of FTE has increased by 21%.

4.7.3 *Overall Economic performance*

From 2017 to 2018, total income increased by 4%, while operating cost increased by 9%. The total wages increased by 18% and depreciation of capital increased by 7%, which resulted in a decrease of net profit by 38%. Compared to the average from 2008-2017, net profit has risen 188%.

Table 4.7.2 Economic performance of the **Error! Reference source not found.** aquaculture sector: 2008-2018.

Variable	2008	2010	2012	2014	2016	2017	2018	Change 2017-18	Develop. 2018/(08-17)
Total income	134.8	140.9	161.5	171.4	189.4	208.7	217.4	4%	31%
Total operating costs	125.5	127.0	144.8	159.1	168.6	177.5	192.9	9%	29%
Total wages	21.3	21.2	22.0	24.2	24.0	26.4	31.1	18%	35%
Gross Value Added	30.6	35.2	38.6	36.5	44.9	57.6	55.6	-3%	43%
Depreciation of capital	6.5	7.2	7.3	6.6	8.7	8.9	9.5	7%	30%
Earning before interest and taxes	2.8	6.7	9.4	5.7	12.1	22.3	15.0	-33%	78%
Financial costs, net	7.0	6.5	4.2	2.7	2.4	2.9	2.9	2%	-30%
Net profit	-4.3	0.2	5.2	3.1	9.7	19.5	12.0	-38%	188%
Total value of assets	193.8	175.7	165.8	182.5	204.8	225.9	260.3	15%	38%
Capital productivity (%)	15.8	20.0	23.3	20.0	21.9	25.5	21.4	-16%	4%
Return on Investment (%)	1.4	3.8	5.6	3.1	5.9	9.9	5.8	-42%	31%

Source: own elaboration from EU Member States DCF data submission

4.7.4 *Main species produced and economic performance by segment*

The three main species produced in the Danish aquaculture sector are rainbow trout, blue mussel and European eel.

Rainbow trout as the dominating species constitutes 93% of the production weight and 95% of production value.

Blue mussel constitutes 6% of production weight but only 1% of production value, due to a low price on mussels per kilo produced. On the other hand, European eel constitutes only 1% of production weight but 4% of production value due to a higher price per kilo.

Figure 4.7.1 Main species in terms of weight and value in **Error! Reference source not found.** production: 2018.

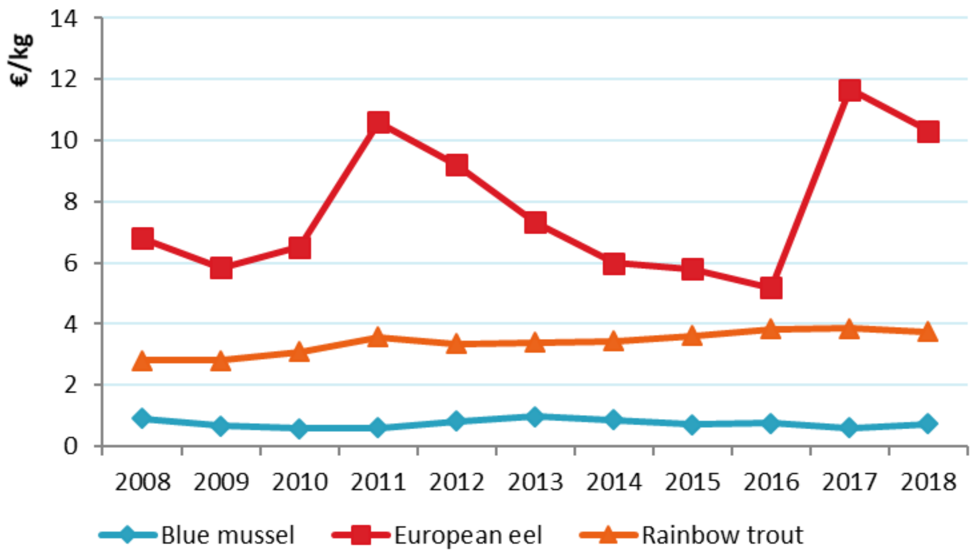
Source: EU Member States DCF data submission

The price of blue mussel has been fairly constant from 2008 to 2018, fluctuating between €0.6 and €0.9 per kg. However, the production volume has more than doubled over the period, which has resulted in an increasing turnover of 74%.

The price of rainbow trout has increased slightly in the same period, rising from €2.80 per kg in 2008 to €3.75 per kg in 2018, an increase of 34%. In the same period, production has increased by 29%, which has resulted in an increasing turnover of 73%.

The price of European eel has fluctuated over the years, showing a low point in 2016 at €5.19 per kg and a high point the year after at €11.66 per kg. The production volume decreased by 80% from 2016 to 2017, due to reduced availability of glass eel.

Figure 4.7.2 Average prices €/kg for the main species produced in Denmark: 2008-2018.



Source: own elaboration from EU Member States DCF data submission

The most important sectors in the Danish aquaculture sector in terms of production volume and value are:

- Trout Ponds
- Trout Recirculation systems

- Trout Cages
- Mussel Longline

The EUMAP segments Trout Ponds and Trout Recirculation systems were formerly reported together under the DCF segment Trout Combined. To present a consistent time series these segments are still presented together in some of the tables and figures.

Segment 1: Trout ponds

The most important segment is land based fresh water producing trout in ponds. In most cases, enterprises in Denmark combine the production in hatcheries and nurseries with grow out farms. The product from these farms is mainly portion size trout of 300 to 400 grams with white meat. The segment consists of 61 enterprises running 123 farms. The production volume was 17 660 tonnes with a corresponding income of €60.4 million. This constitutes 32% of the total production volume and 29% of the total production value in 2018.

Table 4.7.3 Economic performance of main **Error! Reference source not found.** aquaculture segments: 2008-2018.

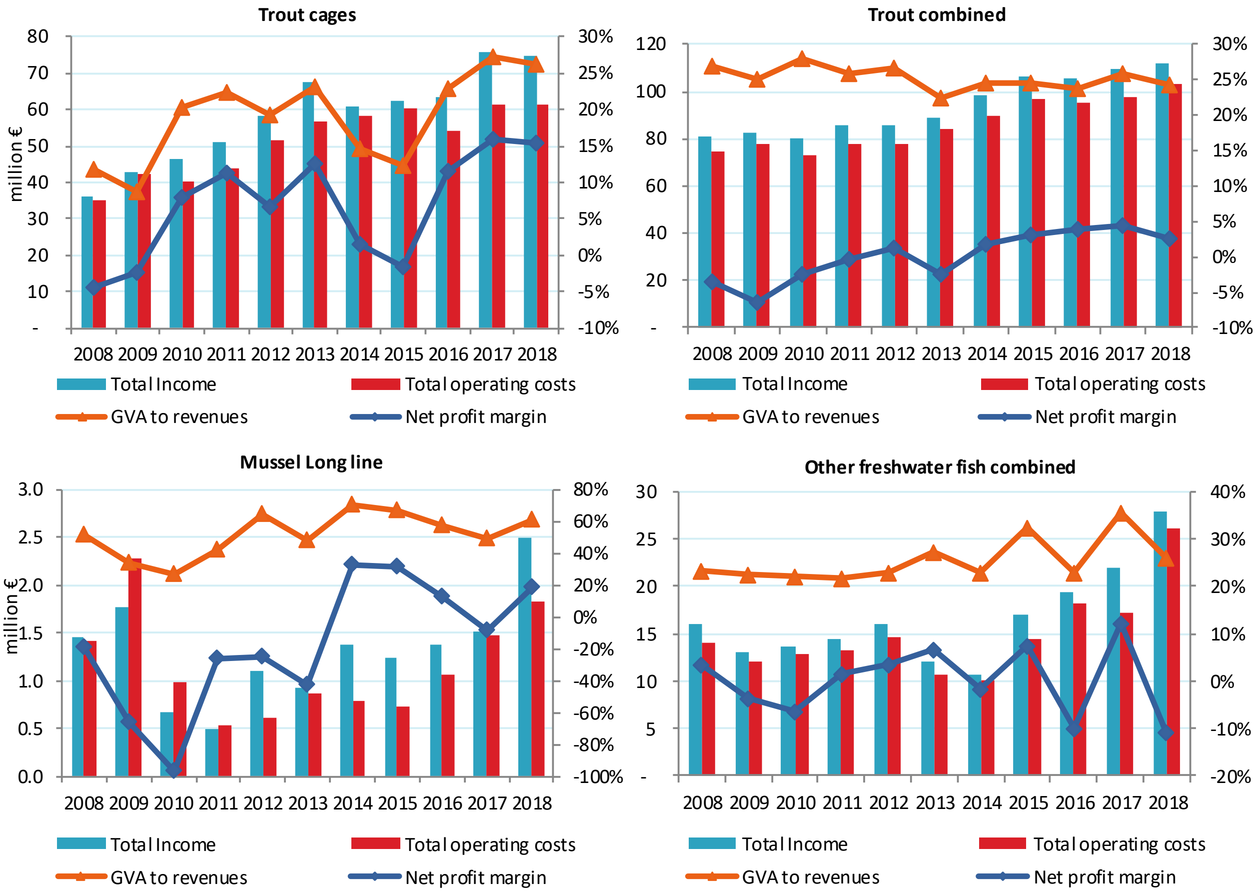
Variable	2008	2010	2012	2014	2016	2017	2018	Change 2017-18	Develop. 2018/(08-17)
Trout cages									
Number of enterprises	6	6	6	7	5	4	4	0%	-31%
FTE	61	56	79	103	100	94	101	7%	26%
Average wage (thousand €)	52.8	59.6	59.2	61.0	55.3	63.4	59.0	-7%	1%
Labour productivity (thousand €)	70.2	171.5	143.0	87.6	145.6	154.9	138.8	-10%	10%
Total sales volume (thousand tonnes)	7.9	11.0	14.0	14.1	12.6	13.8	14.4	4%	16%
Total income (million €)	36.4	46.7	58.2	61.1	63.3	75.7	74.9	-1%	33%
Total operating costs (million €)	35.3	40.5	51.6	58.3	54.2	61.3	61.4	0%	22%
Gross Value Added (million €)	4.3	9.5	11.3	9.0	14.6	20.6	19.7	-4%	83%
Net profit (million €)	-1.6	3.7	3.8	1.0	7.3	12.1	11.6	-4%	201%
Total value of assets (million €)	41.4	30.2	36.3	45.9	43.6	56.3	51.2	-9%	24%
Net investments (million €)	1.1	0.7	1.8	2.6	1.0	1.6	1.6	0%	-8%
Capital productivity (%)	10.4	31.6	31.0	19.7	33.4	36.6	38.5	5%	49%
Return on Investment (%)	-0.4	16.5	13.8	2.4	16.5	22.3	23.2	4%	119%
Future Expectation Indicator (%)	-0.3	-1.8	0.5	2.0	-1.8	-0.4	-0.1	83%	-114%
Mussel Longline									
Number of enterprises	10	13	10	6	5	4	6	-7%	818%
FTE	12	5	1	4	7	12	16	-11%	3300%
Average wage (thousand €)	61.9	103.5	192.5	106.3	66.0	46.2	40.3	28%	-33%
Labour productivity (thousand €)	64.5	38.3	616.4	274.5	113.1	43.2	69.4	7%	-24%
Total sales volume (thousand tonnes)	1.5	1.1	1.1	1.6	1.7	2.4	3.1	-2%	2061%
Total income (million €)	1.4	0.7	1.1	1.4	1.4	1.5	2.5	2%	9298%
Total operating costs (million €)	1.4	1.0	0.6	0.8	1.1	1.5	1.8	6%	9535%
Gross Value Added (million €)	0.7	0.2	0.7	1.0	0.8	0.7	1.5	-5%	4270%
Net profit (million €)	-0.3	-0.7	-0.3	0.4	0.2	-0.1	0.5	-40%	1537%
Total value of assets (million €)	2.4	2.4	2.2	1.6	2.5	2.7	3.6	-7%	5011%
Net investments (million €)	0.9	0.1	0.0	0.6	0.2	0.0	0.0	-41%	1557%
Capital productivity (%)	30.6	7.6	32.3	61.6	31.6	27.6	42.0	2%	-22%
Return on Investment (%)	-8.0	-18.7	-6.1	34.1	9.3	-3.0	13.9	-35%	6984%
Future Expectation Indicator (%)	28.5	-3.7	-28.3	33.0	4.9	-6.2	-5.1	-84%	-91%
Trout combined									
Number of enterprises	134	124	103	93	88	84	78	38%	-90%
FTE	245	191	191	202	204	246	218	78%	-69%
Average wage (thousand €)	63.5	80.0	77.5	77.4	72.2	51.2	65.4	0%	-4%
Labour productivity (thousand €)	89.3	117.8	120.3	119.2	122.9	115.7	124.2	-47%	2%
Total sales volume (thousand tonnes)	32.4	28.3	27.4	29.1	30.2	33.4	32.7	42%	-81%
Total income (million €)	81.0	79.9	86.1	98.3	105.4	109.6	112.0	28%	-69%
Total operating costs (million €)	74.7	72.7	77.9	89.9	95.0	97.4	103.6	51%	-69%
Gross Value Added (million €)	21.9	22.5	23.0	24.1	25.1	28.5	27.1	-6%	-68%
Net profit (million €)	-2.9	-1.9	1.1	1.8	4.1	4.8	2.9	-210%	-1103%
Total value of assets (million €)	125.6	122.4	110.3	119.2	114.2	129.2	120.0	126%	-29%
Net investments (million €)	10.7	8.0	3.6	10.3	4.1	7.8	4.7	775%	104%
Capital productivity (%)	17.4	18.4	20.8	20.2	22.0	22.0	22.6	-59%	-55%
Return on Investment (%)	1.5	1.8	3.3	3.4	4.8	3.8	2.4	-149%	-246%
Future Expectation Indicator (%)	5.0	2.5	-0.9	4.9	-0.6	2.0	0.3	3995%	472%
Other freshwater fish combined									
Number of enterprises	12	11	11	9	9	8	11	38%	9%
FTE	32	31	33	28	55	36	64	78%	91%
Average wage (thousand €)	58.3	70.7	69.8	70.4	60.4	71.8	71.9	0%	5%
Labour productivity (thousand €)	116.9	97.2	111.8	89.2	81.4	216.1	113.7	-47%	-6%
Total sales volume (thousand tonnes)	2.3	2.1	1.7	1.6	3.7	4.0	5.7	42%	142%
Total income (million €)	15.9	13.7	16.1	10.7	19.4	21.9	27.9	28%	81%
Total operating costs (million €)	14.1	12.8	14.7	10.2	18.3	17.3	26.1	51%	89%
Gross Value Added (million €)	3.7	3.0	3.7	2.5	4.5	7.8	7.3	-6%	82%
Net profit (million €)	0.6	-0.9	0.5	-0.2	-2.0	2.7	-3.0	-210%	-1237%
Total value of assets (million €)	24.4	20.7	17.0	15.9	44.5	37.8	85.5	126%	257%
Net investments (million €)	0.5	0.3	0.1	1.5	4.2	1.8	15.7	775%	1304%
Capital productivity (%)	15.1	14.6	21.7	15.5	10.1	20.6	8.5	-59%	-51%
Return on Investment (%)	4.8	-0.4	4.9	0.5	-1.9	7.1	-3.5	-149%	-203%
Future Expectation Indicator (%)	-0.9	-3.1	-2.5	6.8	5.1	0.3	14.3	3995%	2351%

Source: own elaboration from EU Member States DCF data submission

In Table 4.7.3, the economic performance of four Danish segments is presented. It is seen that the gross value added is positive for all segments, but the net profit varies significantly from 2008 to 2018. In 2018, all segments except 'Other freshwater fish combined' show a positive net profit.

In Figure 4.7.3, economic indicators for four Danish segments are shown. It shows that Net profit margin is positive for all segments except Other freshwater fish combined in 2018. For Trout cages, Trout combined and Other freshwater fish combined GVA to revenues and Net profit margin decreases from 2017 to 2018 because of stagnating or decreasing Total income and increasing Total operating costs.

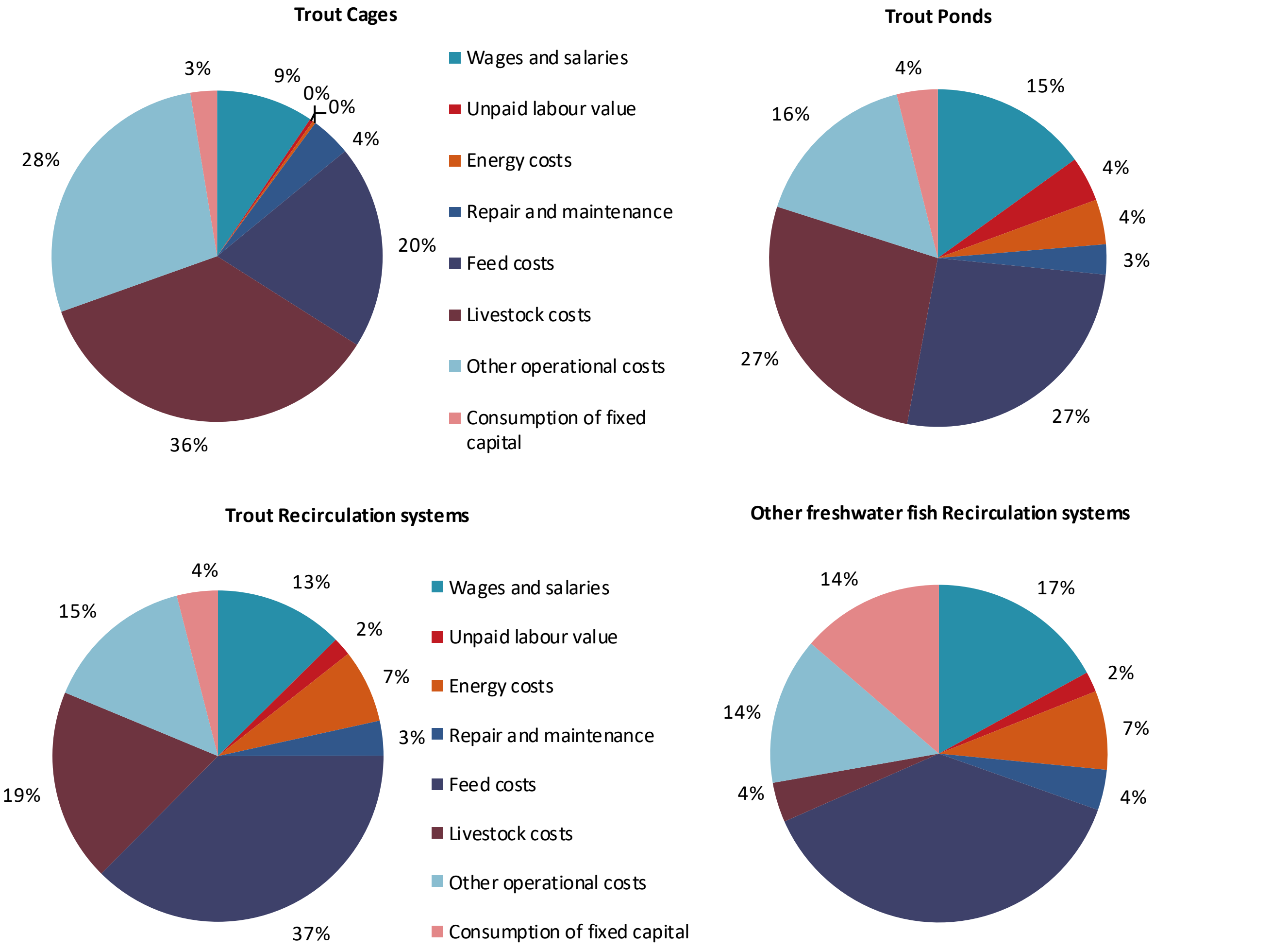
Figure 4.7.3 Economic performance in € million, indicators for the main **Error! Reference source not found.** segments: 2008-2018.



Source: own elaboration from EU Member States DCF data submission

Figure 4.7.4 shows the cost structure for four 'new' EUMAP segments. The four segments account for more than 90 % of the Danish aquaculture production. It is noticeable that Feed cost is an increasing part of total costs as production methods get more specialized. Conversely, Livestock costs decrease as production methods get more specialized. Another reason for the decreasing cost shown for fingerlings (livestock) is that there are vertical integration in the sector, which means that hatcheries and nurseries becomes a part of the grow out farms and the cost for fingerlings (livestock cost) are not presented separately but as a part of other operational costs for the enterprises. The more specialized the sector becomes the more it is a matter of effectively converting feed to food.

Figure 4.7.4 Cost structure of the main segments in Denmark: 2018.



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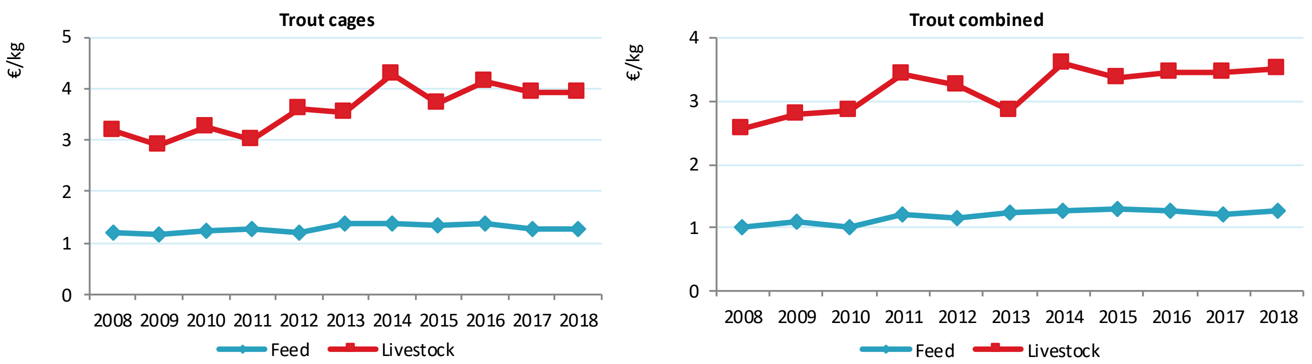
e: EU Member States DCF data submission

Figure 4.7.5 below shows feed and livestock prices for the two most important trout producing Danish segments. Even though cost structures are different for the two EUMAP segments Trout ponds and Trout recirculation systems, the prices of feed and livestock are largely similar. Hence, the two land based trout segments are shown combined as the old DCF segment Trout combined.

Figure 4.7.5 Feed and livestock average prices €/kg for the main **Error! Reference source not found.** segments: 2008-2018.



Source: own elaboration from EU Member States DCF data submission

It can be seen that the price of feed are also largely similar for the sea based production method Trout cages and the land based production methods Trout combined. It is noticeable, though, that the price of livestock is higher for Trout cages. This is because the sea cage production uses larger smolt (livestock) with a weight of 300-500 grams, whereas the land based production methods use smaller fry at a weight of 5-10 grams.

Segment 2: Trout Recirculation systems

The second segment is land based farms producing trout in recirculation systems. The product from these farms is mainly the same as the product from the farms producing in ponds. However, these farms are much larger and use more technology to clean the water discharged from the farms. The segment consists of 17 enterprises running 33 farms. The production volume was 15 071 tonnes with a corresponding income of €43.9 million. This constitutes 27% of the total production volume and 21% of the total production value in 2018.

Segment 3: Trout cages

The third segment is the sea cage farms producing trout in the Baltic Sea. The main product, besides fish, is trout eggs for consumption. In 2018, there were 19 farms distributed among 4 enterprises. The production volume was 14 388 tonnes bringing about a total income of €71.7 million. This segment covers 26% of the volume and 35% of the value of total Danish production in 2018.

Segment 4: Mussels long line

The fourth segment is blue mussels on long lines. The production was 3 102 tonnes, which generated at turnover of €2.3 million in 2018. The segment had 6 enterprises running 14 farms. The segment covers 6% of the volume and 1% of the value of the total Danish production in 2018.

Other segments

The Danish aquaculture sector shows production in two other segments, Eel Recirculation systems and Other freshwater fish Recirculation systems, which produce European Eel and other species in land based recirculation systems. In 2018, these two segments produced a total volume of 5 681 tonnes, which generated a turnover of €27.7 million. This correspond to 10% of the volume and 13% of the value of the total Danish production in 2018.

4.7.5 Outlook

Nowcasts for 2019-20

Danish production volumes and values collected by the Danish Directorate of Fisheries for 2019 have been used for the nowcasting of the Danish sales volume and value for the year 2019. Danish data for 2020 is not yet available and volume and value for 2019 has therefore been used as a guestimate. However, the high uncertainty on sales and prices in 2020 due to the Covid-19 situation has made the forecasting of 2020 very uncertain.

Trends and triggers

Current production trends and main drivers

The main reason for the increase in the marine production in Denmark is the higher prices on larger trout produced in sea cages. The price is driven by the salmon price, which has been high since the disease crisis in Chile. However, to expand the production further the industry needs new licenses. If no new licenses are issued the industry production will stay at a level around 12 - 15 000 tonnes.

The land-based production has shown a downward trend of production over the years. The production was expected to increase slightly when the new regulation going from feed quotas to nitrogen quotas are fully implemented, however, the transition takes time and the results of the change will most likely first show in a couple of years. Furthermore, if the sector is to expand more than a few thousand tonnes, new licenses have to be given to the farmers, otherwise the production will stay at the current level around 30 000 tonnes.

Mussel farming in Denmark has been increasing and been quite success full in terms of increasing both volume and value from the sector.

Market structure

The Danish aquaculture sector has managed to increase labour productivity over the period investigated. The labour cost per unit of output is also relatively low compared to other countries producing trout.

The sector consists of many small producers at the primary level, whereas there are only two to three enterprises buying and processing the trout. This market structure can be a hindrance because the market is not functioning optimally with regard to competitiveness.

In recent years, a segment of organic aquaculture producers has been established. In 2018, there were 23 organic aquaculture producing farms distributed at 11 land based farms and 2 sea cage farms all producing trout and 10 blue mussel farms. The organic producers of trout have higher costs for feed and fry, but they are also receiving a price premium for their products. The segment is producing a little more than 5 000 tonnes, which is mainly mussels, which is an increase of more than 60% from 2016. It is, however, questionable how large the trout production volume can grow before the price premium will disappear.

Issues of special interest

In Denmark, a few farms are experimenting on the production of new species and using new technology. So far, the most successful project is the production of pike perch in recirculating systems. Furthermore, a minor production of turbot fingerlings exists, where the fingerlings are used for restocking and some are exported to the Netherlands and Spain. New large land based recirculation systems have been set up for the production of Atlantic salmon, trout and Yellow kingfish. In a land based recirculated facility the control of the production process is higher than in a sea cage farm and there is a better opportunity to control the pollution of nitrogen, phosphorus and organic material etc., on the other hand, the operating cost is expected to be higher than in the sea cage farms. When the new farms are fully operational they will produce in excess of 8 000 tonnes per year.

Outlook for future production trends

Before 2012, all farms in Denmark were regulated by a feed quota system. Under this regulation the farmer’s main focus was to optimize production under this restriction of input (feed), whilst the farmer had no incentive to reduce the pollution discharged from the farm. A regulatory change in 2012 to individual pollution rights on nitrogen was implemented to give the farmers an incentive to reduce pollution in order to increase production and profitability. This should also secure a further development and adoption of new environmentally friendly production methods and technologies. So far, only 20 large farms in the group of recirculated land based farms has moved to the new regulatory system. Therefore, it is questionable if this change has had a larger effect on the production volume in 2017 and 2018, because of bureaucratic procedures of changing from the old system to the new one, but it is expected that an increase in production volume will be seen in the future.

According to the governmental *Strategy for sustainable development of the aquaculture sector in Denmark 2014-2020*[10] the production goal was to be raised by 25% from 44 000 tonnes in 2012 to 55 000 tonnes in 2020. This was to be helped trough means of *Simplifying administrative procedures*, *enhancing competitiveness* and *coordinating spatial planning*.

From 2012 to 2018, the production volume was raised by 11 700 tonnes from 44 200 to 55 900 tonnes, which was mainly due to an increase in mussels and freshwater fish farming. The administrative procedures are still perceived by the farmers to be the main hindrance for raising production volume, as it has been very time consuming to change from the existing feed quota system to the new output based regulation focusing on nitrogen emissions.

The eel farmers are expected to decrease production due to the restriction on the harvesting of glass eels. Furthermore, this restriction drives up prices on glass eels making it less profitable to produce eel. The mussel farmers are expected to increase production and turnover.

COVID-19 impact

All segments of the Danish aquaculture sector are affected by COVID-19. Most firms report diminishing sales. This is particularly the case for firms that specialized in selling to the hotel and restaurant sector, as both these sectors have been restricted or closed down for most of 2020.

In particular, the newer farms with recirculation systems are more affected by the higher costs due to decreasing sales and a longer production time, because of the large invested capital. The production of blue mussels on long lines seems not affected by higher costs, but are mostly suffering from the diminishing sales.

4.7.6 Data Coverage and Data Quality

Data quality

The account statistic for 2018 is based on a sample of 115 aquaculture farms, which covers 56% of the total population of 206 farms. The sample covers 69% of the total income of the population. Furthermore, data on sales volume and value, purchase of livestock raw material of fish are available for all farms.

The Danish Fisheries Agency (formerly The Danish AgriFish Agency) has registered the total population of farms and enterprises engaged in aquaculture production in Denmark. It is mandatory for all aquaculture producers in Denmark to report the production in volume and value each year at the farm level. The species produced and the technique used in the production are also reported.

The data for The Danish Account Statistics for Aquaculture is collected by Statistics Denmark. The collection is based on the total population of farms provided by The Danish Fisheries Agency. The data is collected at farm level, and can be aggregated to the enterprise level. The data is collected at farm level to get the most homogeneous segments in terms of species and technique. The Danish Account Statistics for Aquaculture collects economic data for costs and earnings and balance sheets. Data is collected on a voluntary basis from the owner’s chartered accountant. The accountant’s task is to report the accounts of his aquaculture clients to Statistics Denmark in a special form where the account information is harmonized for statistical use. Statistics Denmark validates the data from each account in a specially designed data system for quality control.

The extrapolation of the sample to the total population is done in two steps. In the first step, all results from the collected accounts are entered into a database containing information on all existing aquaculture producers in Denmark. From the collected accounts, an average is calculated

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[10] Strategi for bæredygtig udvikling af akvakultursektoren i Danmark 2014-2020
by: NaturErhvervstyrelsen, Ministeriet for Fødevarer, Landbrug og Fiskeri, Miljøstyrelsen og Naturstyrelsen, Miljøministeriet.

for all indicators in each segment. In the second step, an account for the remaining population is estimated based on the average calculated in the first step and the information collected by The Danish Fisheries Agency. The underlying assumption for this calculation is that the production function for each farm is identical within each segment. If the production function is identical, the costs and earnings can be distributed from the sales volume and value in each account.

Data availability

Data for the aquaculture sector is published once a year in an aggregated form at farm level for each segment. The aquaculture statistics are published on Statistics Denmark's website approximately 12 months after the end of the reference year.

Confidentiality

To avoid problems with confidentiality, segments should in general include more than 10 enterprises. In Denmark, both the production of the sea cages farms and the production of eel and other species in land based recirculation systems are quite significant in terms of value, and even though these segments include less than 10 companies, they are surveyed. In order to present detailed data collected from these segments, nearly all enterprises have agreed to participate in the survey. In the case of eels though, only 1 out of 3 companies report to the EUMAP. However all 3 companies report production volume and value to the Danish Fishery Agency, therefore only data regarding production and value are available.

All segments provided by Statistics Denmark have a high degree of homogeneity with regard to species and technique. At farm level, the separation of species into segments is 100%, but if an enterprise produces more than one species, the firm is allocated to the segment of the species that contributes the most to the turnover.

Some enterprises own more than one farm, which can use different techniques. In Denmark, these activities are split up, because the farm is used as the data collection unit. When farms are aggregated into enterprises again, the enterprise is allocated to the segment of the technique that generates the most turnover. There are very few examples of enterprises using more than one technique.

Differences in EUMAP data compared with other official data sources

The Danish data for EUMAP is, in most cases, in line with value and production registered in FAO and EUROSTAT. However, the Danish data for the freshwater sector provided for the EUMAP also contains value and volume for the Danish hatcheries and nurseries and production of smolts for the sea cage farms. The volume and value therefore exceeds the volume and value registered by FAO and EUROSTAT, which only contains the value and volume for fish produced for consumption.

Furthermore, there are some differences in the volume and value collected by the Danish Fisheries Agency, who reports to EUROSTAT and FAO, and Statistics Denmark which reports to the EUMAP. In general, both volume and value are higher in Statistics Denmark Aquaculture Account Statistics. The reason is that the value and volume in the Account Statistics are sales volume and value registered by the enterprises, while the numbers from the Danish Fisheries Agency are measured as farm gate volume and value. Secondly, the data collected by Statistics Denmark are account data and the account year does not necessarily coincide with the calendar year.

4.8 Estonia

Overview of Estonian aquaculture

Estonia only has freshwater aquaculture. The data collection of freshwater aquaculture is not mandatory. Since no data were submitted in the related data call, FAO data were used instead.

4.8.1 Production volume and value

According to FAO data, total aquaculture production in 2018 were 944 tonnes valued €4.2 million. Compared to 2017, the production weight and value increased by 8% and 13%, respectively. The development over the last 11 years also shows increasing trend in the production weight and value. This is mainly due to the rise in rainbow trout production.

Table 4.8.1 Production and sales for Estonia: 2008-2018.

Variable	2008	2010	2012	2014	2016	2017	2018	Change 2017-18	Develop. 2018/(08-17)
Production weight (thousand tonnes)	**0.8**	**0.6**	**0.6**	**0.9**	**0.9**	**0.9**	**0.9**	***8%***	***32%***
Shellfish	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-29%	-26%
Freshwater	0.8	0.6	0.6	0.9	0.9	0.9	0.9	8%	32%
Production value (million €)	**2.9**	**2.0**	**2.4**	**3.5**	**3.9**	**3.7**	**4.2**	***13%***	***47%***
Shellfish	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-41%	-17%
Freshwater	2.8	2.0	2.4	3.5	3.9	3.7	4.2	13%	48%

SOURCE: FAO (2021)

4.8.2 Industry structure

According to the data of the Estonian Veterinary and Food Board, 55 licenced (recognised) companies were operating in the aquaculture sector in 2018; 30 of them farmed fish and 25 were engaged in crayfish farming. Fish farms are small, with low employment rate. Due to the small volume the production are mainly marketed domestically.

4.8.3 Main segments

Rainbow trout remains the main species produced by the Estonian aquaculture sector representing 85% of the total weight and 79% of the total value of production in 2018. In most cases, fish of 1-2.5 kg intended for human consumption are farmed. Rainbow trout in portion size (250-400g) is also produced to some extent, but the demand of Estonian consumers for this product is low. Some farms are also engaged in pre-farming of fish for other farms as an additional activity when necessary.

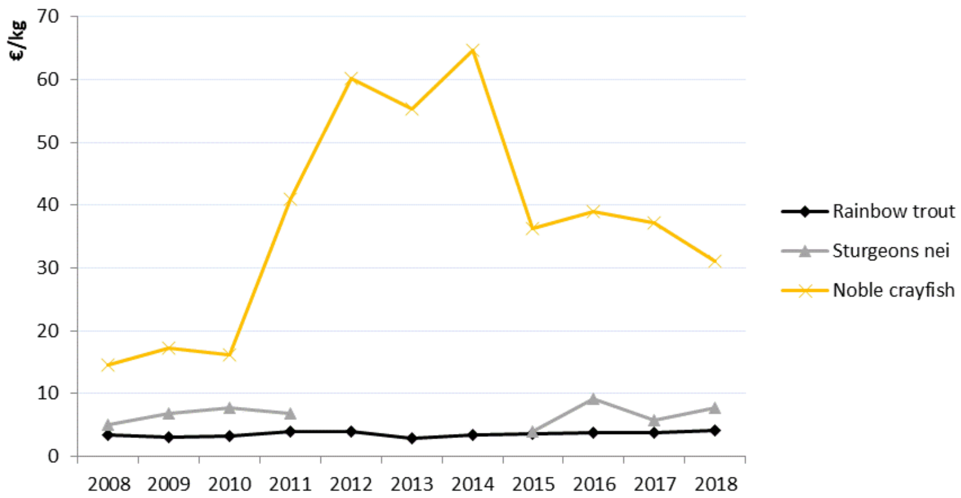
4.8.4 Nowcasts for 2019-2020

According to Statistics Estonia, fish farmers sold 1 062 tonnes of production in 2019, with a total value of more than €3.7 million. The production volume was the highest in 28 years. However, the total value of production decreased, compared to 2018. Due to the Covid-19 pandemic, a decrease in the volume and value of aquaculture production is expected in 2020.

Figure 4.8.1 Main species in terms of weight and value in Estonia production: 2018.

Source: FAO (2021)

Figure 4.8.2 Average prices for the main species produced in Estonia: 2008-2018.



Source: FAO (2021)

4.8.5 COVID-19 impact

In 2020, Covid-19 had a strong impact on Estonian fish farmers, especially during the first wave in the spring (March-May). Mainly were affected fish farmers who marketed their production in the HoReCa sector. The impact was smaller for companies that marketed their products in retail. However, in the second half of the year, demand and prices began to recover. Preliminary data show that due to Covid-19, the sales volume and turnover of fish farmers decreased by 20% - 30% compared to the previous year. Prices followed the same trend. The Estonian government decided to implement the subsidies to compensate the decrease in sales of fish farmers, if sales decreased by more than 15% due to the pandemic in 2020.

4.8.6 Data Coverage and Data Quality

The data collection of freshwater aquaculture is not mandatory under the DCF and EU-MAP programmes of the EU data collection. Estonia only produces freshwater aquaculture products. So Estonia was not obliged to provide economic data for this report. The analysis of the Estonian aquaculture sector is therefore based on data extracted from FAO.

4.9 Finland

Overview of Finnish aquaculture

The Finnish aquaculture sector produced 11.9 thousand tonnes of fish and fry in 2018 generating total turnover of €79 million. There were 157 main activity aquaculture companies in operation in Finland covering also freshwater aquaculture and the sector employed 453 persons totalling 320 FTEs. Profitability of the sector deteriorated, and the net profit decreased to €2.3 million.

4.9.1 Total Production and sales

The Finnish aquaculture sector produced 11.9 thousand tonnes of fish and fry in 2018 generating total turnover of €79 million. Both the sales weight and value decreased by 6%. The food fish production consisted mostly of rainbow trout. Almost 90% of the total production weight and 76% of the production value was generated by rainbow trout in 2018. European whitefish production is also important part of the Finnish food fish supply. European whitefish accounted for 13% of the production value and 7% of the total production weight in 2018. Together these two species accounted for 97% of total fish farming in Finland.

The production of fry in fish farms consists mainly of rainbow trout fry for food fish farming. Fish farms produce also fry of Baltic salmon, landlocked salmon, brown trout, sea trout, char, brook trout and grayling. Hatcheries and nurseries segment generated 27% of the total turnover of the sector in 2018. There were 5 companies using RAS technology in 2018, which produced 800 tonnes of fish with a total income of €4.7 million.

4.9.2 Industry structure and total employment

There were 157 main activity aquaculture companies in operation in Finland in 2018, which was 11% less than in the previous year. The sector employed 453 persons totalling 320 FTEs. Majority of the companies are micro-enterprises. In 2018, there were only 8 companies employing more than 10 persons. In general, the sector is getting more concentrated: The ten biggest companies in the sector in terms of turnover made up 57% of the total revenues in 2018.

Table 4.9.1 Production and sales, industry structure and employment for Finland: 2008-2018.

Variable	2008	2010	2012	2014	2016	2017	2018	Change 2017-18	Develop. 2018/(08-17)
Sales weight (thousand tonnes)	**11.2**	**10.1**	**11.1**	**11.7**	**12.5**	**12.6**	**11.9**	-6%	6%
Marine	6.0	5.5	4.3	5.2	9.0	9.0	8.2	-9%	37%
Freshwater	5.2	4.6	6.8	6.5	3.5	3.6	3.7	3%	-29%
Sales value (million €)	**28.2**	**56.6**	**53.6**	**59.7**	**69.6**	**84.0**	**78.9**	-6%	34%
Marine	21.8	26.6	12.4	20.2	40.3	51.0	48.0	-6%	81%
Freshwater	28.2	30.1	41.1	39.5	29.3	33.0	30.9	-6%	-10%
Number of enterprises	**138**	**163**	**164**	**170**	**173**	**177**	**157**	-11%	-5%
Marine	42	33	16	19	28	28	29	4%	7%
Freshwater	138	130	148	151	145	149	128	-14%	-10%
Employment	**282**	**473**	**430**	**515**	**495**	**512**	**453**	-12%	-3%
Marine	105	126	70	89	185	177	153	-14%	24%
Freshwater	282	347	360	426	310	335	300	-10%	-15%
FTE	**209**	**367**	**339**	**329**	**341**	**350**	**320**	-9%	-5%
Marine	91	101	57	69	140	132	111	-16%	15%
Freshwater	209	266	282	260	201	218	209	-4%	-17%

Source: EU Member States DCF data submission

4.9.3 Overall Economic performance

The economic performance of the Finnish aquaculture sector has been improving since 2014, when the sector made net losses. Total income of the aquaculture sector was highest in 2017, and together with exceptionally high financial income (due to a merger) generated unusually high net result, €10 million. In 2018, the profitability remained at reasonable level, although the production weight and average price of rainbow trout decreased.

In 2018, the total income of the sector was €82 million making profits of €3.8 million before interest and taxes (EBIT); net profit reached €2.3 million (Table 4.7.2). The total operating costs were 90% of the total income adding up to €73 million in 2018. The operating costs were dominated by the cost of feed (41%), livestock (19%) and wages and salaries (17%).

Table 4.9.2 Economic performance of the **Error! Reference source not found.** aquaculture sector: 2008-2018.

Variable	2008	2010	2012	2014	2016	2017	2018	Change 2017-18	Develop. 2018/(08-17)
Total income	51.3	57.8	55.4	61.6	73.7	85.6	81.5	-5%	29%
Total operating costs	45.7	50.5	54.9	58.0	67.8	75.3	73.1	-3%	25%
Total wages	10.5	12.3	13.3	13.0	13.8	14.8	13.2	-11%	0%
Gross Value Added	16.0	19.6	13.7	16.6	19.7	25.0	21.6	-14%	21%
Depreciation of capital	2.6	2.7	3.4	3.5	3.4	3.7	4.7	25%	49%
Earning before interest and taxes	3.0	4.6	-2.8	0.1	2.5	6.5	3.8	-42%	147%
Financial costs, net	-0.4	-0.9	-0.2	1.2	1.0	-3.8	1.5	138%	1170%
Net profit	3.4	5.5	-2.7	-1.1	1.5	10.3	2.3	-78%	39%
Total value of assets	68.3	90.8	99.3	95.7	117.0	148.0	131.4	-11%	35%
Capital productivity (%)	23.5	21.5	13.8	17.4	16.8	16.9	16.4	-3%	-14%
Return on Investment (%)	4.4	5.1	-2.9	0.1	2.1	4.4	2.9	-35%	69%

Source: own elaboration from EU Member States DCF data submission

4.9.4 Main species produced and economic performance by segment

The food fish production consisted mainly of rainbow trout. Almost 90% of the total production weight and 76% of the production value was generated by rainbow trout in 2018. European whitefish production is also important part of the Finnish food fish supply. European whitefish accounted for 13% of the production value and 7% of the total production weight in 2018. Considering both main-activity and secondary activity companies, 14.2 thousand tonnes of rainbow trout and 0.8 thousand tonnes of European whitefish were produced in 2019 for food fish. Other species farmed were trout, arctic char, sturgeon and pike perch which total 0.3 thousand tonnes of production in 2019.

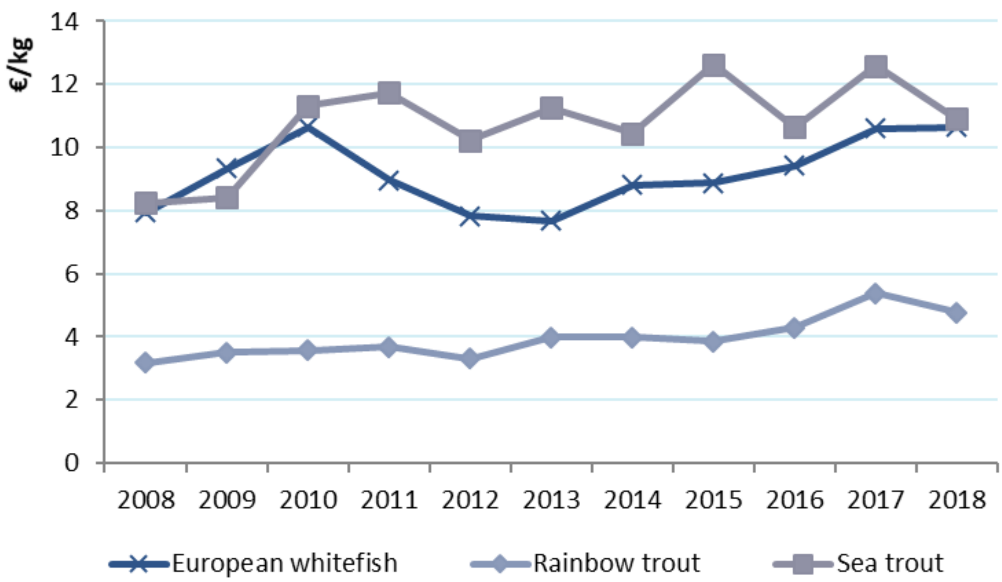
The production of fry in fish farms consists mainly of rainbow trout fry for food fish farming. Fish farms produce also fry of Baltic salmon, landlocked salmon, brown trout, sea trout, char, brook trout and grayling. Hatcheries and nurseries segment generated 27% of the total turnover of the sector in 2018. Fry production for stocking and further rearing was 50 million specimens of fry in 2019.

Figure 4.9.1 Main species in terms of weight and value in **Error! Reference source not found.** production: 2018.

Source: EU Member States DCF data submission

Figure 4.7.2 presents the price development of the two main food fish species, rainbow trout and European whitefish, as well as sea trout (which here presents the average price of combined food fish and fry production). European whitefish prices have been increasing since the low-point in 2013 resulting in around €10.5 per kg in 2018. Sharp increase in global salmon prices were transmitted to Finnish rainbow trout markets in 2017, when the average price was €5.6 per kg. The price has come down to €5.2 per kg in 2018 and to €4.5 per kg in 2019.

Figure 4.9.2 Average prices €/kg for the main species produced in Finland: 2008-2018.



Source: own elaboration from EU Member States DCF data submission

Finnish aquaculture sector is divided in new EUMAP segmentation into 5 segments:

- Segment 1: Trout Cages;
- Segment 2: Trout Tanks and raceways;

- Segment 3: Trout Recirculation systems;
- Segment 4: Trout Hatcheries and nurseries;
- Segment 5: Other freshwater Fish Ponds;

The most important farming method is the trout cage farming that covers marine rainbow trout and European whitefish production. Two other trout production methods are inland food fish production in tanks and raceways and Recirculation systems. Hatcheries and nurseries segment include also farms that have rainbow trout production. The last and least segment is the natural food ponds that produce freshwater juveniles for restocking.

In the previous segmentation according to DCF, there was a segment of combined production of juveniles and food fish that was the biggest segment of the sector. These companies are allocated for 2015 onwards according to EUMAP based on main type of production. This has increased significantly the production and revenue of the Trout cage production and Hatcheries and nurseries segments compared to the results based on previous segmentation for 2008-2014. Fish ponds were included in hatcheries and nurseries until 2014.

Segment 1: Trout cage production

The most important segment in terms of production was marine production of rainbow trout and European whitefish in cages with total income of €48.8 million in 2018. The production consisted mostly of rainbow trout (7.7 thousand tonnes), but also 430 tonnes of European whitefish were produced.

The gross value added increased to €19.8 million while the segment made a net profit of €14.1 million in 2018. Although the net profit was 14% lower than in 2017, marine production in cages in by far the most profitable segment in the sector and making considerable return on investment 30.8%.

Segment 2: Trout tanks and raceways

Trout tanks and raceways are traditional inland aquaculture production methods. In 2018, the segment produced 623 tonnes of rainbow trout and 52 tonnes of European whitefish. The total weight of sales declined by 10% from the previous year and the total income went down by 29% to €3.8 million due to the decrease in prices. After several unprofitable years the segment has been able to make positive result in 2017 and 2018. The net profit was €0.3 million in 2018.

Segment 3: Recirculation systems

Recirculating aquaculture systems have become more common in Finland in the recent years while they are still struggling making the production profitable. The recirculating systems have a great potential as the nutrient load can be easily managed while it is possible to maintain optimal culturing conditions all year round. Fish farming is a highly regulated industry: the environmental permits granted to fish farms practically determine the allowed volume of fish produced. The production increase in partly based on the recent increase in production of recirculating fish farms.

There have been massive investments in the RAS production in the recent years, although poor profitability has already forced a few companies to close their production down. High investments and production costs as well as risks related to introducing new technologies impose challenges for this technology and the segment is making losses.

There were 5 companies using RAS technology in 2018, which produced 800 tonnes of fish with a total income of €4.7 million. While the total income has remained at €4.6 to €4.9 million in the past three years (2016-2018), the total operating costs have doubled. Therefore, the segment was making over €14 million losses in 2018. At the same time, investors still have faith in the industry and considerable investments to new production units (€25 million) were made.

Table 4.9.3 Economic performance of main **Error! Reference source not found.** aquaculture segments: 2008-2018.

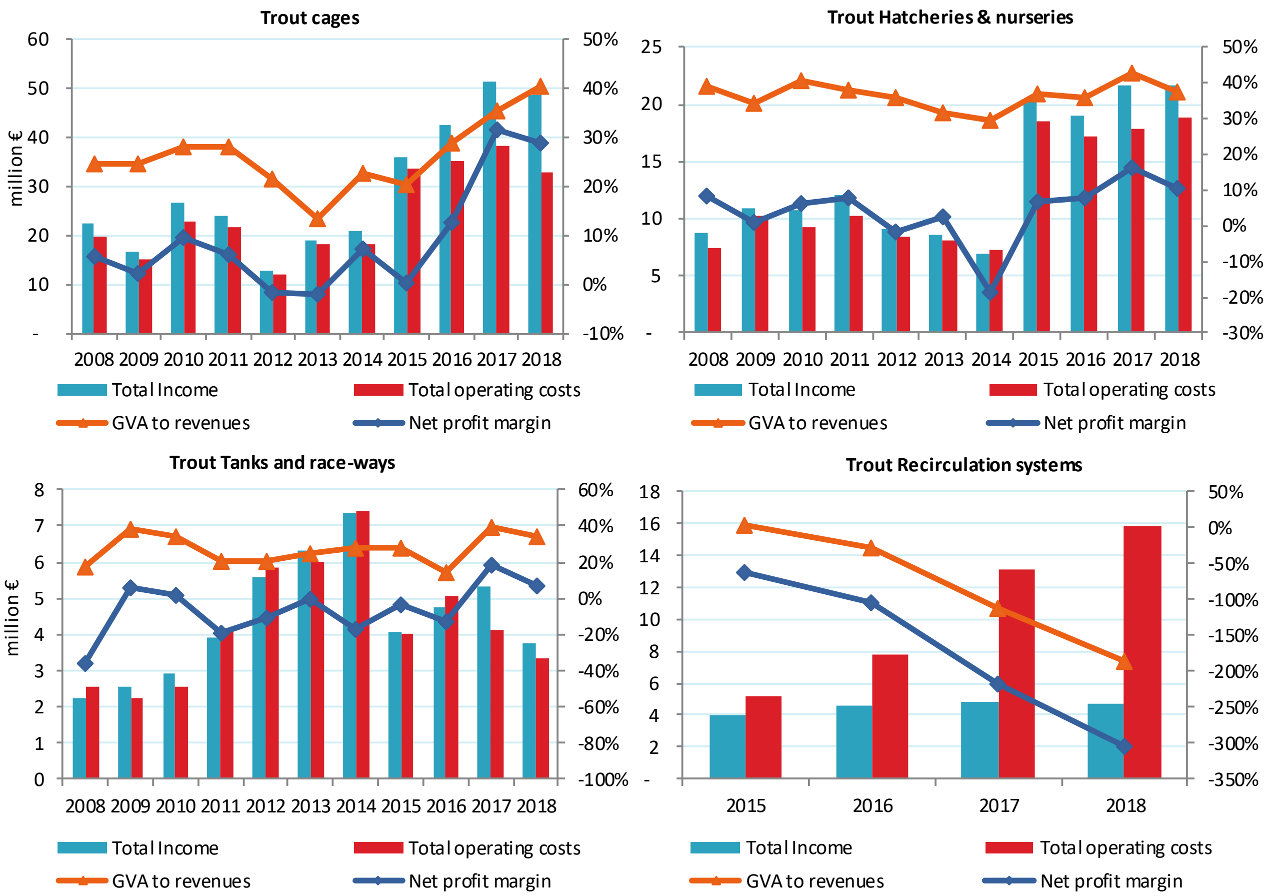
Variable	2008	2010	2012	2014	2016	2017	2018	Change 2017-18	Develop. 2018/(08-17)
Trout cages									
Number of enterprises	42	33	16	19	28	28	29	4%	7%
FTE	91	101	57	69	140	132	111	-16%	15%
Average wage (thousand €)	34.3	36.4	36.4	32.4	34.1	35.9	33.9	-5%	-4%
Labour productivity (thousand €)	60.9	74.5	48.9	68.9	67.1	103.1	129.4	26%	108%
Total sales volume (thousand tonnes)	6.0	5.5	4.3	5.2	9.0	9.0	8.2	-9%	37%
Total income (million €)	22.4	26.6	12.9	20.8	42.7	51.5	48.8	-5%	80%
Total operating costs (million €)	19.9	22.8	12.1	18.2	35.3	38.2	33.0	-13%	40%
Gross Value Added (million €)	5.5	7.5	2.8	4.8	12.4	18.2	19.8	9%	176%
Net profit (million €)	1.3	2.5	-0.2	1.5	5.4	16.4	14.1	-14%	395%
Total value of assets (million €)	24.1	28.3	18.5	20.6	49.4	53.6	46.4	-13%	44%
Net investments (million €)	-1.3	0.9	-0.6	-0.9	1.2	2.2	2.4	9%	724%
Capital productivity (%)	23.0	26.6	15.1	23.0	25.1	34.0	42.7	25%	100%
Return on Investment (%)	6.6	9.7	-0.2	8.3	11.9	21.7	30.8	42%	373%
Future Expectation Indicator (%)	-8.7	-0.8	-7.2	-8.5	-0.5	0.9	1.9	112%	147%
Trout Hatcheries & nurseries									
Number of enterprises	95	97	87	97	26	25	24	-4%	-68%
FTE	65	101	66	60	114	128	125	-2%	39%
Average wage (thousand €)	31.2	27.8	39.9	39.9	42.9	41.8	40.2	-4%	9%
Labour productivity (thousand €)	53.1	43.0	49.3	34.3	46.4	57.0	48.2	-16%	3%
Total sales volume (thousand tonnes)	0.5	0.7	0.5	0.7	2.1	2.2	2.2	-1%	104%
Total income (million €)	8.8	10.8	9.1	6.9	19.1	21.7	21.8	0%	69%
Total operating costs (million €)	7.4	9.2	8.5	7.3	17.3	17.9	18.8	5%	64%
Gross Value Added (million €)	3.4	4.3	3.3	2.1	6.8	9.2	8.2	-11%	71%
Net profit (million €)	0.7	0.7	-0.1	-1.3	1.5	3.5	2.3	-36%	195%
Total value of assets (million €)	11.3	13.0	11.7	23.1	21.0	23.5	26.5	13%	62%
Net investments (million €)	0.0	0.5	-0.6	-0.4	0.6	0.6	2.3	258%	1396%
Capital productivity (%)	30.5	33.3	27.9	8.9	32.5	39.4	30.9	-22%	5%
Return on Investment (%)	6.5	5.8	-0.6	-5.4	5.9	13.5	8.9	-34%	127%
Future Expectation Indicator (%)	-6.5	-2.2	-10.8	-5.6	0.2	0.2	6.5	2526%	268%
Trout Tanks and race-ways									
Number of enterprises	15	13	27	22	17	18	15	-17%	-14%
FTE	21	30	37	45	26	24	21	-13%	-28%
Average wage (thousand €)	35.0	21.3	39.1	47.2	33.5	29.8	32.5	9%	-6%
Labour productivity (thousand €)	18.5	32.6	31.7	45.9	20.3	61.4	52.3	-15%	45%
Total sales volume (thousand tonnes)	0.7	0.5	1.6	1.2	0.9	0.8	0.7	-10%	-31%
Total income (million €)	2.2	2.9	5.6	7.4	4.7	5.3	3.8	-29%	-16%
Total operating costs (million €)	2.6	2.6	5.9	7.4	5.1	4.1	3.3	-19%	-24%
Gross Value Added (million €)	0.4	1.0	1.2	2.1	0.7	2.1	1.3	-37%	10%
Net profit (million €)	-0.8	0.1	-0.6	-1.3	-0.6	1.0	0.3	-73%	190%
Total value of assets (million €)	6.9	14.5	7.9	16.3	5.5	4.7	4.5	-3%	-42%
Net investments (million €)	-0.1	0.3	-0.2	-0.1	0.1	0.2	0.2	10%	2525%
Capital productivity (%)	5.6	6.7	14.9	12.6	12.7	44.6	28.8	-35%	42%
Return on Investment (%)	-8.7	0.9	-6.8	-4.6	-10.3	21.6	6.3	-71%	924%
Future Expectation Indicator (%)	-5.7	0.8	-5.5	-5.2	-1.7	0.8	1.4	87%	136%
Trout Recirculation systems									
Number of enterprises					7	7	5	-29%	-29%
FTE					42	50	45	-10%	13%
Average wage (thousand €)					45.6	56.1	52.1	-7%	7%
Labour productivity (thousand €)					-25.9	-102.6	-178.1	-73%	-328%
Total sales volume (thousand tonnes)					0.4	0.5	0.8	40%	56%
Total income (million €)					4.6	4.9	4.7	-3%	5%
Total operating costs (million €)					7.8	13.1	15.8	20%	82%
Gross Value Added (million €)					-1.2	-5.4	-8.7	-60%	-299%
Net profit (million €)					-4.8	-10.6	-14.3	-35%	-140%
Total value of assets (million €)					38.2	63.7	49.5	-22%	27%
Net investments (million €)					0.0	2.3	25.2	993%	3186%
Capital productivity (%)					-3.3	-8.5	-17.6	-106%	-380%
Return on Investment (%)					-10.6	-14.7	-26.6	-81%	-107%
Future Expectation Indicator (%)					-2.1	1.9	46.7	2299%	2439%

Source: own elaboration from EU Member States DCF data submission

Segment 4: Trout Hatcheries and nurseries

The total income of hatcheries and nurseries of other freshwater fish was €21.8 million in 2018 and there were 24 companies in operation. The production of fry in fish farms consists mainly of rainbow trout fry for food fish farming. Fish farms also produce Baltic salmon, landlocked salmon, brown trout, sea trout, char, brook trout and grayling fry. Under the DCF the fish pond producers were included in hatcheries and nurseries segment, and reported separately in EU-MAP from 2015 onwards. Therefore, there is an apparent decline in the number of enterprises in 2016. In this segment, there are also enterprises with combined production of food fish. Despite the high total income the increased operational costs led to 11% decrease in gross value added and furthermore declined net profit of €2.3 million.

Figure 4.9.3 Economic performance in € million, indicators for the main **Error! Reference source not found.** segments: 2008-2018.



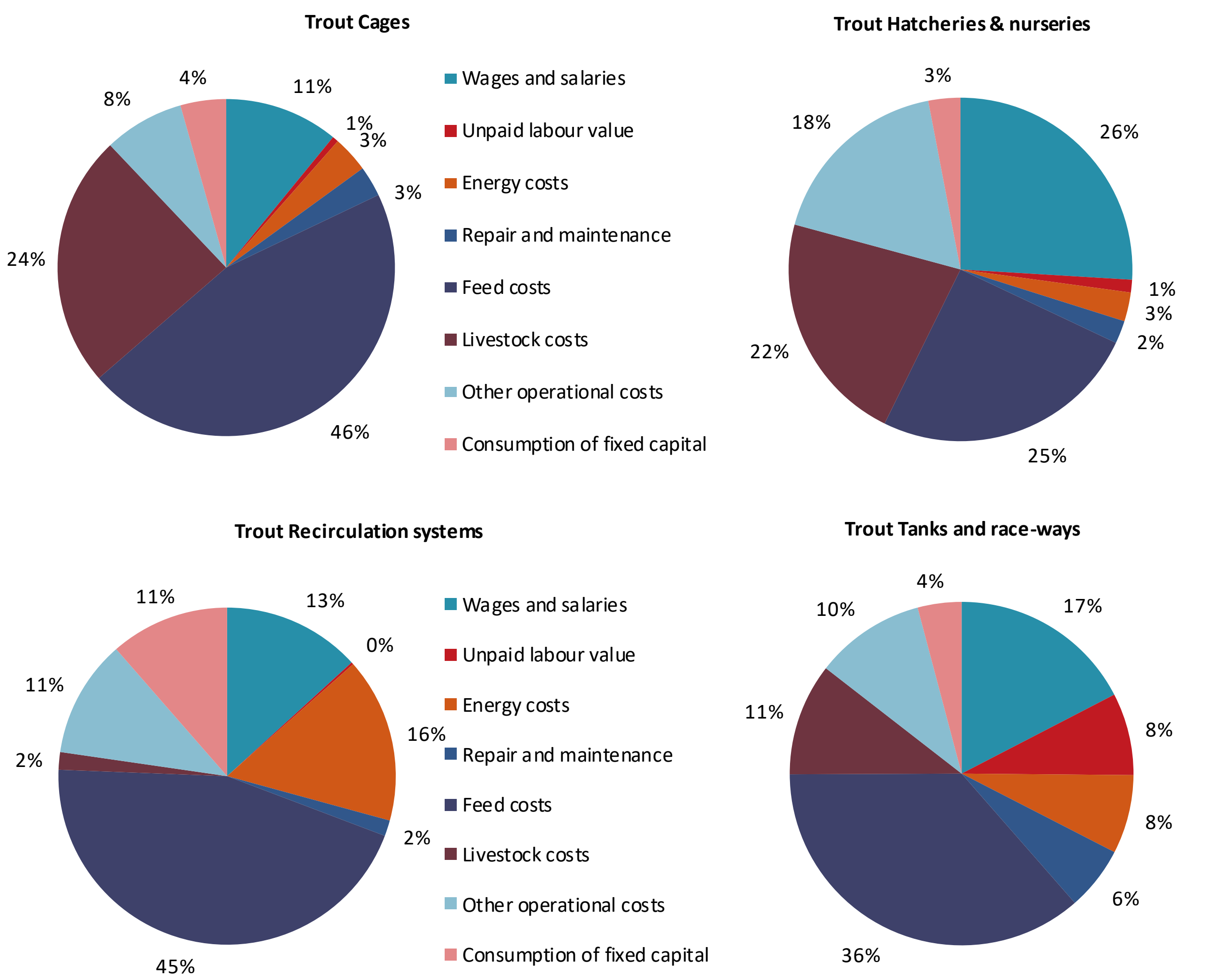
Source: own elaboration from EU Member States DCF data submission

The cost structures for the four Finnish aquaculture segments are presented in the Figure 4.7.4. Feed costs is the largest cost item in most segments. Trout cages segment has relatively highest feed costs accounting for 46% of total costs while the wages and salaries make up only 11% of the total operating costs.

Hatcheries and nurseries that do not have combined food fish production have different cost structure from the other segments. Wages and salaries comprise of most of the costs (26%) of the segment, while feed costs are 25% and livestock costs 22%.

The main cost items for inland food fish producers (RAS and Tanks and raceways) are the feed cost and wages and salaries. RAS production is by far most energy intensive with 16% cost share.

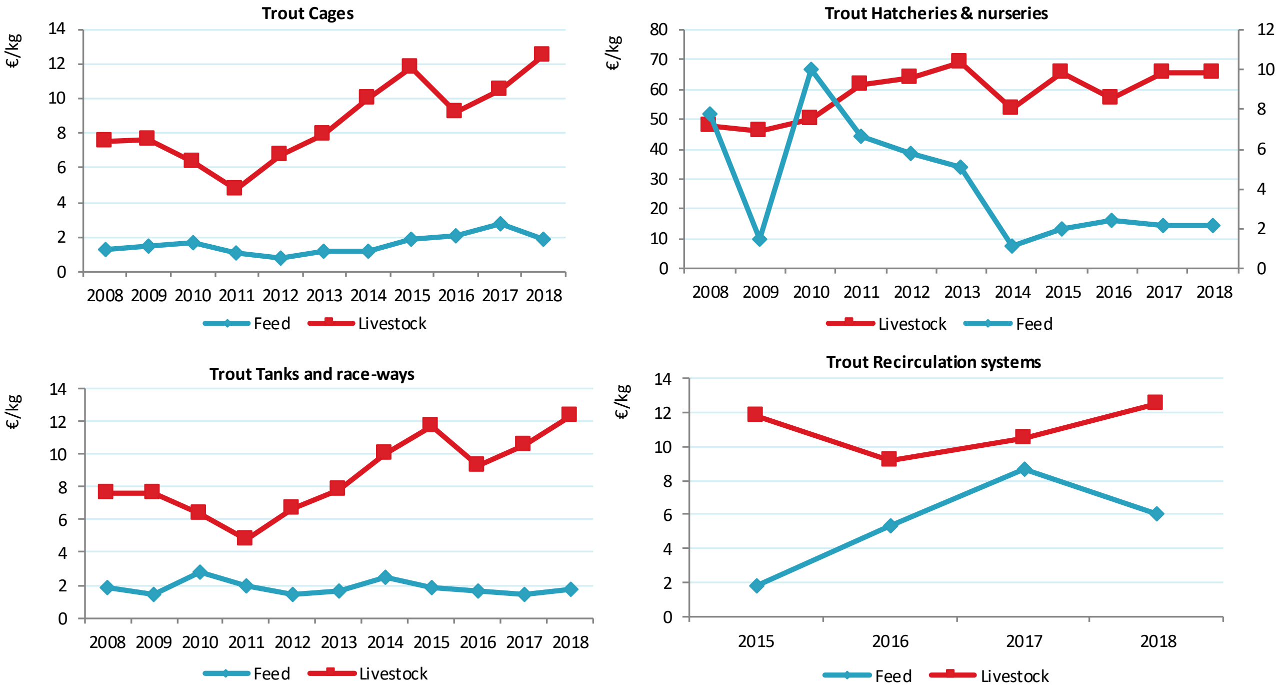
Figure 4.9.4 Cost structure of the main segments in Finland: 2018.



Source: EU Member States DCF data submission

Figure 4.7.5 illustrates the development of average prices for feed and livestock. Average feed costs for cages and tanks and raceways reflect the reality quite well, while the time series for hatcheries and nurseries is affected by the segmentation change in 2015. Prior 2015 fish ponds were included in hatcheries and nurseries segment, and reported separately 2015 onwards. It is also good to recognise that the cost data comes from different data source than volume of feed and livestock, which can create some anomalies in the time series.

Figure 4.9.5 Feed and livestock average prices €/kg for the main **Error! Reference source not found.** segments: 2008-2018.



Source: own elaboration from EU Member States DCF data submission

4.9.5 Outlook

Nowcasts for 2019-20

All aquaculture companies, including both main-activity and secondary activity companies, produced approximately 15.3 thousand tonnes of food fish for sale in 2019, which was a thousand tonnes more than in 2018. The total value of fish produced for sale was €70 million, which was €3 million less than in the previous year. The price of rainbow trout was influenced by the world market price of salmon and the average price decreased to €4.5 per kg.

The preliminary economic data for main-activity aquaculture companies indicates that the weight of sales increased in 2019 by 7% to 12.7 thousand tonnes However, the prices decreased, which led to reduce in total income by 4% down to €78.3 million. As the total operational costs were at similar level to 2018, the profitability decreased in 2019.

Year 2020 was highly affected by the Covid-19 crisis. World markets for salmon collapsed and the world market price of salmon dropped. This affected the price of farmed rainbow trout in Finland and together with increased imports of Norwegian salmon, the average prices were low also in the autumn 2020 affecting the profitability of aquaculture companies. Increased energy costs affected the most companies using RAS technology, where the production is energy intensive.

Trends and triggers

The Finnish aquaculture sector has been increasingly concentrated. The ten biggest companies in the sector in terms of turnover made up over half of the total revenues in 2018. The competitiveness and performance of the sector is mostly connected to the price developments of fish, mainly rainbow trout and salmon, but also developments of the feed cost play an important role.

The Finnish aquaculture sector has been strongly affected by the environmental permit policy. The environmental permits granted to fish farms practically determine the allowed volume of fish produced. The main reason for introducing the environmental permit mechanism has been the limiting nutrient loadings in the Baltic Sea.

The restrictive environmental policy has restrained the intensifying the Finnish aquaculture production and consequently the sector has not been able to benefit from the economies of scale. Finland has a National spatial planning program that aims to concentrate the aquaculture production in marine areas into bigger production units and to direct the production in areas where the use of marine areas can be optimally accommodated. Transferring marine aquaculture production in big production units further offshore to the open sea has potential for increasing the production.

The industry has put high hopes on rainbow trout to become a competitor to Norwegian salmon. Because of low environmental impacts of recirculating fish farms, they are considered a good means of increasing Finnish food fish production and massive investments have been made in the technology in recent years. RAS fish farms produced approximately one thousand tonnes of food fish, mainly rainbow trout in 2019. There are around ten farms using recirculated water at least to some extent in Finland.

Currently, the Finnish fish consumption is relying highly on imported fish. The Finnish government wants to improve the security of supply by increasing domestic production of fish and supports investments to increase the domestic aquaculture production through the new EMFF funding programme.

The new governmental programme promoting domestic fish aims to ambitiously double fish consumption and domestic fish production in Finland by 2027. In order to achieve this, the domestic aquaculture production needs to expand. This can be achieved by taking advantage of the growth potential of new technologies (RAS, offshore/open sea farms and circular bioeconomy) while considering both the economic and environmental impacts.

COVID-19 impact

Along with declining demand of fish in Horeca sector, the world markets of salmon collapsed in 2020. The domestic primary production of fish suffered from reduced demand and low prices while the fish retail sector secured good supply of fish for consumers. The Finnish aquaculture sector is mainly affected by the covid-19 through changes in the world markets of salmon. Together with decreased demand for fish by the restaurant businesses, lowering world market price for salmon and less continental flights, there was oversupply for salmon in 2020. This affected the price of farmed rainbow trout in Finland. Low prices for imported fish increased the imports of Norwegian salmon, while affected prices for farmed and wild fish. Finland has been highly dependent on imported fish, which has made it vulnerable to global crisis, such as covid-19, affecting fish world markets. Finland wants to improve the security of fish-supply and to increase the domestic aquaculture production through implementing new governmental programme promoting domestic fish.

4.9.6 Data Coverage and Data Quality

Data quality and availability

Economic EU data collection of aquaculture sector in Finland combines information from different data sources. Main sources are a production survey of Natural Resource Institute (Luke), structural business and financial statement statistics of Statistic Finland (SF) and account survey conducted by Natural Resource Institute. Financial statements were available for all firms in Business Register having aquaculture as the main activity.

Primary sources of financial statements data in Statistics Finland are direct inquiries and business taxation material supplemented by Business Register data. Data is based on corporate balance sheets and profit and loss account data. Statistics Finland checks for the validity of the data. Any missing data was estimated within stratum. Account data was surveyed by Natural Resource Institute by stratified survey to detect the detailed cost structure of fish farms. Cost and earnings estimates were done by design-based and model assisted regression and ratio estimation. The cost variables were estimated with ratio estimation from financial statements. A production survey was collected exhaustively from the producers. Any missing information was estimated by stratum.

The reference year of economic data collection is the preceding year. Preliminary financial statements data from Statistics Finland are available on the 4th quarter after the reference year. Data on production volume and value is available half a year after the reference year. Therefore, information of the economic situation of aquaculture sector is provided earliest one year after the period investigated.

Natural Resource Institute does not provide or publish any information about the financial statements or key indicators of individual companies. If there are less than five companies in a segment, they are clustered with other segments.

Other data issues or missing data

Natural Resources Institute Finland provides the data on aquaculture for Eurostat and the DCF, but differences in Eurostat and DCF data exist because of different data needs. Eurostat data include all aquaculture production in Finland, including also production of companies that are not main activity producers whereas DCF data includes only those companies that have aquaculture as their main business activity. In addition, Eurostat data include only food fish production and no juvenile or fry production. Both fish produced for human consumption and fry are included in the DCF data.

4.10 France

Overview of French aquaculture

In 2018, the French aquaculture is characterized by a better overall performance compared to previous years. This trend will be confirmed in 2019 but must be nuanced according to the different French segments.

Some species/segments are not included in the analysis in marine production (sea bass & sea bream hatcheries & nurseries, sea bass & sea bream cages, other marine fish on growing), in freshwater production (sturgeon (caviar) and species reared in ponds like carp, pike, pike perch, roach and burbot), in shellfish production (mussel raft, mussel long line, other shellfish long line), and in aquatic plant (macro algae, micro algae and spirulina).

4.10.1 Total Production and sales

Total sales in the French aquaculture sector reached 237.9 thousand tonnes and €1 024 million in 2018.

The removed segments represent 8% of the volume and 17% of the value of the national sales. Among the latter, the saltwater fish farming is a small sector in France. The sales volume reached 4.5 thousand tonnes and €69 million in 2018[11]. With hatcheries and nurseries, cages and land-based facilities, the cumulated production sold of sea bass and sea bream represented 74% and 80% of the value of saltwater fish farming. It should be also highlighted the production of sturgeon caviar, even there were produced 39.7 tonnes from only 7 companies, it achieved a value of almost €23.5 million[12]. With 159 firms, the production of algae and cyanobacteria reached 188 tonnes and €8.9 million in 2018. Finally, the sales of reared fishes in pond represented 3.7 thousand tonnes and €18.5 million.

In this chapter, all published data concern only 5 segments for which all economic data are available: Trout Tanks and Raceways (seg2.2), Mussel On-bottom (seg10.11), Oyster Rafts (seg11.9), Oyster On-bottom (seg11.11), Multispecies On-bottom (seg15.11). With these 5 segments, French aquaculture sector represented 218 thousand tonnes of farmed product in 2018, which corresponded to an increase by 4% on 2017. The total value of production showed an increase by 6% to €850.9 million in 2018.

4.10.2 Industry structure and total employment

From 2010 to 2018, the number of enterprises decreased from 3 171 to 2 782. Employment in the French aquaculture sector reach 15 249 persons for 9 782 full time equivalent jobs (FTE) (Table 4.7.1).

The shellfish sector account for 2 455 companies (88% of the national total), mainly small scale and family structures (69%). They employ around 13 710 jobs representing 8 633 full time equivalent jobs (FTE) as seasonal jobs are quite important. During the latest years, the number of companies was decreasing slightly but this sector had 3 750 enterprises in 2002 and seems to have stabilized since 2017. In addition, if the tasks in the leaseholds are carried out by most men, the work in the establishment (packaging, orders, billing, etc.) is rather feminine.

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[11] *Source: national survey 2018 (SSP).*
[12] *Source: national survey 2018 (SSP).*

The number of freshwater fish farming companies was 327 in 2018, 75% being small scale or family structures; the employment account for 1 539 jobs, corresponding to 1 150 FTE.

Table 4.10.1 Production and sales, industry structure and employment for France: 2010-2018.

Variable	2010	2012	2014	2016	2017	2018	Change 2017-18	Develop. 2018/(10-17)
Sales weight (thousand tonnes)	**287.8**	**246.1**	**225.7**	**227.1**	**209.1**	**218.0**	4%	-9%
Shellfish	247.3	212.8	191.5	191.8	171.3	180.5	5%	-11%
Freshwater	40.4	33.3	34.2	35.3	37.8	37.4	-1%	5%
Sales value (million €)	**792.7**	**875.9**	**842.1**	**790.4**	**799.1**	**850.9**	6%	4%
Shellfish	670.2	770.0	720.8	656.5	650.7	703.9	8%	2%
Freshwater	122.5	105.9	121.3	133.9	148.4	147.0	-1%	18%
Number of enterprises	**3,171**	**3,126**	**2,985**	**2,766**	**2,779**	**2,782**	0%	-7%
Shellfish	2,831	2,796	2,655	2,432	2,455	2,455	0%	-7%
Freshwater	340	330	330	334	324	327	1%	-1%
Employment	**18,519**	**17,363**	**16,492**	**15,074**	**15,187**	**15,249**	0%	-9%
Shellfish	17,212	16,153	15,286	13,841	13,710	13,710	0%	-11%
Freshwater	1,307	1,210	1,206	1,233	1,477	1,539	4%	22%
FTE	**10,139**	**9,646**	**9,060**	**8,837**	**9,832**	**9,783**	0%	4%
Shellfish	9,127	8,704	8,167	7,892	8,633	8,633	0%	3%
Freshwater	1,012	942	893	945	1,199	1,150	-4%	16%

Source: EU Member States DCF data submission

4.10.3 Overall Economic performance

For the 5 segments where all economic indicators are available, the weight of shellfish farming sector (83% of the total turnover) influenced widely the result of national economic performance. So, an average indicator can hide a disparity between different segments.

For these 5 segments, total income and total operating costs was relatively stable from 2010 to 2018, reaching respectively €909.8 million and €695.7 million while the total wages increased slightly by 5% (Table 4.7.2). In global, aquaculture sector made a positive net profit in 2018 of €118.5 million.

Table 4.10.2 Economic performance of the French aquaculture sector: 2010-2018.

Variable	2010	2012	2014	2015	2016	2017	2018	Change 2017-18	Develop. 2018/(10-17)
Total income	887.8	954.3	906.3	835.4	841.3	854.5	909.8	6%	3%
Total operating costs	632.1	679.0	676.1	634.9	632.2	652.4	695.7	7%	6%
Total wages	235.3	227.8	261.0	223.5	225.3	223.8	247.6	11%	6%
Gross Value Added	446.1	475.2	474.7	417.5	428.6	421.5	457.6	9%	4%
Depreciation of capital	84.7	183.6	177.1	178.2	75.5	73.8	77.6	5%	-40%
Earning before interest and taxes	171.0	91.7	53.0	22.3	133.6	128.3	136.6	6%	41%
Financial costs, net	8.5	32.9	19.7	20.7	18.9	14.1	18.1	28%	-13%
Net profit	162.5	58.8	33.3	1.6	114.8	114.2	118.5	4%	55%
Total value of assets	1,054.6	1,080.7	1,099.6	1,095.4	1,050.4	1,144.1	1,235.2	8%	15%
Capital productivity (%)	42.3	44.0	43.2	38.1	40.8	36.8	37.0	1%	-10%
Return on Investment (%)	16.2	8.5	4.8	2.0	12.7	11.2	11.1	-1%	22%

Source: own elaboration from EU Member States DCF data submission

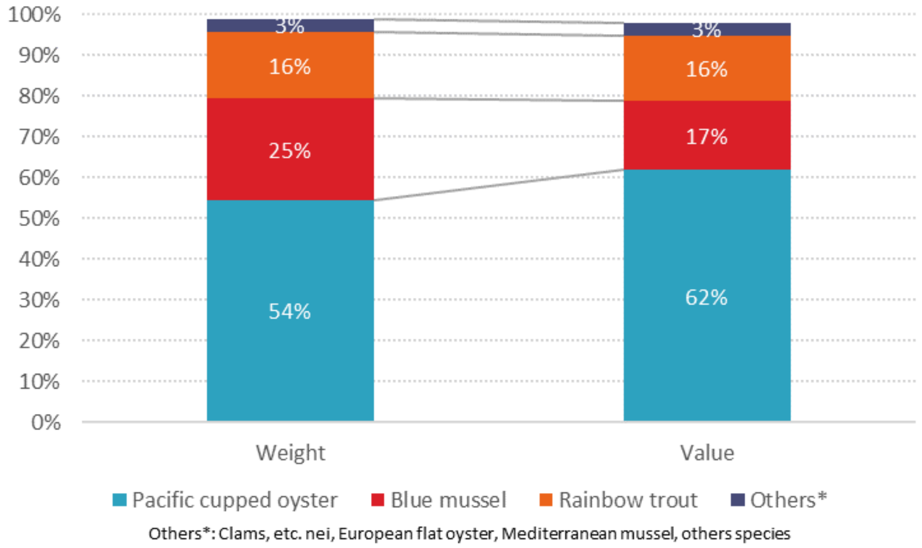
Wages represent 36% of the total operating cost.

Despite the considerable uncertainty regarding future production, subject to natural hazards, professional continued reinvesting to renew their outdated equipment. The cost item "depreciation of capital" decreased by 40% in 2018 on average 2010-2017. The return on investment increased by 22% in 2018 on average 2010-2017.

4.10.4 Main species produced and economic performance by segment

Main species of French aquaculture sector are Pacific cupped oyster, blue and Mediterranean mussel, and rainbow trout. The weight of Pacific cupped oyster (55% of the volume, 62% of the value) remained important despite the recorded mortality since 2008 (Figure 4.7.1).

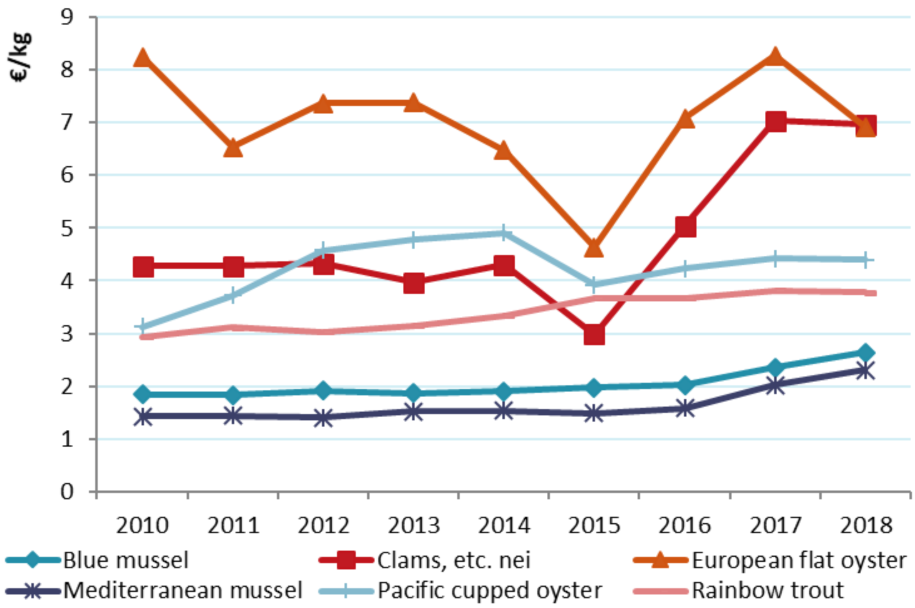
Figure 4.10.1 Main species in terms of weight and value in **Error! Reference source not found.** production: 2018.



Source: EU Member States DCF data submission

The price is given as a global indicator as volumes and values combine sales of juveniles, young adults sold to other aquaculture farms, adult sold to human consumption (Figure 4.7.2).

Figure 4.10.2 Average prices €/kg for the main species produced in France: 2010-2018.



Source: own elaboration from EU Member States DCF data submission

Price for rainbow trout rose between 2010 and 2018 by almost €1 per kg. This increase is partly due to a change in the products on the market, in particular the increase in the proportion of smoked trout with higher added value than fresh portion trout.

Stable between 2010 and 2016, there has been a regular increase in the prices of blue and Mediterranean mussels since 2016.

For Pacific cupped oyster, after stability for some years before 2010, the price increased every year until 2017, and then stabilized in 2018. This is an effect of the decreasing production sales due to mortalities of juveniles since 2008. The price of oysters seems to have reached an upper limit for the consumer market.

Flat oysters and clams are more noble products subject to significant variations in mortality from year to year. Their prices reflect their availability according to the law of supply and demand.

The most relevant segments in the French aquaculture are presented below.

Segment 1: Oyster bottom

Companies in this segment are very heterogeneous (i.e. in terms of size, turnover, etc.), and they have different strategies of production. Some of them focus on one stage of production (short cycle) instead of achieving the whole rearing cycle. The spat is supplied either by wild spat (produced by the farmers themselves thanks to collectors of different kinds in the regions located at the South of Loire, or purchased to these farmers by others), or spat produced in hatcheries, or both. In response of mortalities of spat, hatcheries select and produce more resistant diploid or triploid spats. The production of triploids spat is dominant. If the cost of the seed is higher than the wild seed one, the growth of these oysters is faster (shorter production cycle) and rotation of stock is higher. It exists also a last phase of oyster production, the refining ("affinage") of oyster. This additional process, which consists in ending the rearing of oysters by a temporary immersion in marshland ponds (“claires”), provides a significant added-value to the final product. Only the oyster farms of Charente Maritime and Vendée practice this process.

The segment consists of 1 667 enterprises and 6 061 FTE. The sales production volume was 111.3 thousand tonnes with a corresponding turnover of €525.9 million. The production volume accounts for 51% and the value accounts for 58% of the total French production.

Since 2008, the French oyster industry is facing mortalities of spat (shellfish less than one year) in pacific cupped oysters. To cope with these mortalities, several strategies have been implemented. Some companies, which have leasehold to collect spat, have increased the number of spat collectors. The work of collector is labour intensive. So, this strategy has conducted to increase the number of seasonal employments. As a result, the average number of jobs per company has risen from 3.1 in 2010 to 3.64 in 2018. Due to the necessity to handle the supply of natural spat, the demand for spat collection leaseholds has increased and caused a strongly progression of the transfer price between oyster farmers. In complement or not with natural seed, the purchase of juveniles in the hatcheries offered a solution in terms of diversification of oyster juvenile. The consequence is the augmentation of the value of the livestock.

Between 2010 and 2018, the average size of companies is growing, resulting in a strong increase in the value of assets over the period (+21% 2018/(Avg 2010-2017)). If global net investments of the segment are decreasing, brought back to the company, it is on the rise indicating modernisation efforts on the part of companies. Return on investment reached 8% for oyster bottom segment in 2018 (-5 points/2010).

Table 4.10.3 Economic performance of main **Error! Reference source not found.** aquaculture segments: 2010-2018.

Variable	2010	2011	2012	2013	2014	2015	2016	2017	2018	Change 2017-18	Develop. 2018/(10-17)
Oyster On-bottom											
Number of enterprises	1,993	2,029	1,963	1,906	1,860	1,728	1,658	1,667	1,667	0%	-10%
FTE	6,178	6,082	6,032	5,773	5,863	5,606	5,474	6,061	6,061	0%	3%
Average wage (thousand €)	21.5	23.7	23.3	25.3	28.9	26.3	27.1	17.6	19.0	8%	-22%
Labour productivity (thousand €)	32.9	37.3	47.9	50.2	51.4	24.3	24.5	22.7	24.5	8%	-33%
Total sales volume (thousand tonnes)	129.5	126.9	118.4	110.9	106.8	127.4	118.9	106.8	111.3	4%	-6%
Total income (million €)	468.0	523.8	589.6	568.0	566.2	510.5	485.8	499.8	525.9	5%	0%
Total operating costs (million €)	367.9	409.8	416.5	409.4	420.0	394.4	377.9	405.3	423.4	4%	6%
Gross Value Added (million €)	203.2	227.0	289.2	289.9	301.5	259.0	252.3	240.0	259.2	8%	1%
Net profit (million €)	53.7	53.8	51.5	46.9	30.0	-5.6	47.8	39.0	42.7	9%	8%
Total value of assets (million €)	498.7	605.7	638.6	620.7	657.9	656.7	665.7	686.8	763.4	11%	21%
Net investments (million €)	11.7	39.4	38.6	43.2	37.8	49.4	44.4	54.1	39.0	-28%	-2%
Capital productivity (%)	40.8	37.5	45.3	46.7	45.8	39.4	37.9	34.9	34.0	-3%	-17%
Return on Investment (%)	11.8	11.6	10.7	9.5	6.4	1.1	8.9	6.9	7.0	1%	-16%
Future Expectation Indicator (%)	-5.9	-0.7	-10.3	-9.1	-10.1	-9.0	-0.6	1.0	-1.3	-228%	76%
Mussel On-bottom											
Number of enterprises	361	314	334	282	287	400	385	351	351	0%	3%
FTE	1,400	1,239	1,203	1,075	1,079	1,461	1,426	1,322	1,322	0%	4%
Average wage (thousand €)	34.9	34.9	33.2	31.2	33.3	18.8	26.4	14.4	17.0	18%	-40%
Labour productivity (thousand €)	98.7	77.5	83.7	86.5	79.0	35.4	46.8	50.3	55.9	11%	-20%
Total sales volume (thousand tonnes)	81.5	67.9	64.4	60.7	59.9	48.7	55.2	48.4	49.6	2%	-19%
Total income (million €)	176.8	137.4	135.6	122.5	122.7	109.8	149.0	122.1	140.1	15%	4%
Total operating costs (million €)	87.0	84.2	74.2	62.7	73.1	56.9	81.0	64.7	78.0	21%	7%
Gross Value Added (million €)	138.2	96.1	100.7	93.0	85.2	79.5	103.7	87.3	97.0	11%	-1%
Net profit (million €)	63.1	24.3	9.1	23.4	9.5	17.1	48.3	41.5	42.1	1%	42%
Total value of assets (million €)	287.1	242.7	227.4	189.8	200.5	174.2	222.9	222.2	253.2	14%	15%
Net investments (million €)	41.9	20.9	14.6	14.6	13.8	12.5	11.9	2.6	9.0	241%	-46%
Capital productivity (%)	48.1	39.6	44.3	49.0	42.5	45.6	46.5	39.3	38.3	-3%	-14%
Return on Investment (%)	22.9	12.8	7.3	14.9	6.9	12.0	23.4	19.8	18.5	-7%	23%
Future Expectation Indicator (%)	6.2	-0.5	-13.3	-8.9	-11.0	-11.2	-1.7	-4.8	-2.5	48%	56%
Multispecies On-bottom											
Number of enterprises	157	129	151	83	92	56	56	61	61	0%	-38%
FTE	716	556	637	300	380	333	319	319	319	0%	-28%
Average wage (thousand €)	25.3	23.7	19.9	28.1	31.3	31.3	33.8	22.2	23.2	4%	-14%
Labour productivity (thousand €)	70.3	35.2	40.3	50.5	59.5	48.6	49.3	46.0	39.0	-15%	-22%
Total sales volume (thousand tonnes)	24.8	14.5	17.9	9.2	12.7	14.1	9.7	7.7	7.5	-3%	-46%
Total income (million €)	90.5	50.4	61.3	30.0	42.2	43.3	45.8	33.2	37.1	12%	-25%
Total operating costs (million €)	44.8	42.4	47.6	22.2	30.5	30.8	34.6	23.5	30.8	31%	-11%
Gross Value Added (million €)	50.3	19.5	25.7	15.1	22.6	22.9	22.0	18.5	15.7	-15%	-36%
Net profit (million €)	34.3	1.9	7.1	3.3	6.4	9.0	7.1	5.1	4.1	-20%	-56%
Total value of assets (million €)	115.3	46.6	59.4	36.0	50.5	32.9	24.3	40.8	23.2	-43%	-54%
Net investments (million €)	-0.7	4.6	3.1	3.0	3.3	1.1	-1.2	3.2	2.9	-10%	40%
Capital productivity (%)	43.7	41.9	43.2	42.1	44.7	69.4	90.6	45.3	67.5	49%	28%
Return on Investment (%)	30.0	7.7	15.0	11.7	14.8	29.4	31.3	14.4	19.1	32%	-1%
Future Expectation Indicator (%)	-10.2	0.4	-2.9	-1.6	-1.9	-5.2	-20.1	-1.4	4.2	408%	179%
Trout Tanks and race-ways											
Number of enterprises	340	321	330	330	330	330	334	324	327	1%	-1%
FTE	1,012	1,016	942	946	893	945	945	1,199	1,150	-4%	16%
Average wage (thousand €)	24.8	25.7	24.1	39.0	30.4	27.1	21.3	14.1	16.8	19%	-35%
Labour productivity (thousand €)	37.2	26.0	36.7	44.3	41.6	33.6	32.4	39.0	35.3	-10%	-3%
Total sales volume (thousand tonnes)	40.4	36.1	33.3	34.5	34.2	34.3	35.3	37.8	37.4	-1%	5%
Total income (million €)	125.1	126.8	125.1	131.6	127.3	142.5	138.8	158.9	154.7	-3%	15%
Total operating costs (million €)	112.4	126.1	112.9	125.9	117.2	126.2	119.0	121.7	123.6	2%	3%
Gross Value Added (million €)	37.7	26.4	34.6	41.9	37.1	41.5	39.9	57.6	54.3	-6%	37%
Net profit (million €)	6.3	-9.6	3.0	-10.3	2.3	7.9	13.2	30.0	24.4	-19%	357%
Total value of assets (million €)	109.0	115.1	88.5	106.8	123.1	188.7	98.4	132.8	114.9	-13%	-5%
Net investments (million €)	8.3	7.9	2.8	3.2	9.5	4.6	3.5	6.9	6.0	-13%	3%
Capital productivity (%)	34.6	22.9	39.1	39.2	30.2	22.0	40.5	43.4	47.3	9%	39%
Return on Investment (%)	6.6	-5.4	8.2	-8.1	2.3	5.4	15.5	23.7	22.1	-7%	267%
Future Expectation Indicator (%)	2.5	0.9	-2.3	-10.4	1.8	-0.8	-1.1	0.8	0.3	-67%	125%

Source: own elaboration from EU Member States DCF data submission

Segment 2: Mussel bottom

The second most important segment is the mussel bottom and consists of 351 firms and 1322 FTE in 2018. Since 2010, the production of mussel is decreasing. This decline was due to unfavourable weather causing a deficit of production and poor quality of mussels (2011, 2012). The deficit comes also from important resurgence of predators (sea-star, birds, spider crabs, etc.) in some areas of production (Channel and Atlantic coasts). Since 2014, a high mortality of mussels has been located in production areas located in the West of France (Pertuis Breton and bay of Bourgneuf). The mortalities have reached up to 100% on the long line for some professionals and 50-80% of the "bouchot" cultivation system. The causes of these mortalities are difficult to establish (pathological, environmental and physiological). Given the short cycle of the mussel, producers cannot replenish their stocks. There is no hatchery of mussels in France. As with a lot of environmental hazard causing shellfish mortalities, the prevention methods or the tools for reducing the economic consequence are limited. Financial difficulties are important (drop in sales, net loss of turnover) while cleaning of leaseholds (remove the mussels) causes significant costs. If older companies have cash to cover fixed costs, young companies, much more indebted, have significant difficulties. Measure 56.1.f of EMFF has been mobilized in order to compensate the mussel farmers impacted.

In 2018, the sales production volume is 49 thousand tonnes with corresponding a total income of €140 million (respectively 2% and 15% increase over 2017). This cultivation represents 90% of the value of French mussel turnover and 86% of the weight. Compared to the average 2010-2017, gross value added is quite stable (-1%) in 2018, capital productivity decreases (-14%) and net profit rises strongly (42%). Despite strong variations from one year to the next, this segment remains very profitable.

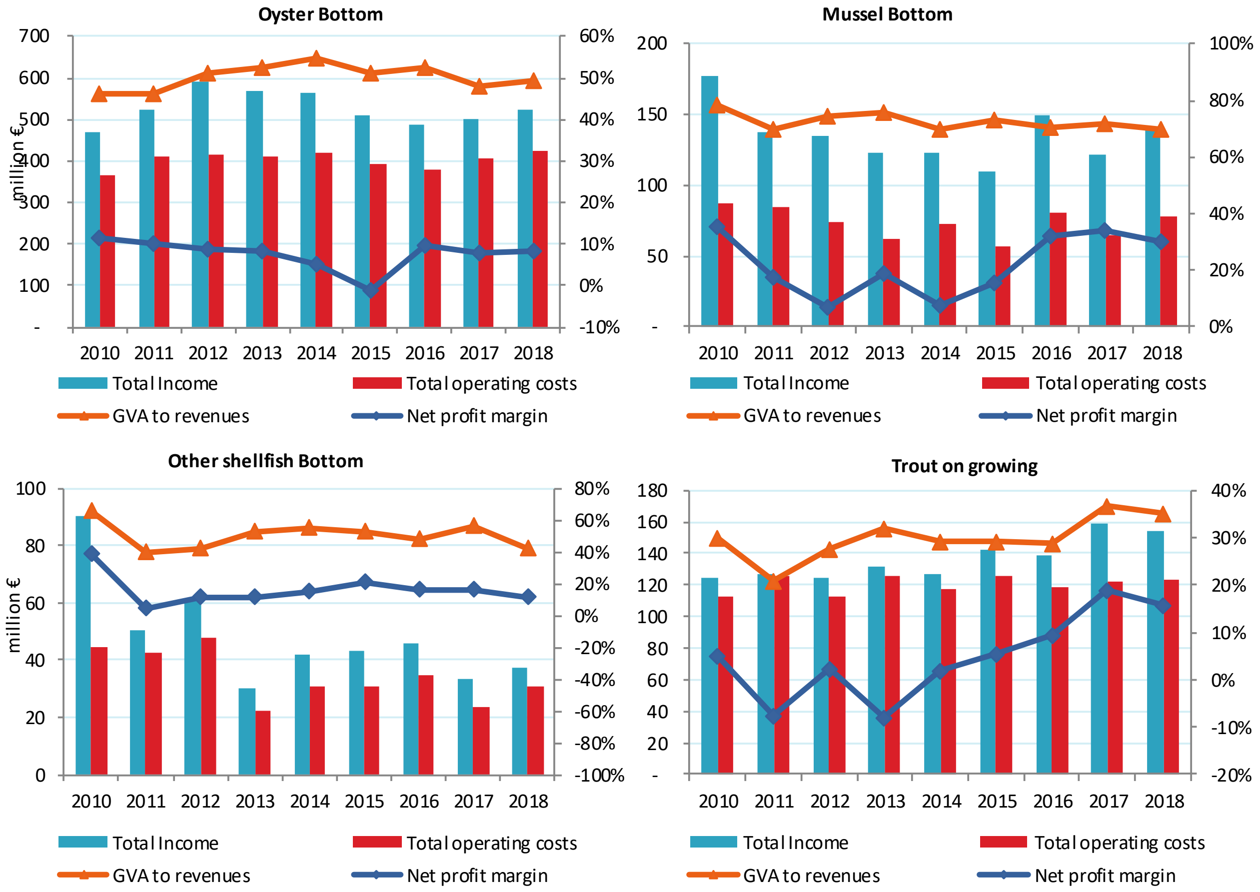
Segment 3: Multispecies On-bottom

This EUMAP segment corresponds to the previous DCF segment "Other shellfish Bottom" and includes companies that raise several species of shellfish (mainly oysters and mussels). Over time, the companies making up this segment can vary greatly since the indicator used to include them corresponds to a percentage of turnover (a species must not represent more than 60% of the company's total turnover). In 2018, Multispecies On-bottom segment is made up of 61 companies and 319 FTE. The strong heterogeneity of companies and its volatile composition does not allow a solid analysis of the evolution of the different indicators and results.

Segment 4: Trout tanks and raceways

This EUMAP segment aggregate the previous DCF segments "Trout on growing" and "trout combined". This segment is 37.4 thousand tonnes bringing about a total income of €154.7 million. This segment accounts 327 enterprises for 1 150 FTE. Since 2010, the economic situation in this segment had developed unfavourably. The turnover (-5%), sales volume (-38%), the total value of assets (-21%) and the total number of FTE (-12%) are decreasing between 2010 and 2016. But since 2016, the economic performance of trout firms is increasing. The evolution of main indicators are positive like as evidenced by the increase in total sales volume (+5% 2018/(Avg 2010-2017), gross value added (+37%) or net profit (multiplied by 4,5). This change is due to an increase in the production of companies in connection with a dynamic market (sustained domestic demand in France) whose prices are rising.

Figure 4.10.3 Economic performance in € million, indicators for the main French segments: 2010-2018.



Source: own elaboration from EU Member States DCF data submission

The operational cost structures for the four French segments are detailed below and in Figure 4.3.4.

Segment 1: Oyster bottom

Livestock is the main cost (29% of the total operating costs and depreciation of capital) as there are exchange of oysters between regions to improve shellfish growth, to supply adults to farmers specialized in "affinage" process. In 2018, wages and value of unpaid labour is a high cost (34% of the total costs). Because of recurring recruitment difficulties, oyster farmers are increasingly having to resort to occasional staff, particularly temporary or foreign personnel who must then be housed. As a result, the costs of wages and salaries increase accordingly (+6% 2018/2017). The weight of the depreciation of fixed capital reached 10% of the total costs in 2018. Since few years, investments are progressing strongly within companies (+4% between 2017 and 2018). The renewal of equipment but also investments to reduce the harsh working conditions are made.

Segment 2: Mussel bottom

The most important operational cost items are wages and salaries and the imputed value of unpaid labour. Investments are important for this activity. The depreciation of capital item attains 38% of the total "operating costs plus depreciation of capital". In the case of mussel farming, the spat supply is exclusively on wild source, if the livestock costs are limited (12%) compared to others costs, the purchases of mussels have risen significantly to compensate for mortalities due to predation (+45% 2018/2015).

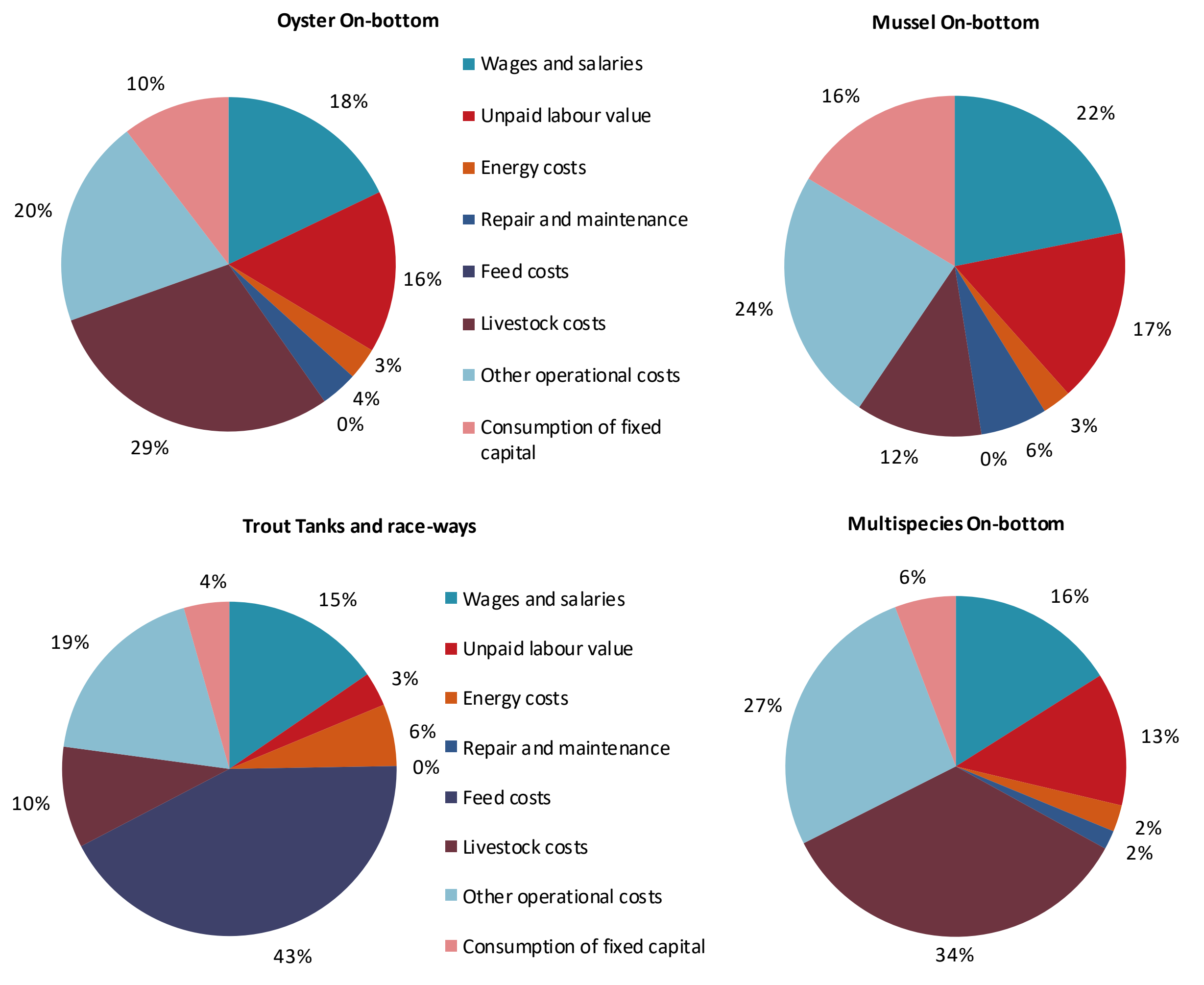
Segment 3: Multispecies On-bottom

This segment is characterised by the majority weight of livestock costs (34%) and then by the weight of other operational costs. Given the diversity of companies in this segment, it is difficult to interpret the cost structure.

Segment 4: Trout tanks and raceways

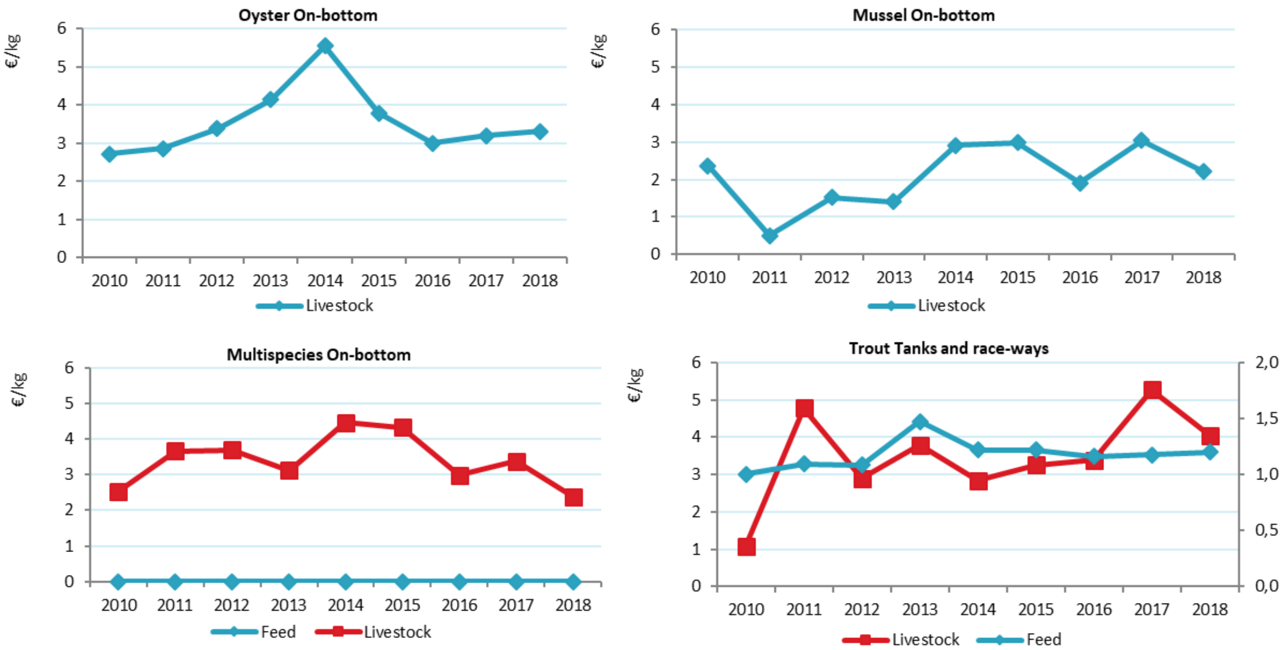
As these farmers have to feed their juveniles, also the adults that they are rearing up for their own production, feed costs are also high (43% of the total "operational costs plus depreciation of capital" in 2018). Livestock costs is stable over time (12%). The second operational cost items is wages and salaries.

Figure 4.10.4 Cost structure of the main segments in France: 2018.



Source: EU Member States DCF data submission

Figure 4.10.5 Feed and livestock average prices €/kg for the main French segments: 2010-2018.



Source: own elaboration from EU Member States DCF data submission

4.10.5 Outlook

Nowcasts for 2019-20

Compared to 2018, the year 2019 is characterised by an increase in French aquaculture production: +5% in value (€1 071 million) and +9% in volume (260.2 thousand tonnes - source SSP). This positive dynamic is recorded in main sectors except for aquatic plant production. Turnover rose by 9% in the freshwater sector, 3% in shellfish sector and 13% in the marine sector. Rainbow trout (+14% in value and volume) and Pacific cupped oyster (+8% in volume, 5% in value) sales were particularly in progression. Behind this global approach, some species are nevertheless in decline, such as S*almo trutta fario* (-41% in weight, -29% in value) or Mediterranean mussel (-19% in value, -23% in volume).

Between 2019 and 2020, beyond the impact of COVID-19 (see specific point), a decrease of shellfish production, (estimated by 10% in weight), with a drop of price, is recorded. Two phenomena can explain this evolution: predation for mussels and summer mortalities for oysters. Since few years, the increase in the phenomenon of unprecedented harmful algal blooms, both geographically and at the level of the responsible micro or even pico-algae. Climate change and loss a biodiversity seems to be the main causes of such a situation. Shellfish farmers seem to be adapting to the reduction in production by trying to "produce less but sell better". This trend is confirmed in 2020 under the impact of COVID with prices only decreasing by 2% but a forecast turnover in contraction of 10%.

In several French regions, significant predation by protected birds, sea breams, spider-crabs, piercing winkles increases from year to year, leading to a mechanical reduction in the volume marketed. Profitability deteriorates in 2020, and even more so in 2021, in particular for mussel farmers. Compulsory reseeding creates additional supply of spat and labour costs. Volumes are lower and, if prices hold (which is not always the case given the poor growth in certain sectors), they do not allow tonnage losses to be made up. Discussions between the Interbranch and competent Authorities are initiated to find a way to regulate this predation. Another avenue envisaged by the Interbranch should consists of a form, to be defined, of economic compensation for predation carried out by a protected species, like the predation of ewes by wolves.

Concerning the other shellfish farming, clam growers suffered 90% mortality in 2020, making the impact of COVID-19 negligible. Cockle breeders had an excellent season in terms of volume and price and was not able to meet Spanish demand.

The reduction in spirulina production by 21% in 2019 is due to climatic conditions and the difficulty for large producers to find sufficient outlets on the markets. However, this drop in production sees its impact on sales reduced due to a 16% increase in the price per kilogram. The 26% increase in macroalgae production is the direct consequence of better zootechnical mastery by the companies which previously encountered various difficulties. This situation is expected to strengthen in 2020 with the development of new farms in Brittany.

4.10.6 Trends and triggers

Current production trends and main drivers

Environmental hazards lead fluctuations of quantities and prices on the different markets. In a context of high uncertainty, the management of shellfish stocks and relations with the various customers (between shellfish farmers, with retailers or wholesalers, etc.) are at the heart of the companies' concerns.

In the oyster sector, summer spat oyster mortalities have stabilized at a median level of 50% and are now included in the business plan of oyster farmers. Local and annual variations in water quality and farmed shellfish diseases lead main stakeholders (the Interbranch, French State) to exploring the possibilities of offshore development thus in waters of a better quality, in close relation with the floating wind farms from which the public debate comes to be completed at the end of 2020. An increase in production that would be absorbed by greater demand could be envisaged in this frame, given that today the purely national market corresponds only to one act of consumption per year by the average consumer for oysters and to three for mussels.

Initiatives are emerging in the shellfish farming "vessel of the future" to further reduce the already low carbon footprint of shellfish farming. Two pilot projects for electric vessels are underway in 2020. The efforts of professionals to reduce the difficult working conditions are multiplying and are resulting in investments in various material (hoist, crane, etc.). Tests on new types of equipment such as exoskeleton as carried out to relieve the tasks associated with the work of oyster bags.

Shellfish farmers dread climate change increasing risk of epizootic and the emergence of emerging pathogens and thus diseases in the marine environment. This climate change will affect the environmental parameters: temperature change on ocean acidification, on rainfall and therefore the salinity and the concentration and nutrient quality. This will have consequences on future aquaculture output and on the economic results. That is why, in order to deal with hazards, discussions between the Interbranch and the French State are continuing on the creation of a mutual management device involving shared funded by the compulsory contributions of professionals and half by the EMFFA.

In freshwater sector, launched in 2014, the Fish Health Plan 2020 has three main focuses: 1/ Improving management and sanitary supervision; 2/ Optimisation of animal health approval procedures; 3/ Ensuring a high level of sanitary safety. This Plan 2020 notably includes the national programme for the eradication and monitoring (PNES) of viral haemorrhagic septicaemia (VHS) and infectious haematopoietic necrosis (IHN), which aims to obtain a qualification “free of these diseases” throughout metropolitan France, with a view to improving the health level of fish farms and reducing the constraints linked to fish movements.

Market structure

In 2019, France exported 12 368 tonnes of oysters (for a value of €92.4 million) and imported 7 183 tonnes (€32.8 million) what released a €59.6 million credit balance. Oyster exportations are marginal in relation to production, which meets domestic demand, but exports are increasing year after year (€10 million in 2000, €23 million in 2010). The companies that have contributed to the development of oyster exports suffered export difficulties from the end of 2019 due to the COVID-19 crisis (1/3 of exports are to China/Hong Kong, and 1/3 to Italy according to France Agrimer). They have largely repositioned themselves on the national market, creating an oversupply in some markets.

French mussel production is not sufficient to meet the national demand. The imports of mussels (57 227 tonnes in 2019) mainly, from Netherlands or Spain in fresh mussels (respectively 13 275 tonnes and 19 216 tonnes), Chile (cooked or prepared mussels, 9 108 tonnes). These importations exceeded widely the exports (5 125 tonnes) revealing a €74 million trade deficit. 85% of imports are in fresh.

The strong membership (350 companies out of a potential of 400) to the "TSG moules de bouchot" quality scheme makes it possible to envisage a recovery of around 15 000 tonnes of small-sized products, through industrial extraction and processing of mussel meat. It was proposed to the managing authority of official quality schemes to modify the specifications to integrate this new operation into the TSG.

In the "Vision 2030" for French shellfish farming, the Interbranch envisages the development of the shellfish processing sector. France's food security objective is targeted, the shellfish segment imported from Third Countries, clearly identified by the Interbranch for a fair competition. The increase in depreciation expense, which has recently started to emerge, should logically be confirmed in 2019 and then continue to grow in 2020.

French finfish products are in competition with foreign domestic productions where natural conditions, social and environmental standards are more advantageous. In 2019, France exported 7 865 tonnes of trout and imported 9 642 tonnes, what released a €22.3 million trade deficit. The exchanges mainly concern fresh trout. Spain is the main exporter to France (56% of total volume exportation). France's main customers are Germany (53% of French exportation in volume) and Belgium (27%).

4.10.7 COVID-19 impact

Oyster segment: Oyster farmers are initially impacted in January and February 2020 by one hundred administrative closures in relation with Norovirus contamination of the waters. Heavy consequences for both regional sales and export was reported. Then spread's sales are impacted by the first lockdown in relation with COVID-19: direct sales, fishmongers and supermarket sales are not concerned and maintained a correct level of activity, but dispatchers specialized with restaurants and HORECA are heavily impacted, and to a less extent, exporters. Such a specialization of certain companies was not known to the professional organization and the State services. The re-opening in summer let it possible to have a nice season. Sole impact at this period: Sales to wholesalers suffered a sharp drop in prices (reported for a few numbers of producers under the real costs of production). A winter season finally safeguarded: The ban on meeting in large family reunions is offset by more small gatherings with friends. The number of acts of consumption is maintained but the average portion is decreasing. The final impact is reflected in a drop in the volume of products marketed by 10%, consumer prices limited decreased, i.e. an estimated loss of turnover of 12% as well.

This pandemic episode will have highlighted the resilience of small family shellfish farming businesses. The cross-cutting aids put in place by the government for all the affected sectors will have produced their effects. New modes of consumption (Click & collect, Internet / home delivery) and the development, at a level of more than 50%, of direct sales on the farm or on local markets are proof of the capacity of this sector to bounce back from a major crisis. Particular attention will be given to companies which have proved to be very specialized in their sales method exclusively with wholesalers or with restaurants.

Mussel segments: Mussel farmers are not impacted by the first lockdown in March and April 2019, the period corresponding to the growth on the bouchot until the summer. The reopening of activities in June 2019 does correspond to the main period of sales of mussels. Thus, direct sales to consumers, sales in restaurant and/or supermarket result in a "good year" of activity.

Conclusion for the shellfish farming: The need for traceability and much more precise data in real time has been identified such as the digitization of the sector and companies, associated with remote declarations. The number of companies which should ultimately require the specific aid adopted in Article 55 of the EMFF, applications for which are now open until April 2021, will be much lower than envisaged at the start of the crisis. This is due to the fact that companies have implemented strategies to deal with the health crisis and the 10% deductible for the calculation of compensation (10% of the loss of income is borne by the companies).

Freshwater segments: The impact of COVID-19 has been various across different trout farmers. Concerning those producing for **human consumption**, the first lockdown led companies to slow the growth of fish by rationing. The decreased sales (in terms of volume) are estimated between 1 and 10%. Additional costs (between 1 and 10%) related to the overstocking of feed and the longer operating time of the aerators (related to the overloading of the tanks with trout) are recorded by some farmers. By opposite, the use of short time working has reduced labour costs for some farmers. The lack of customers during the first confinement was compensated during the summer season. Sales prices increased, allowing the trout farms to maintain their activity at a good level. The bulk sales had decreased for the benefit of pre-packed goods. The situation is more complicated for firms positioned in the **restocking market and recreational activities**. When the fishing season started i.e. during the first lockdown, sales were suspended. Firms positioned to export (essentially on the living market) are particularly impacted and the decrease in sales (volume) reached as much as -40% for some of these companies. Livestock maintenance costs (workforce, feed, energy, etc.) have remained constant even if some farmers used partial unemployment. At the end of lockdown, due to an abundant fish supply, price drop on the market (between 1 and 10%).

Marine segment: During the confinements, marine fish farmers have redirected their sales to supermarkets and hypermarkets, with greater development of processing and pre-packaging. But the prices charged were lower (-10%) than those for catering and foreign competition were important. In rare cases, some professionals have slaughtered their livestock (hatcheries). Such as freshwater segment, fish farmers were subject to additional costs: feed (+5%), energy, (5%) or to reducing costs like partial unemployment (-5%).

Conclusion for the fish farming: This pandemic episode highlighted the sensitivity of trout farmers facing to the impossibility of selling during containment periods. Limited living storage capacity, moreover, storage is only relevant over a short period of time and suppose an adaptation of the trout rearing. The high density of fish in the raceways can induce a higher mortality rate, a poorer quality of trout. COVID-19 pushes professionals to think about the possibilities of offering more processed products allowing a deferral of consumption, the possibility to store frozen fish provided the market supports it.

4.10.8 Data Coverage and Data Quality

Data quality and availability

It is important to underline that the segments proposed at the European level include very heterogeneous French shellfish both in terms of their production (different techniques used) and their marketing (a multitude of outlets where the value of the shellfish in monetary terms can be very different). The interpretation of the results is therefore sometimes complicated. The sensitivity of farmer economic performance can be very different for the same contingency or, for example, in the face of the COVID crisis.

The planned sample rate is 15% overall (from 16% to 25%) and could be realised for the main segments. Some segments have been removed because of either an achieved sampling rate low (e.g. mussel raft). The effort in order to consolidate the sample must be reinforce in the future.

For year 2018, the socioeconomic data of 492 enterprises in the shellfish farms segments was collected (274 in 2010) representing 20% of the population. The main segments had an appropriate sampling rate, giving a good precision.

The socioeconomic data of 54 enterprises in the trout segments was collected for year 2018, representing 16.5% of the population. As these segments show a high variation from small farms to very important ones, this sampling rate give a medium precision for economic data.

Decision to consider shellfish farms in "oyster" or "mussel" segments is based on the turnover ratio of one of these species group to the overall turnover; otherwise, the firm is included in "Multispecies On-bottom". This minimum ratio was fixed to 60% of the total turnover.

The economic indicators are available for 5 segments corresponding to 83% of the total turnover in 2018 and 92% of the total sold volume. Therefore, even if total data is presented for the whole French aquaculture sector, economic indicators have been calculated only using data for these main indicators where all economic data was available.

Other data issues or missing data

Some species/segments are not included in the analysis in marine production (Sea bass & Sea bream Hatcheries & nurseries, Sea bass & Sea bream cages, Other marine fish on growing), in freshwater production (species reared in ponds as carp, pike, pike perch, roach, burbot, etc.), in shellfish production (mussel Raft, mussel Long line, Other shellfish Long line), and in aquatic plant (macro and micro algae including spirulina).

4.11 Germany

Overview of German aquaculture

On-bottom production of blue mussel dominates the marine aquaculture in Germany. Due to extensive farming conditions, its harvest is highly dynamic and varies between less than 5 000 tonnes to more than 20 000 tonnes per year. Germany's freshwater aquaculture production oscillates around more or less about 19 000 tonnes per year. Main freshwater species are salmonids (trout and char) and common carp. Further, catfish and high value species like eel, sturgeon, crustaceans and pike perch are produced in recirculating systems (RAS) in addition. Latter group is considered in total national volume, but not in economic analyses in this chapter. If not other mentioned, the chapter only focuses on species for consumption, not for (re-)stocking.

4.11.1 Total Production and sales

Blue mussel (*Mytilus edulis*) production dominates the marine aquaculture sector in Germany. It takes place in coastal areas of the southern and middle North Sea. The total sale volume of blue mussels were 2017 about 18 557 tonnes and 2018 about 15 871 tonnes. Average prices per kg were much lower 2017 than in 2018. Notwithstanding, both years can be considered as very profitable years. Gross sales were about €25.5 million in 2017 and about €32.5 million in 2018. It is the third successful year in a row since 2016.

In **freshwater cultures** salmonids (mainly rainbow (*Oncorhynchus mykiss*), brown (*Salmo trutta fario*), char (*Salvelinus fontinalis* and *Salvelinus alpinus × fontinalis*)) and common carp (*Cyprinus carpio*) are the most important species in German aquaculture. In 2017, about 16 436 tonnes of salmonids and carps were produced. Together, sales of salmonids and carp are estimated of about €83.6 million. Furthermore, there are some freshwater niche segments like catfish (*Clariidae* and *Siluridae*), eel (*Anguilla anguilla*), sturgeon (*Acipenseridae*) and other, mainly produced in RAS and which counted for additional 2 722 tonnes in 2017. In 2018, salmonids and carp farms produced about 15 004 tonnes and their estimated sale value was €69.6 million. Other freshwater fish and crustacean produced in RAS counted for additional 2 321 tonnes in 2018.

4.11.2 Industry structure and total employment

The German aquaculture sector is small and highly diverse at the same time. Around 2 800 farms (more than 0.3 ha or 200 m²) cultivate fish and seafood in Germany as a business in fresh and marine waters. In total, around 2 000 people are employed at aquaculture facilities and it is assumed that around 3 500 unpaid owners and family workforce are engaged here in addition.

Blue mussel enterprises dominate the marine sector and are located in the federal states of Lower-Saxony and Schleswig-Holstein holding production licenses given from the states. These licenses are valid for a restricted time. Mussel producers are obliged to form producer organisations according to Common Fisheries Policy (CFP). In consequence, the number of enterprises are stable around 10 producers. The mussel cultures in Schleswig-Holstein is much more productive and profitable than in Lower-Saxony for different reasons: better environmental frame conditions in the middle North Sea on the one hand and negative impacts in the south North Sea on the other hand. Only one start-up of mussel aquaculture operates on a small scale (less than 50 tonnes) in the Baltic Sea. Around 100-120 people work in the marine aquaculture in Germany in general, probably the half of them in the mussel segment in particular. The statistic also includes employees from marine aquaculture research facilities. Employment data from 2008-2014 is not comparable with 2015 and following years, because the source of data have changed.

Freshwater aquaculture is characterized by small salmonid and carp family businesses in Germany first at all. Often these around 2 800 freshwater facilities operate as additional income source and are run in part-time. According to a survey undertaken 2017 more than 50% of the interviewed freshwater facilities (n=145) produced less than 5 tonnes per year. Only 10% of the farms had more than five employees. In general, 1 707 people were registered as employees (FTE = 1 320) of a salmonid or carp farm in 2017 and 2018. However, unpaid labour (family and owner workforce) plays a decisive role in salmonid and carp aquaculture. From surveys among fish farms 2017/2018 it can be inferred, that unpaid labour provide around 1 700 FTE in carp and salmonid segments in addition. If also smallest carp and trout farms (less than 0.3 ha or 200 m²) would be taken into account, the total number of farms was 9 659 in 2018 according to employers' liability insurance association. Thereof 8 525 carp farms and 1 134 trout facilities were registered by the association. A registration is mandatory, if you want to sell fish legally. In consequence, the degree of total input of unpaid labour in Germany's aquacultures might be higher, if enterprises, which have aquaculture as side business, would be considered.

Because of the high importance of unpaid labour in the sector, the number of employees is lower than the number of enterprises (table 4.7.1). In 2017, freshwater aquacultures have been included in the data collection for the first time.

Table 4.11.1 Production and sales, industry structure and employment for Germany: 2008-2018.

Variable	2008	2010	2012	2014	2016	2017	2018	Change 2017-18	Develop. 2018/(08-17)
Sales weight (thousand tonnes)	**6.8**	**4.9**	**6.7**	**6.9**	**22.2**	**35.0**	**30.9**	-12%	150%
Shellfish	6.8	4.9	6.7	6.9	22.2	19	16	-14%	48%
Freshwater						16.4	15.0	-9%	-9%
Sales value (million €)	**9.7**	**4.1**	**9.5**	**15.0**	**25.3**	**109.1**	**102.1**	-6%	348%
Shellfish	9.7	4.1	9.5	15.0	25.3	25.5	32.5	27%	125%
Freshwater						83.6	69.6	-17%	-17%
Number of enterprises	**11**	**11**	**11**	**11**	**10**	**2,899**	**2,754**	-5%	820%
Shellfish	11	11	11	11	10	8	8	0%	-22%
Freshwater						2891	2746	-5%	-5%
Employment	**60**	**57**	**60**	**60**	**127**	**1,817**	**1,824**	0%	638%
Shellfish	60	57	60	60	127	110	117	6%	53%
Freshwater						1707	1707	0%	0%
FTE	**60**	**57**	**60**	**60**	**103**	**1,416**	**1,424**	1%	604%
Shellfish	60	57	60	60	103	96	104	8%	48%
Freshwater						1320	1320	0%	0%

Source: EU Member States DCF data submission

4.11.3 Overall Economic performance

The **blue mussel** producers have experienced the third year in a row of an outstanding positive harvest, which mainly results from high volumes gained in Schleswig-Holstein waters. Regarding the fact, that blue mussel on-bottom production is highly fluctuating, these peaks of production from 2016 ongoing are necessary to balance the weak economic period of the segment from 2008 to 2014, where overall production never exceeded the mark of 7 000 tonnes. For unknown reason, no data on marine aquaculture is reported by Germany for 2015.

The decrease in **freshwater aquaculture** bases on an ongoing concentration process, which effects small, traditional enterprises operating with carp or trout ponds first and foremost. In fact, between 2015 and 2018 the population of freshwater aquaculture farms have declined about 21% (national agricultural statistic, Destatis, own calculation). This fact clearly illustrates the high economic pressure traditional freshwater segments face. Small-scaled farms exited the market, because farms were unprofitability in mid-terms and/or the owner retired without handing over the business to a successor. In contrast to the number of farms given up, small-scaled traditional pond systems only provide a low input to national production volume. Beside this general trend, economic indicators should be interpreted with caution. The survey 2017/2018 among freshwater aquaculture enterprises in Germany has still been at the beginning and faces some shortcomings (cf. section Data Coverage and Data Quality).

Table 4.11.2 Economic performance of the German aquaculture sector: 2017-2018.

Variable	2017	2018	Change 2017-18
Total income	113.9	137.5	21%
Total operating costs	142.2	122.3	-14%
Total wages	72.7	69.3	-5%
Gross Value Added	42.7	84.5	98%
Depreciation of capital	7.6	7.0	-9%
Earning before interest and taxes	-35.9	8.3	123%
Financial costs, net	1.4	0.7	-54%
Net profit	-37.4	7.6	120%
Total value of assets	156.1	137.7	-12%
Capital productivity (%)	27.3	61.4	125%
Return on Investment (%)	-23.0	6.0	126%

Source: own elaboration from EU Member States DCF data submission

4.11.4 Main species produced and economic performance by segment

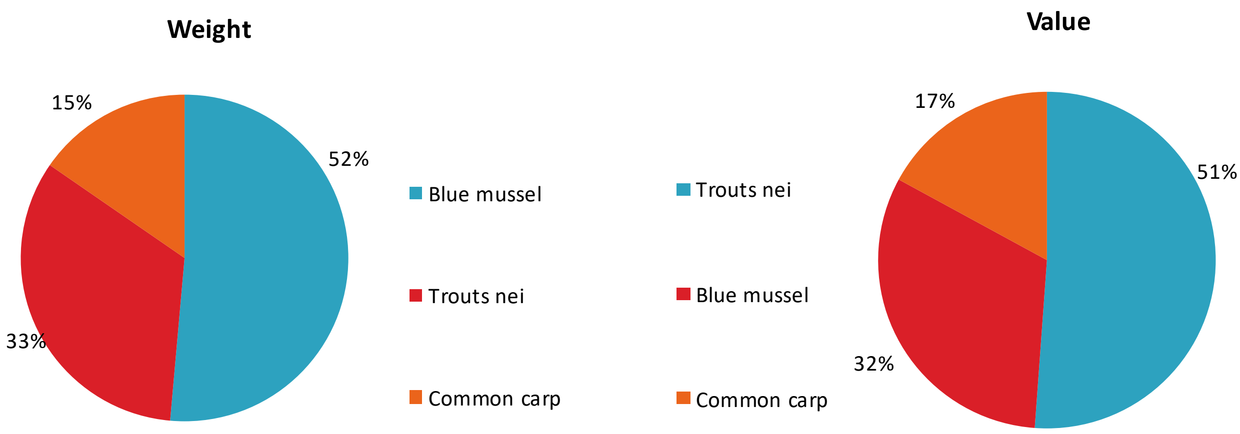
Blue mussel, salmonids (trout and char) and carp are the main species in terms of volume in the German aquaculture sector. The production of blue mussels was 18 557 tonnes in 2017 and 15 871 tonnes in 2018. While the blue mussel production is highly dynamic due to the availability of wild seed occurrence, salmonid and carp production is comparable stable. Carp and salmonids together have a share of more than 80% of the total volume of freshwater fish production in Germany. In 2017, 10 794 tonnes in 2017 and 10 258 tonnes in 2018 of salmonids were produced. Carp facilities produced 5 642 tonnes in 2017 and 4 746 tonnes in 2018. In addition, 2 686 tonnes of other freshwater species were produced in 2017 and 2 293 tonnes in 2018. The value of sales of salmonids and carp are estimated of about €83.6 million in 2017 and €69.6 million in 2018. Note the fact that high value species like eel are included in the segment of other species, but not considered in reported DCF data due to low volumes. The values of other species is roughly estimated of being about additional €13 million. The last are mainly produced in around 50 RAS, which usually operate at a larger scale than the traditional pond facilities in Germany.

Blue mussels are produced in **on-bottom cultures (seg. 10.11)**. Longlines are only used to culture seed for stocking purposes and to supplement the still important livestock gained from fishing wild seed. The availability of the last is the crucial factor for the high fluctuation in production volumes of the segment. Other factors like ocean dumping from the rivers Elbe, Weser and Ems *et al.* and harbours, closing fishing areas, storms and the ongoing expansion of the pacific oyster (*Crassostrea gigas*) can negatively affect the availability of mussel seed and later the culture itself further. The blue mussel on-bottom segment has a culture period – depending on natural conditions – of one up to two years. By trend, on-bottom cultures in Lower-Saxony are more affected by the above mentioned impacts than the production of Schleswig-Holstein is.

Salmonids are produced traditionally in **trout ponds (seg. 2.1)**. It is assumed that the majority of farms (2018 more than 850 facilities) can still be classified here. Trout ponds also stood for around 3 000 tonnes of salmonid sales weight and €16.2 million of sales value in 2018. Also consisting only of 160 facilities assumed, the **trout tanks and raceways segment (seg. 2.2)** is much more productive. In 2018, they produced more than 7 000 tonnes of the salmonid production, which corresponds to a share of two-third of total German salmonid production. The value of sales from more mechanised segment was around €36 million. Only a very few enterprises use partly recirculation systems based on the example of Danish Model Farms. These few farms are classified as well under trout tanks and raceways segment. For German circumstances, these systems are relatively large and produce often more than 100 tonnes per year. In consequence, these few enterprises have a significant impact on the total quantities. Salmonid production mainly takes place in the federal states of Baden-Württemberg, Bavaria, Lower-Saxony and North Rhine-Westphalia. Together, these four states provide more than 80% of the national salmonid production.

Carp ponds (seg. 4.1) are mainly located in Bavaria, Saxony and Brandenburg. These three states provide more than 80% of the total German carp production. While there are larger farms in Saxony and Brandenburg, which not seldom operate with ponds more than 100 ha, Bavarian carp production is characterized by smallholder peasant farming as additional business or as an integrated system of a medium-sized terrestrial farm. Almost all carp production systems are earthen pond and polycultures. Traditional secondary species in carp ponds are sturgeon (*Acipenser ruthenus*), tench (*Tinca tinca*), pike (*Esox lucius*), perch (*Perca fluviatilis*), European catfish (*Silurus glanis*) and pike perch (*Sander lucioperca*). The volume of this side-production is not reported in details in the statistics, but should be about additional 10% of total carp production. Carp ponds stood for 4 746 tonnes of sales, which had a value of €17.4 million in 2018.

Figure 4.11.1 Main species in terms of weight and value in German production: 2018.



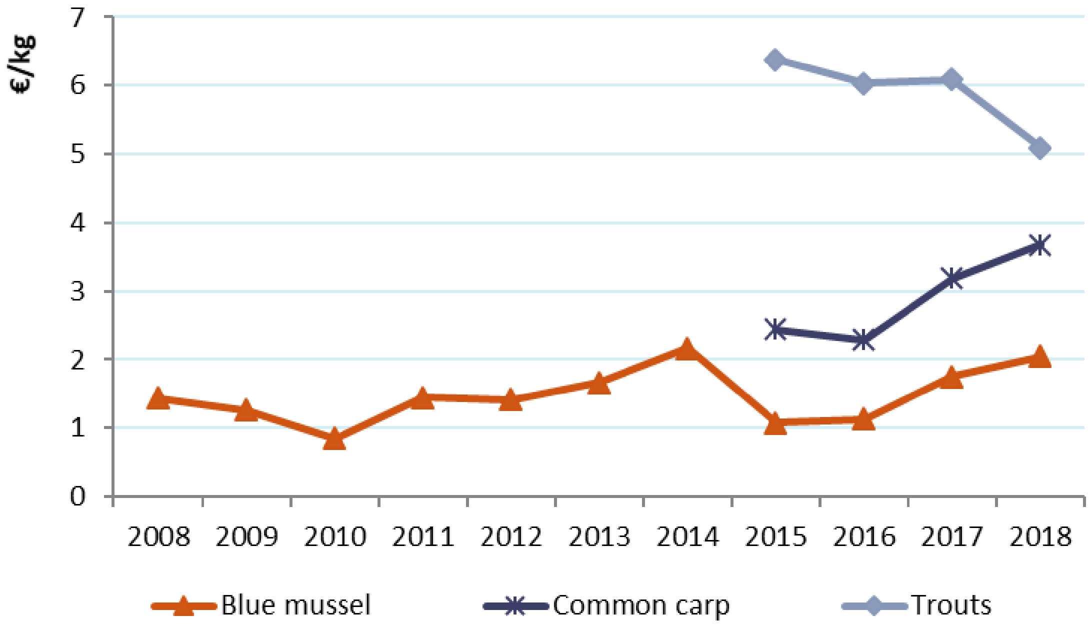
Source: EU Member States DCF data submission

German **blue mussel** enterprises are price takers in the European market. They sell their mussels either directly to Dutch wholesalers or indirectly via the central mussel auction in Yerseke in the Netherlands. The price highly depends on the quality of the mussel harvest. There are different quality classes at the blue mussel market. The bigger, the higher the flesh proportion and the brighter the flesh colour is, the higher the quality class and the price payed. The quality of mussels depends highly on environmental conditions and faced impacts in the extensive on-bottom culture. The best class is distributed to the gastronomy, where Belgium, Netherlands and France are important markets for German blue mussels. The lowest class sold gain up to three times lower prices than the highest quality. The lowest quality is distributed to discounters. In 2018, German mussel producers benefited from an extinction of blue mussel cultures in Dutch waters in particular and the southern North Sea in general, which resulted in a decreased supply and high prices for German blue mussels with an average price of €2.00 per kg (compared to €1.70 per kg in 2017).

The prices for freshwater species vary a lot per species, per region and per final product (fresh, chilled, frozen, smoked, etc.). For the majority of small-scaled **trout pond** farms direct-sales to the consumer is very important and generates the highest value. Here, point of sales are farmer markets and farm shops. Trout farms, which are classified to the **trout tanks and raceway segment**, often also have a direct marketing integrated in their business model, but provide markets for fingerlings and stocking as well as fish for processing (smokeries) simultaneously. The retailer market (supermarket) is not attractive for German trout entrepreneurs, because of comparable low prices and restriction, which supermarkets dictate suppliers for getting listed. Notwithstanding, there is a price transmission from trout imports observed, mainly from Denmark and Turkey to domestic trout commodities, which are offered in the supermarkets. In consequence, imports from these countries indirectly influence the price development, at least on wholesale level. A mixed calculation between different sales channels, different salmonid species and the above described impacts on price development led to average trout prices between €5.10 per kg and €6.40 per kg. Having only a few years of price development, it is not possible to interpret, if the decrease in mean prices from 2016 to 2018 is part of a natural market fluctuation or an ongoing trend.

For **carp pond** farms, carp imports from Czech Republic and Poland have a huge impact towards the price development. Of course, direct marketing also plays a role here, but wholesalers have a significant market power purchasing about 50% of the total sale volumes. Another quarter of sale volumes is distributed for stocking to angling clubs or other fish farms (including secondary species). The sales to restaurants and other retailers counts for approximate 20%. As orientation, German carp producers with less than 20 ha should gain at least €2.40 per kg to be profitable in mid-terms. Between 2015 and 2018, this mark was often reached looking at mean prices between €2.40-3.70 per kg. Only 2016, the mean price was €2.30 per kg and under this crucial mark.

Figure 4.11.2 Average prices €/kg for the main species produced in Germany: 2008-2018.



Source: own elaboration from EU Member States DCF data submission

While Mussel enterprises at least in Schleswig-Holstein and modern trout tank and raceways farms had positive net profit margins, the economic indicators clearly illustrate the structural change and economic pressure, which is putted on traditional pond farms in salmonid and carp culture. Another indicator of a critical economic situation for a part of the sector is the decreasing number of farms. However, the relative decrease in Table 4.7.3 among the segments is misleading due to methodical reasons. Trout farms were allocated via a fixed allocation formula towards the segments trout ponds or trout tanks and raceways. In fact, the last segment is definitely not as harmed by termination of businesses as the first.

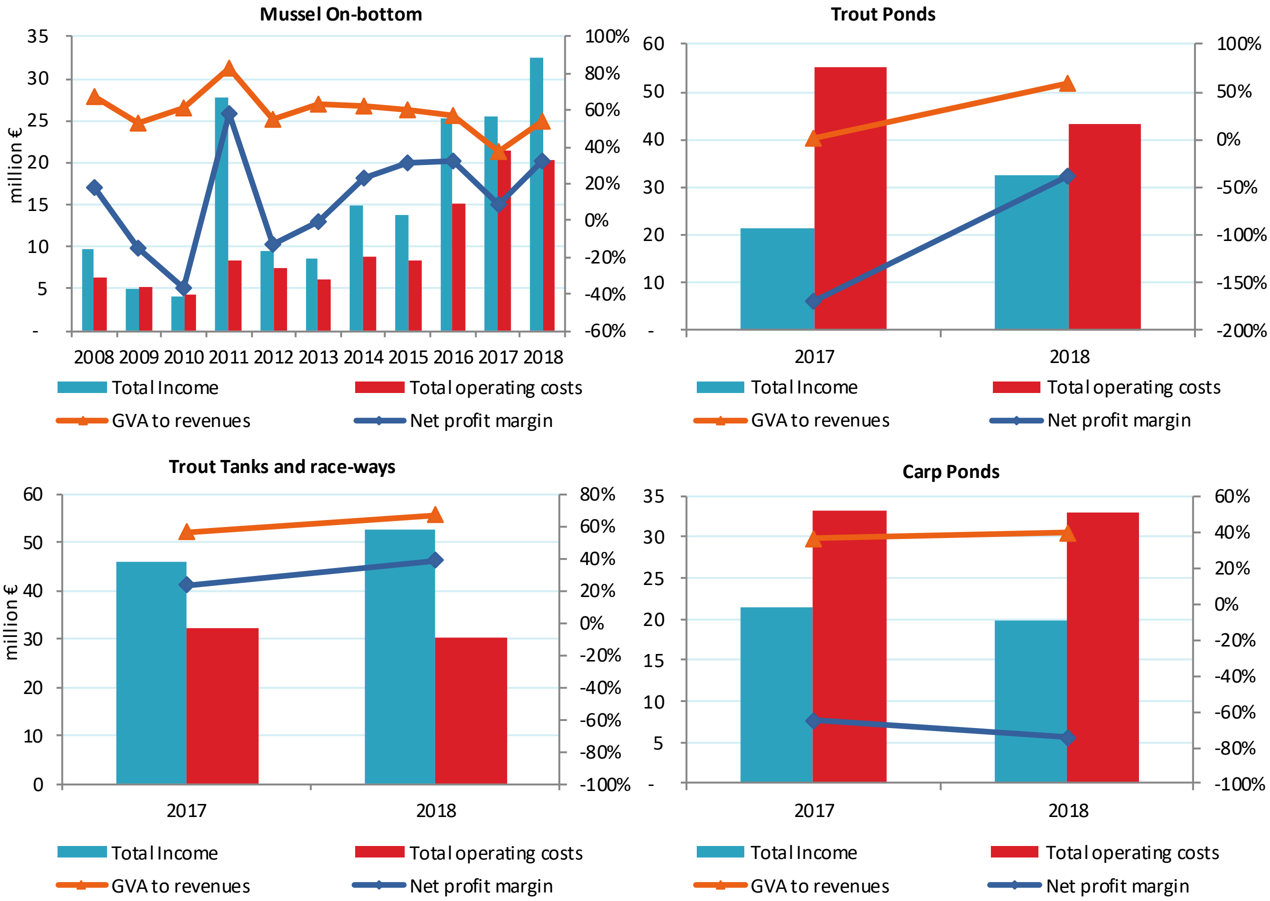
The main cost positions in the **blue mussel on-bottom segment** are fuel for the mussel vessel, wages and the purchase of imported mussel seeds. Mussel seeds are gained from imports, wild catch and long-line systems. The last two are integrated in the operating costs of mussel enterprises. In a mean, the cost or effort for blue mussel seed received from imports is €0.60 per kg, from fisheries (wild catch) is €0.25 per kg and from longlines is €0.80 per kg. In years with a good catch of wild mussel seed, imports are low and vice versa.

Table 4.11.3 Economic performance of main German aquaculture segments: 2017-2018.

	Mussel On-bottom			Trout Ponds			Trout Tanks and race-ways			Carp Ponds		
Variable	2017	2018	Change 2017-18	2017	2018	Change 2017-18	2017	2018	Change 2017-18	2017	2018	Change 2017-18
Number of enterprises	8	8	0%	919	869	-5%	169	160	-5%	1803	1717	-5%
FTE	96	104	8%	494	494	0%	222	222	0%	604	604	0%
Average wage (thousand €)	48.2	44.5	-8%	26.7	23.8	-11%	28.8	31.2	8%	15.8	16.3	4%
Labour productivity (thousand €)	87.1	149.8	72%	0.5	28.3	5591%	76.2	104.6	37%	10.4	11.3	8%
Total sales volume (thousand tonnes)	18.6	15.9	-14%	3.4	3.2	-5%	7.4	7.1	-5%	5.6	4.7	-16%
Total income (million €)	25.5	32.5	27%	21.2	32.5	53%	45.7	52.4	15%	21.4	19.8	-8%
Total operating costs (million €)	21.4	20.4	-5%	55.2	43.1	-22%	32.4	30.2	-7%	33.3	33.0	-1%
Gross Value Added (million €)	9.6	17.5	83%	0.3	19.3	5591%	25.6	35.2	37%	7.2	7.8	8%
Net profit (million €)	2.2	10.4	362%	-36.1	-12.7	65%	10.3	19.8	92%	-13.8	-14.7	-7%
Total value of assets (million €)	45.9	18.0	-61%	15.7	9.9	-37%	48.6	14.2	-71%	45.9	25.3	-45%
Net investments (million €)	9.0	0.5	-94%	0.8	2.2	156%	5.1	5.3	4%	1.2	2.9	134%
Capital productivity (%)	20.9	97.3	366%	2.2	193.9	8909%	52.7	248.0	371%	15.7	30.7	96%
Return on Investment (%)	4.9	57.6	1078%	-227.5	-124.8	45%	22.9	142.8	524%	-29.4	-58.3	-99%
Future Expectation Indicator (%)	15.5	-6.7	-144%	-6.6	4.2	164%	5.7	22.9	299%	-0.7	5.7	885%

Source: own elaboration from EU Member States DCF data submission

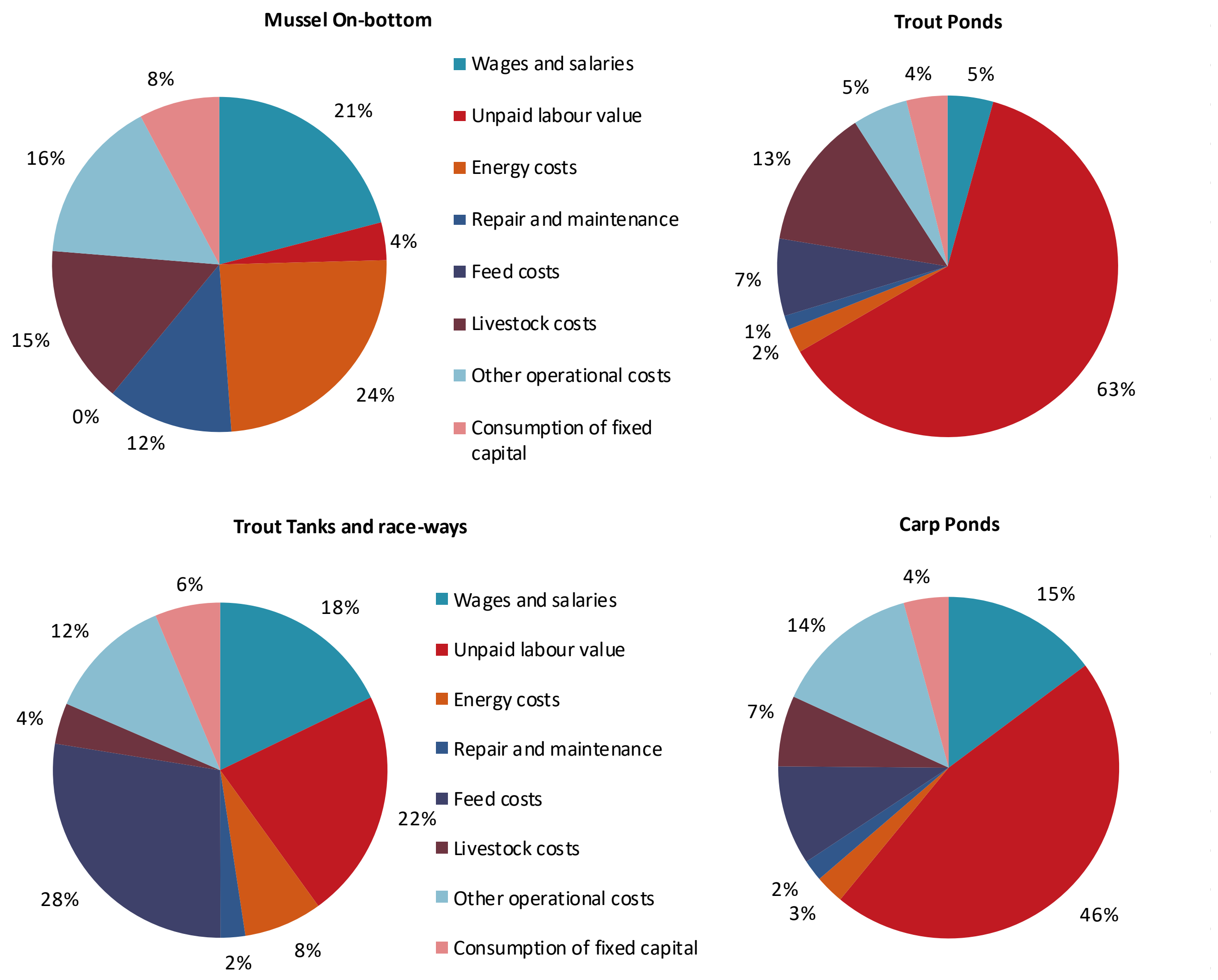
Figure 4.11.3 Economic performance in € million, indicators for the main German segments: 2017-2018.



Source: own elaboration from EU Member States DCF data submission

As traditional extensive or semi-intensive segments **trout and carp ponds** have a huge need of work force, which is mainly covered by unpaid labour provided by the owner himself and members of his family. If unpaid labour value is not considered, which often happens in contribution margin calculations, costs for fry and fingerlings are most important for trout ponds, because small scaled farms do usually not run own hatcheries. The cost for livestock are followed by feed costs next. Feed costs for trout ponds were about €1.10 per kg in 2018, which is mainly trout feed used for grow-out. Carps eat natural feed, produced by the ponds itself (plankton). Further, farmers feed additionally grain. Only large carp farms feed their stocks with fish feed to optimize growing rates. That mix resulted in average feed costs of about €0.36 per kg in 2018. Hence farms of the segment **trout tanks and raceways** tend to be larger scaled and more automated, labour costs are lower and feed costs make up almost 30% of total costs in average (in fact feed costs in modern farms can have a share of more than 40%). In 2018, average feed cost were €1.32 per kg. The feed cost are higher than in the segment trout ponds, because the more expensive feed for fry and fingerling is included. Cost for labour is almost equal distributed between wages for employees and value of unpaid labour. Of course, energy costs, mostly in form of oxygen is also an important part of salmonid cost structure. The low costs for livestock is caused in the fact, that farms of this segment are mainly vertical integrated. Hatchery, nursery, grow-out and (sometimes) processing are part of the farm. The effort invested into the production of own eggs, fry and fingerling are already considered in the other operating costs.

Figure 4.11.4 Cost structure of the main segments in Germany: 2018.



Source: EU Member States DCF data submission

4.11.5 Outlook

Nowcasts for 2019-20

In 2019, 2 488 freshwater aquaculture facilities produced 18 532 tonnes of salmonids, carp and other freshwater species. The landings statistics of mussel enterprises report a production of 19 413 tonnes in 2019, but the report is tentative. However, it indicates that the positive trend of blue mussel production is ongoing, which mainly results from very good harvest in Schleswig-Holstein again, while mussel enterprises in Lower-Saxony face challenges. 2 036 people were employed in the marine and freshwater aquaculture sector in 2019 and it can be assumed that the amount of unpaid labour, owners and family labour, is similar to 2018 with a slight decreasing trend (cf. Trends and Triggers).

Trends and triggers

- **Mussel seed:** Blue mussel producers tend to culture mussel fingerlings with longlines, where natural seed find optimal growing conditions. However, the technique is still very cost intensive compared to wild caught or the resettlement of wild cultures of young mussels from neighboring coastal areas (imports).
- **External impacts in the North Sea:** Blue mussel producers at the southern North Sea in Lower-Saxony suffer from climate change impacts (e.g. increased frequency of storms), increased ocean dumping from rivers like Elbe, Weser and Ems and harbors maintenance,

construction work for new offshore wind parks and the ongoing expansion of the pacific oyster (*Crassostrea gigas*) in particular. In contrast, blue mussel producers in Schleswig-Holstein located at the middle North-Sea profit from struggling competitors in the South North Sea (Lower-Saxony and Netherlands).

- **Climate change impact on-shore:** Shortage of water supply and increased water temperatures put economic pressures on freshwater fish producers and lead to necessary new investments (e.g. pump systems, water treatment, fish stables).
- **Concentration process**: Ongoing trend of decreasing number of farms. In particular, small-scaled farms have exited the market in the last decade. In contrast, the overall production does only slightly decrease, which infers that the sector get more concentrated (Destatis).
- **Investment backlog**: Small farms are much less able to arrange needed investments in up-to-date techniques to meet current challenges (climate change impact, concentration process, lack of successors *et al.*).
- **Predators**: In particular, carp farms suffer from fish loss due to protected wild fish predators like cormorant or otter. In average, interviewed carp farmers reported a fish loss due to predators of about -28% per year. Trout farmers reported average fish loss due to predators of about -12% per year. The last are able to invest in predator protection measures, because their rearing systems are more compact and easier to protect than carp ponds (own survey, n=104).
- **Over-aging**: The average age of German fish farm owner was 54 years in 2018 (own survey, n=104). In general, the mean of German workforce age is 44 years (Destatis).
- **Gender-gab**: Only 7% of farm owners are female (own survey, n=104). In contrast, 55% of all workforce is female in Germany's industries and services (Destatis).
- **Lack of successors**: In particular, small traditional farms struggle in finding a successor (cf. concentration process).
- **Direct marketing**: The COVID-19 pandemic seems to boom the direct marketing. But, this increase of direct marketing could not balance the overall negative economic impacts of the pandemic (decrease demand from gastronomy, cf. COVID-19 impact).

4.11.6 COVID-19 impact

German **blue mussel** firms could profit from very high prices in third and fourth quarter of 2020, which are results of a demand surplus at the end of the year and led to high turnovers. In contrast, this surplus based partly on the fact, that mussel farms at the southern part of North sea did not prepare the total harvest 2019/2020 for sale in the second half of 2020 in spring as usual. In spring, the pandemic situation was highly alarming. Gastronomy was closed, the mussel auction in Yerseke was closed, logistics were disturbed, mussel vessels could not ensure hygienic rules such as social distancing on board and stayed at port. In consequence, a significant part of consume mussels were not shifted from winter on-bottom storage cultures to shallow, sale storage cultures, where ready-for-sale mussels get usually a final growth boost. The described impacts effected the mussels firms in Lower-Saxony more than in Schleswig-Holstein, where firms could sell their harvest earlier in the first quarter of 2020 because of better natural frame conditions. However, not shifted blue mussels, which remained in face of the uncertainty at winter on-bottom storage cultures are putted (once more) at risk of winter storms and other negative impacts. High losses in volumes could be the consequences for the next harvest and the true financial consequences for the mussel enterprises will occur in 2021.

Regarding **freshwater aquaculture**, almost 50% of interviewed firms (n=87) reported decreased sales and turnover for 2020. While carp farms, which experienced a decrease in sales, had loss of about minus 28% in average; salmonid (trout and char) farms had experienced loss of about minus 20% in average. More often than carp farms, salmonid aquacultures were able to enhance their direct marketing (angling ponds as additional enterprise included). More than 25% of salmonid farms could increase their sales about 13% in average. New regional adaptation strategies like "carp-to-go" were investigated. These initiatives have created alternative sale channels while the gastronomy was forced to close during the important Easter season. Further, prices for carp in the winter sale season (Christmas sale peak) were unusual high, because of a demand surplus mainly caused in disturbed imports from Czech Republic and Poland. However, both facts could not balance the overall loss of the carp branch. Finally, around 40% of carp and salmonid farmers did not experienced any impacts on their business by the pandemic.

A dominating majority (more than 80%) of all interviewed farmers in Germany from freshwater and blue mussel aquaculture (n=92) agreed, that the pandemic of Covid-19 is not the most important challenges for aquaculture (cf. trends and triggers).

4.11.7 Data Coverage and Data Quality

Until 2011, aquaculture statistics based on (partly estimated) data from the sixteen federal states' fisheries authorities (Brämick 2013 *et seq.*). Since that time, the national Federal Statistical Office of Germany (Bundesamt für Statistik, Destatis) has taken over central responsibility. It collects the data directly via an annual census among fish farmers to be in line with the European Regulation EC No 762/2008. Furthermore, Destatis have introduced thresholds in 2015. Since then, the statistical reports only consider farms more than 0.3 ha or 200m³. In reducing bureaucratic effort for smallholders this introduction of thresholds is welcomed. Notwithstanding, it leads to the fact, that the statistic are not comparable with recent years since 2015.

In terms of economic indicators for freshwater aquaculture, there is a need to reform the national agricultural statistic law (Agrarstatistikgesetz). In contrast to production data requested by Eurostat data collection, the provision of economic and demographic data, which are collected under the DCF, is not mandatory for fish farmers. This voluntary base results in four shortcomings. Firstly, the DCF data collecting organisation in Germany (Thuenen-Institute) does still not have access to the national register of aquaculture firms and hence to the addresses of the population. For that reason, Thuenen-Institute's survey bases on an alternative researched address register. Secondly, the response rate of fish farmers tend to be quite low in a written survey. In 2018, the answers represented only 4% of the facility population (N=2 746), but 15% of the production volume. To have at least a holistic picture of the sector's economics, data from the sample is projected towards the sector. In some cases, like the majority of cost positions, the coefficient of variation is quite appropriate, less than 0.2. In other cases, such as subsidies it is outstanding worse (more than 0.8). Thirdly, the sample refers to the same sample frame, but does not cover the same farms in the sample. Only a part of farms, which responded to the survey in 2017, did also respond to it in 2018. In addition, farms, which did not response to the survey in 2017, responded to it in 2018. This limits the comparability within the survey. Fourthly, the presented data originates from different sources: production volume and number of facilities are transferred from Destatis census (in case of mussels from Federal Office for Agriculture and Food/Bundesamt für Landwirtschaft und Ernährung, BLE), data on employment is transferred from national labour agency (Bundesagentur für Arbeit, BA) and data on unpaid labour and the majority of economic indicators like turnover, costs, investments etc. results from the above mentioned survey among fish farmers.

In consequence, the chapter provides a holistic picture of the sector by merging all information available about the economics of the sector on the one hand. However, this picture might only provide a good orientation, which lacks in precision due to above reasons on the other hand. Germany has addressed these shortcomings in its new Strategy for Aquaculture 2021-2030 (Nationaler Strategieplan Aquakultur für Deutschland) under the EMFAF.

4.12 Greece

Overview of Greek aquaculture

In Greece, the seabass and seabream segment constitutes the largest part of aquaculture production, followed by the mussel, trout, and other freshwater fish. The sector in 2018 demonstrates an increase in sales weight and sales value at 130.8 thousand tonnes and €556.3 million. Also, for 2018, there are 650 enterprises with 3 584 employees and the sector demonstrates financial losses of €52.4 million, despite the sales increase.

4.12.1 Total Production and sales

For the total aquaculture sector sales in Greece, 2017 was a break in a 3-year continuous trend of increase that appeared again in 2018 with a 9% rise and an overall 11% increase for the 2008-2017 period. In 2018, marine aquaculture demonstrated a 7% increase from 2017 while the seabass & seabream production sector is still under further consolidation resulting in the concentration of aquaculture units under large companies' management.

The mussel production sector demonstrates a significant 26% increase of sales volume in 2018. During 2017, a long-awaited designation of Areas of Organized Aquaculture Development (AOAD or POAY in Greek) started and the decline of production is considered an occasional one since it was attributed to a mussel farms association, in a specific area, due to the attempts of harmonization with the European directives and relocation of units in accordance with the new policies. Production the following year was immediately normalized, as the new European directives were generally followed. This case may be repeated in the future for other associations as relocation for the first year at least carries such a risk. But according to Greek authorities, the procedure of new AOAD designation will be completed by 2022. The mussel price is stabilized in the last 5 years and shows a satisfactory increase in the domestic market where the price is usually better and was helped even further by its entry into supermarket chains and small fish shops in deshelled form. Freshwater production, mainly trout, has stabilized sales volumes for 2017-2018 at 4.5 and 4.2 thousand tonnes, respectively.

Regarding the sales value, both marine and shellfish demonstrated a rise in 2018 while the freshwater sales dropped 4%. For the period 2008-2017, only marine aquaculture demonstrates a continuous trend of increase. For the same period, the mussel aquaculture shows a decrease in sales value reflecting the respective mussel price drop.

4.12.2 Industry structure and total employment

Regarding the aquaculture companies in Greece, a percentage of 20% corresponds to SA and Ltd enterprises that demonstrate over 80% of the total sector's yearly sales. The largest companies operate in the seabass & seabream sector. In Greece, most aquaculture units are not economically autonomous units and there are cases where a single company may own or rent numerous fish farms, especially in the case of seabass-seabream. For 2018, the 650 units belong to 407 companies.

In the case of mussel farms, there are numerous proprietors with registration codes for tax purposes registered as mussel farmers that often own percentage ownership in several mussel farms. There is a small drop of shellfish farm units in 2018 compared to 2016 and 2017 attributed to relocation in new areas or due to merging caused by the establishment of Areas of Organized Aquaculture Development.

As for employment in the aquaculture sector, it remained generally on the same levels during 2017-2018 except for freshwater sector that demonstrated a small increase of 5% while in FTE terms the marine sector had a 15% increase in 2018 attributed mainly to consolidation of the sector and merging of companies.

Table 4.12.1 Production and sales, industry structure and employment for Greece: 2008-2018.

Variable	2008	2010	2012	2014	2016	2017	2018	Change 2017-18	Develop. 2018/(08-17)
Sales weight (thousand tonnes)	**115.4**	**123.6**	**114.8**	**118.0**	**135.2**	**119.6**	**130.8**	9%	11%
Marine	90.3	102.4	95.0	89.5	107.1	98.5	105.7	7%	11%
Shellfish	21.2	18.0	17.6	21.8	25.7	17	21	26%	13%
Freshwater	3.9	3.2	2.2	6.7	2.5	4.5	4.2	-8%	18%
Sales value (million €)	**456.0**	**534.7**	**545.0**	**448.1**	**583.9**	**545.3**	**556.3**	2%	12%
Marine	433.8	514.6	530.5	433.4	562.6	527.9	539.0	2%	12%
Shellfish	9.0	8.6	7.1	8.6	10.3	6.1	6.5	6%	-17%
Freshwater	13.2	11.5	7.4	6.1	11.0	11.3	10.9	-4%	8%
Number of enterprises	**1,038**	**1,017**	**1,051**		**642**	**659**	**650**	-1%	-16%
Marine	337	337	380		329	343	347	1%	4%
Shellfish	604	590	595		201	201	193	-4%	-57%
Freshwater	97	90	76		112	115	110	-4%	14%
Employment					**3,786**	**3,536**	**3,584**	1%	-3%
Marine					3,111	3,026	3,064	1%	1%
Shellfish					385	325	325	0%	-22%
Freshwater					290	185	195	5%	-23%
FTE					**3,482**	**2,924**	**3,338**	14%	4%
Marine					2,676	2,574	2,958	15%	15%
Shellfish					575	199	199	0%	-54%
Freshwater					231	151	181	20%	-12%

Source: EU Member States DCF data submission

4.12.3 Overall Economic performance

Total income of the aquaculture sector, despite a 3% drop in 2018, shows an increase during the 2014-2018 period. Regarding the industry's costs, total operating costs show significant increase in 2018 in comparison to 2017 and throughout the 5-year period while the cost of wages has decreased by 11% due to low wage levels especially for new employees.

The consolidation of the sector and merging of smaller companies to large ones and the dominance of very large seabass & seabream enterprises reveal the increase of foreign capital dependency of the aquaculture companies in Greece with increased financial costs due to bank loans (for new investments), and capital depreciation. In 2018, 37% of the SA and Ltd enterprises demonstrate losses in their financial annual reports while for 2017 the respective percentage of companies with financial losses was 20%.

Furthermore, most losses are attributed to large and very large companies and the respective losses reach in some cases tens of million euro. According to their balance sheets, most companies attribute those financial results to the reduced selling price of fish and to the reduced valuation price of livestocks at fair value, where, in their case, the financial impact is severe since the stocks are significantly large. Those facts lead to the financial losses in 2018, in both earnings before interest and taxes and negative net profit values. Also, despite an increase in total assets, capital productivity and return of investment rates drop in 2018.

Table 4.12.2 Economic performance of the Greek aquaculture sector: 2014-2018.

Variable	2014	2015	2016	2017	2018	Change 2017-18	Develop. 2018/(14-17)
Total income	680.3	476.1	585.6	835.4	806.3	-3%	25%
Total operating costs	657.4	370.0	432.2	710.6	805.9	13%	49%
Total wages	99.3	53.4	56.5	69.0	61.5	-11%	-12%
Gross Value Added	119.0	159.5	209.9	193.7	61.9	-68%	-64%
Depreciation of capital	18.7	13.9	10.6	24.9	26.5	7%	56%
Earning before interest and taxes	4.2	92.2	142.8	99.9	- 26.2	-126%	-131%
Financial costs, net	45.1	7.4	14.8	25.8	26.3	2%	13%
Net profit	- 40.8	84.7	127.9	74.1	- 52.4	-171%	-185%
Total value of assets	1,200.3	1,045.7	1,088.9	1,374.7	1,362.5	-1%	16%
Capital productivity (%)	9.9	15.2	19.3	14.1	4.5	-68%	-69%
Return on Investment (%)	0.4	8.8	13.1	7.3	- 1.9	-126%	-126%

Source: own elaboration from EU Member States DCF data submission

4.12.4 Main species produced and economic performance by segment.

The main aquaculture species produced in Greece are seabream, seabass, mussel, and trout. For 2018, seabream production corresponds to 42% of total production volume and 46% of total production value. Additionally, seabass represents 36% of total production volume and 46% of value. There is also significant production of hatcheries/nurseries units as well as other marine fish cages units, most of them operate under the seabass seabream production companies and although most of the fry production is used for own purposes during the production process, fry sales are a secondary revenue form. According to the Hellenic Ministry of Rural Development and Food, total fry production in Greece for 2018 amounted to 433 905 thousand juveniles, of which 95% was seabass and seabream and 55% was used for own purposes. The same companies usually own other marine cages activity where Mediterranean species are farmed, such as Red porgy, Meagre, Dentex and others.

Mussel production corresponds to 16% of total production volume but only to 1% of value. Last, trout production represents 2% of total volume and 1% of total value.

Figure 4.12.1 Main species in terms of weight and value in Greek production: 2018.

Source: EU Member States DCF data submission

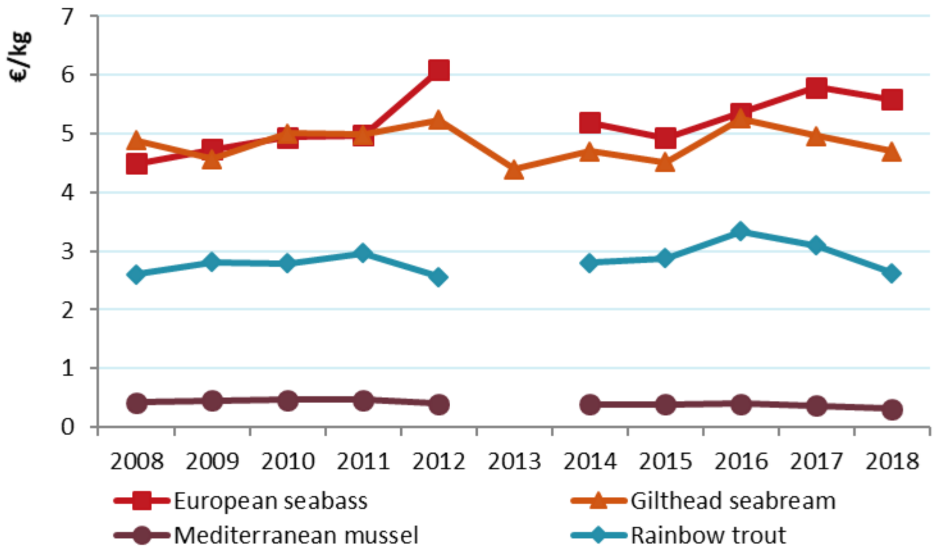
The price for seabass in Greece converges for the year 2018 to around €5.6 per kg and for seabream to €4.7 per kg as in Greece, the price for sea bass is always higher than the price of sea bream on an average of €0.70 during the last 10 years. For the 2008-2018 period, the average price for seabass was €5.2 per kg and for seabream €4.8 per kg. Greece, compared to the other European Mediterranean countries, usually has the lowest price per kilogram, which is due to the competition from the corresponding low prices of the neighbor Turkey. 70% of Greek production is exported to Italy (35-37%), Spain (10-14%), France (8-12%) and Portugal (8-10%). Only 19% is directed to domestic consumption, the highest rate recorded in the last decade, due to the placement of these products in Greek supermarkets. The ongoing consolidation of the seabass & seabream sector in Greece, favors the possession of significantly large livestocks by the companies to ensure competitive prices.

For Mediterranean mussel, in 2018 the average price was €0.31 per kilogram while during the past decade the average price ranges from €0.31-€0.37 per kilogram. The fact that the largest production units are located in Northern Greece facilitates the direct transfer and sale of production to the neighboring country Italy (exports make up 80-90% of total domestic production). As mentioned previously, new mussel farms are expected to emerge from establishment, relocation and merging due to designation of Areas of Organized Aquaculture Development.

Regarding the rainbow trout, in Greece, after a period of reduced production and partial operation of trout farms, a recovery is undergoing since 2016 with an increase in production from 70-100% and the average price reached €2.65 per kg for the year 2018. The main destination of trout exports are the Balkan countries, which have traditionally had the highest consumption of similar fish species (Bulgaria, Romania).

The increase in trout production and the significant quantities of mussel production and exports have also led to the creation of processing units, with smoked trout and deshelled mussels as the main products, favoring an increased demand for these species.

Figure 4.12.2 Average prices €/kg for the main species produced in Greece: 2008-2018.



Source: own elaboration from EU Member States DCF data submission

According to the new EUMAP segmentation, the aquaculture segments in Greece are as follows:

- Segment 1: Sea bass & Sea bream Cages
- Segment 2: Mussel Longline
- Segment 3: Trout Tanks and race-ways
- Segment 4: Other freshwater fish Other methods

There are some changes between DCF and EUMAP segments:

The segment 2.2 "Trout tanks and raceways" previously was under the DCF segment 2.2 "Trout on growing".

The segment 8.5 "Other freshwater fish Other methods" was under the DCF segment "Other freshwater fish combined (seg5.3)"

And last, "Mussel Longline (seg10.10)" corresponds the DCF segment Mussel Long line (seg7.2)

In aquaculture sector data collection for Greece, seabass and seabream production sector is reported under three segments, Sea bass & Sea bream Cages (seg3.6), Sea bass & Sea bream Hatcheries & nurseries (seg3.8) and Other marine fish Cages (seg9.6) as requested by the Hellenic Ministry and should be reviewed as one under the main cages segment as it has been proposed in the previous EWG, since the allocated revenues and costs belong in most cases to same companies with parallel activities.

Segment 1: Trout cage production

The trout on growing segment as mentioned before is undergoing a restructure and according to the financial results, the increased sales volume (22% in 2018 compared to 2017) and value (6% in 2018) were followed by an increase in FTE employment (54% in 2018) and operating costs by 30%. The segment demonstrates losses of €0.8 million and drops on capital productivity and return on investment performance indicators.

Segment 2: Mussel Longline

The mussel aquaculture activity as aforementioned is partly in restructure due to new designated Areas of Organized Aquaculture Development. Nevertheless, the mussel longline segment in Greece, despite the low mussel price, shows for 2018 26% increase in sales volume, 6% increase in total income and after financial losses in 2017, demonstrates profits of €0.7 million. Also, indicators like return of investment and FEI show impressive increase (154% and 209%, respectively).

Segment 3: Other freshwater fish Other methods

The segment of Other freshwater fish Other methods demonstrates for 2018 a 15% increase on total income and has minimized the previous year losses. Capital productivity has a 104% increase compared to 2017, return of investment shows 96% increase and FEI a 31% increase.

Segment 4: Seabass and Seabream Cages

The largest part of the aquaculture industry in Greece, the seabass & seabream cages segment, undergoing a consolidation and restructuring phase that according to the Federation of Greek Maricultures will be completed in 2021, for 2018 shows a small increase in enterprises (3%) and a 15% increase in FTE. Average wage dropped by 20%, as it was the case for all aquaculture segments. The total sales volume demonstrated a raise of 7% followed by a raise in operating costs (21%) and a 4% drop in total income. The segment, after 3 years of profits demonstrated losses of €50.6 million mainly due to the impact of low fish prices on the livestock valuation for some very large companies in the sector. There were also significant drops in capital productivity (76%), Return of investment (117%), and FEI (52%) in 2018.

Table 4.12.3 Economic performance of main Greek aquaculture segments: 2015-2018.

Variable	2015	2016	2017	2018	Change 2017-18	Develop. 2018/(15-17)
Trout Tanks and race-ways						
Number of enterprises	49	62	63	59	-6%	2%
FTE	124	120	56	86	54%	-14%
Average wage (thousand €)	14.5	9.1	19.2	14.9	-22%	4%
Labour productivity (thousand €)	26.5	29.2	27.5	13.0	-53%	-53%
Total sales volume (thousand tonnes)	2.0	2.1	1.9	2.3	22%	16%
Total income (million €)	5.8	6.9	5.9	6.2	6%	0%
Total operating costs (million €)	3.5	3.2	5.2	6.8	30%	70%
Gross Value Added (million €)	4.2	4.8	2.5	1.3	-47%	-66%
Net profit (million €)	2.3	3.6	0.5	-0.8	-276%	-139%
Total value of assets (million €)	4.3	4.9	5.7	4.5	-22%	-10%
Net investments (million €)	0.0	0.0	0.9	0.1	-86%	-59%
Capital productivity (%)	97.5	96.7	43.2	29.1	-33%	-63%
Return on Investment (%)	53.6	73.4	8.9	-17.1	-292%	-138%
Future Expectation Indicator (%)	-1.9	-1.2	12.6	-2.3	-118%	-172%
Mussel Longline						
Number of enterprises	185	201	201	193	-4%	-1%
FTE	511	575	199	199	0%	-54%
Average wage (thousand €)	7.6	5.5	18.9	13.6	-28%	28%
Labour productivity (thousand €)	15.8	26.2	17.5	18.0	3%	-9%
Total sales volume (thousand tonnes)	22.8	25.7	16.6	20.9	26%	-4%
Total income (million €)	8.9	10.3	6.1	6.5	6%	-23%
Total operating costs (million €)	4.1	3.3	7.4	5.6	-24%	14%
Gross Value Added (million €)	8.6	10.1	5.7	5.8	3%	-28%
Net profit (million €)	4.8	6.9	-1.3	0.7	152%	-81%
Total value of assets (million €)	4.4	0.9	1.0	1.2	17%	-42%
Net investments (million €)	0.0	0.0	0.0	0.0	250%	846%
Capital productivity (%)	198.0	1080.9	546.5	481.0	-12%	-21%
Return on Investment (%)	109.0	741.5	-121.8	65.8	154%	-73%
Future Expectation Indicator (%)	-0.4	-1.2	-0.8	0.9	209%	207%
Other freshwater fish Other methods						
Number of enterprises	51	50	52	51	-2%	0%
FTE	112	111	95	95	0%	-10%
Average wage (thousand €)	15.9	12.1	19.0	13.8	-27%	-12%
Labour productivity (thousand €)	83.1	10.5	-404.6	17.8	104%	117%
Total sales volume (thousand tonnes)	5.5	0.4	2.6	1.9	-30%	-35%
Total income (million €)	13.7	4.1	7.5	8.6	15%	2%
Total operating costs (million €)	5.1	4.1	49.2	9.3	-81%	-52%
Gross Value Added (million €)	10.4	1.3	-38.4	1.7	104%	119%
Net profit (million €)	7.9	-0.6	-42.7	-1.7	96%	86%
Total value of assets (million €)	13.3	9.9	9.1	9.2	1%	-14%
Net investments (million €)	0.0	0.6	0.0	0.3		48%
Capital productivity (%)	78.2	13.4	-421.5	18.3	104%	117%
Return on Investment (%)	59.3	-6.0	-467.4	-17.9	96%	87%
Future Expectation Indicator (%)	-5.3	0.7	-10.7	-7.4	31%	-44%
Sea bass & Sea bream Cages						
Number of enterprises	273	329	343	347	1%	10%
FTE	2487	2676	2574	2958	15%	15%
Average wage (thousand €)	18.5	19.0	21.7	17.4	-20%	-12%
Labour productivity (thousand €)	42.3	60.1	82.2	13.6	-83%	-78%
Total sales volume (thousand tonnes)	0.1	0.1	98.5	105.7	7%	221%
Total income (million €)	447.6	564.3	815.9	784.9	-4%	29%
Total operating costs (million €)	357.4	421.4	648.9	784.3	21%	65%
Gross Value Added (million €)	136.3	193.8	224.0	53.0	-76%	-71%
Net profit (million €)	69.8	118.1	117.6	-50.6	-143%	-150%
Total value of assets (million €)	1023.8	1073.2	1358.8	1347.5	-1%	17%
Net investments (million €)	5.4	10.8	33.4	29.9	-11%	81%
Capital productivity (%)	133.1	180.6	164.8	39.3	-76%	-75%
Return on Investment (%)	7.5	12.4	10.5	-1.8	-117%	-118%
Future Expectation Indicator (%)	-0.7	0.1	0.7	0.3	-52%	2516%

Source: own elaboration from EU Member States DCF data submission

Figure 4.12.3 Economic performance in € million, indicators for the main Greek segments: 2008-2018.

Source: own elaboration from EU Member States DCF data submission

Figure 4.7.4 shows the cost structure of the four main aquaculture segments in Greece.

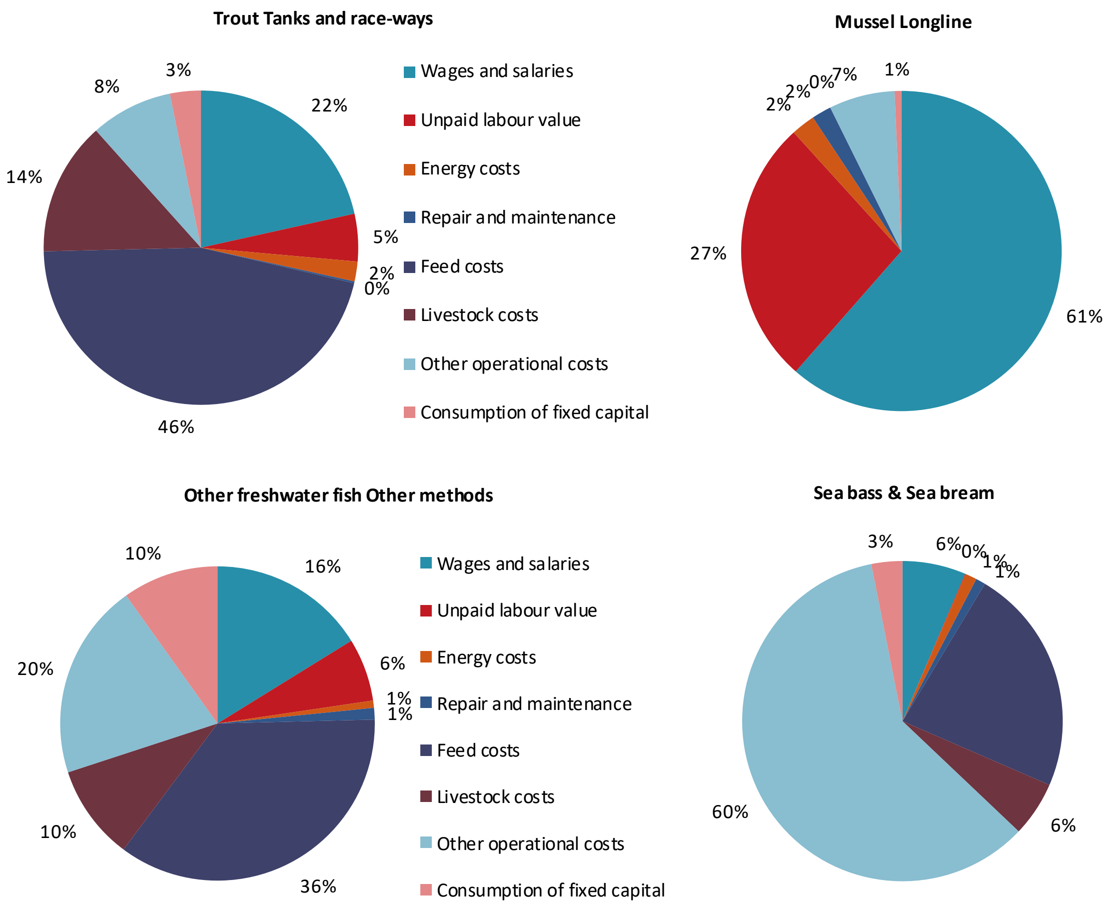
Regarding 2018, For the seabass and seabream cages segment, other operational costs represent 53% of total operational cost followed by feed cost (34%), livestock cost (7%) and consumption of capital (4%).

For trout tanks and raceways, the most significant costs are feed cost (46%) followed by wages (22%), livestock cost (14%), other operational costs (8%) consumption of capital (3%) and energy cost (2%).

The mussel longline greatest production cost is wages and salaries (61%) followed by imputed value of unpaid labor (27%), other operational costs (7%) and repair and energy costs equally at 2% each.

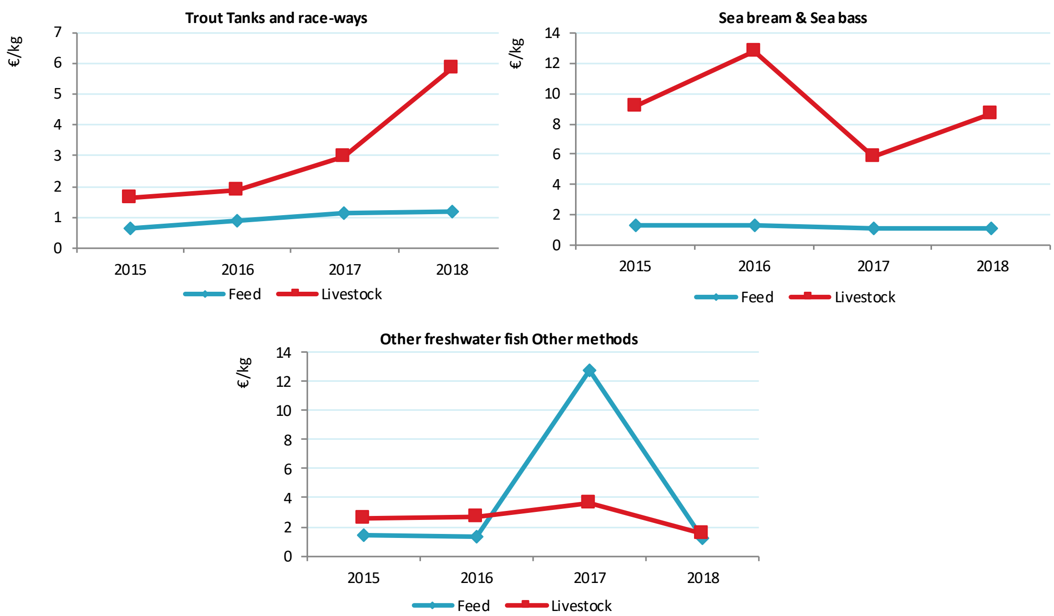
Last, the Other freshwater fish Other methods production cost structure consists of raw material costs (36%), other operational costs (20%), wages and salaries (16%), consumption of fixed capital and raw material cost both at 10% imputed value of unpaid labor (6%) and energy and repair costs both at 1%.

Figure 4.12.4 Cost structure of the main segments in Greece: 2018.



Source: EU Member States DCF data submission

Figure 4.12.5 Feed and livestock average prices (€/kg) for the main Greek segments: 2008-2018.



Source: own elaboration from EU Member States DCF data submission

4.12.5 Outlook

Nowcasts for 2019-20

Limited fluctuations of the total production are expected for both 2019 and 2020.

A significant increase of production volume is expected for marine fish other than seabream and seabass.

Trends and triggers

The mergers of marine aquaculture companies in Greece reached a peak during 2020 and no significant changes are expected in the marine fish farming structure in the near future.

The impact of covid-19 outbreak in the economy of the EU is expected to negatively affect the demand for fresh fish in the EU. Due to alleviation measures already undertaken by the producers this lower demand is expected to be offset by the expansion in new markets. Gloria storm and reduced aquaculture supply in Spain had a positive impact on export volumes and export price for non-affected producers including producers in Greece.

New aquaculture-based products are expected to be introduced in the market, mainly ready to cook and ready to eat products. This is partly an effect of the covid-19 outbreak that forced some of the producers to stock production in the form of deep-frozen products. A limited negative impact on turnover and profit is expected in the short run.

The total production volume is not expected to change significantly for any production segment (marine fish mussels, trout) though year-to-year production may be affected by natural phenomena such as storms and diseases.

A significant rise in the production of marine species other than seabass and seabream is expected.

A new label "Fish from Greece" has been introduced recently targeting export markets in order to differentiate from non-EU imported products. If successful, this label may aid to level the playing field between the Greek products produced under strictly regulated conditions in the EU and non-EU products.

4.12.6 COVID-19 impact

The covid-19 outbreak is still ongoing, thus impacts refer to the period of 2020.

Due to the lockdown in Greece and other EU countries, HORECA demand was limited, significantly affecting sales and export during the initial stage of the outbreak. Demand from tourism was also limited. Exports by air were constrained to North America. Packaging and processing were disrupted due to new sanitary rules. Producers turned to deep-freezing of products and new markets. The price initially decreased as a result of higher supply and lower demand, though after the Gloria storm in Spain, price rose again. Some covid-19 state aid funds were and still are available for the aquaculture industry in Greece.

4.12.7 Data Coverage and Data Quality

As it is previously mentioned, in Greece, most aquaculture units are not economically autonomous units and there are cases where a single company may own or rent numerous fish farms, especially in the case of seabass-seabream species. For 2018, the 650 units belong to 407 companies or, in the case of mussel farms, registration codes for tax purposes since a person registered as mussel farmer often owns percentage ownership in several mussel farms. For monitoring purposes, the data collection follows the aquaculture unit structure according to National Work Plan 2017-2019. In the previous aquaculture data collection, the issue of seabass & seabream segmentations emerged. Most of the sector's companies operate two or more parallel activity segments and since the secondary ones like hatcheries/nurseries, demonstrate zero or exceptionally low revenue as production is used for own consumption and the fry value is very small while the costs are allocated equally, the segments analysis produced faulty financial results. Therefore, and according to suggestions from the previous STECF aquaculture report, although the seabass & seabream segments and volumes were uploaded separately as in previous data call, the seabass seabream economic analysis was focused on the main cage activity.

The data collection methodology followed the National Work Plan 2017-2019 and the methodologies, guidelines and practices agreed by PGECON, are implemented in the survey. Most economic data was collected according to census method with estimation procedures applied for certain values like energy cost and unpaid labour due to inadequate input of small companies or reluctance to answer, using the non-probability sample survey method. The data collection methodology consisted of the mailing and completion of a questionnaire that included topics of both social and economic data, employment, production and revenue values along with the company's cost structure and a short enumeration of the company's main problems and predictions followed by onsite visits to the companies that completed the questionnaire along with a data processing of published balance sheets and financial statements.

Additional sources for aquaculture data collection are companies' published balance sheets available mostly online from companies' websites and Ministry of Finance's databases, due to enterprises' obligation to publicize them. Regarding confidentiality, during on site interviews, for social data and production cost structure data collection, no personal data is collected. The collected data provided by financial records and questionnaires as well as segmented values provided by non-probability sample survey, were supplemented with and cross checked by data from Prefectural Chambers of Commerce, Industry and Trade (e.g. brand name, location, VAT number, phone and fax numbers),Prefectural Directorates of Fisheries and Veterinary Services, the National Food Control Agency (EFET) and the Hellenic Ministry of Rural Development and Food (e.g. purchase of raw material, production per species, total sales in quantity and value, employment, functioning regulations), from the Integrated Monitoring System of Fisheries Activities (OSPA) and from business and professional online data bases.

Issues of confidentiality are raised during the social data and environmental data gathering attempts especially on smaller companies. For the large companies' case, since in Greece there are very large enterprises with over one thousand employees as well as large ones that employ hundreds on various activities especially due to the consolidation of the seabass seabream sector, segmented data generally is only offered in total (men and women in total, age segmentation in total etc) and not interconnected (how many women over 24 had higher education for example), due to the number of employees and the reluctance to offer complicated detailed social data.

The data collection methodological documents are publicly available on Ministry of Rural Development and Food web sites and the survey data are stored in databases that ensure confidentiality through safe and recorded usage.

4.13 Hungary

Summary

Hungary is a landlocked country producing only freshwater aquaculture products. The data collection of freshwater aquaculture is not mandatory. Hungary submitted some initial data, but for consistency reasons it was preferred to use FAO data instead.

Production volume and value

The Hungarian aquaculture sector produced 17.9 thousand tonnes of fish in 2018. This production was valued at about €38.4 million (FAO, 2021). Hungary produces only freshwater species.

Despite a slight drop in production in 2018 the production weight and value has been increasing during the past ten years. The production weight in 2018 was 13% higher than previous ten-year average; respective growth in value was 27%.

Table 4.13.1 Production and sales for Hungary: 2008-2018.

Variable	2008	2010	2012	2014	2016	2017	2018	Change 17-18	Develop. 2018/(08-17)
Production weight (thousand tonnes)	**15.7**	**14.2**	**15.1**	**15.3**	**16.2**	**18.3**	**17.9**	***-2%***	***13%***
Marine	0	0	0	0	0	0	0	0%	0%
Shellfish	0	0	0	0	0	0	0	0%	0%
Freshwater	15.7	14.2	15.1	15.3	16.2	18.3	17.9	-2%	13%
Production value (million €)	**31.2**	**28.0**	**30.6**	**29.4**	**31.5**	**38.7**	**38.4**	***-1%***	***27%***
Marine	0	0	0	0	0	0	0	0%	0%
Shellfish	0	0	0	0	0	0	0	0%	0%
Freshwater	31.2	28.0	30.6	29.4	31.5	38.7	38.4	-1%	27%

SOURCE: FAO (2021)

Main segments

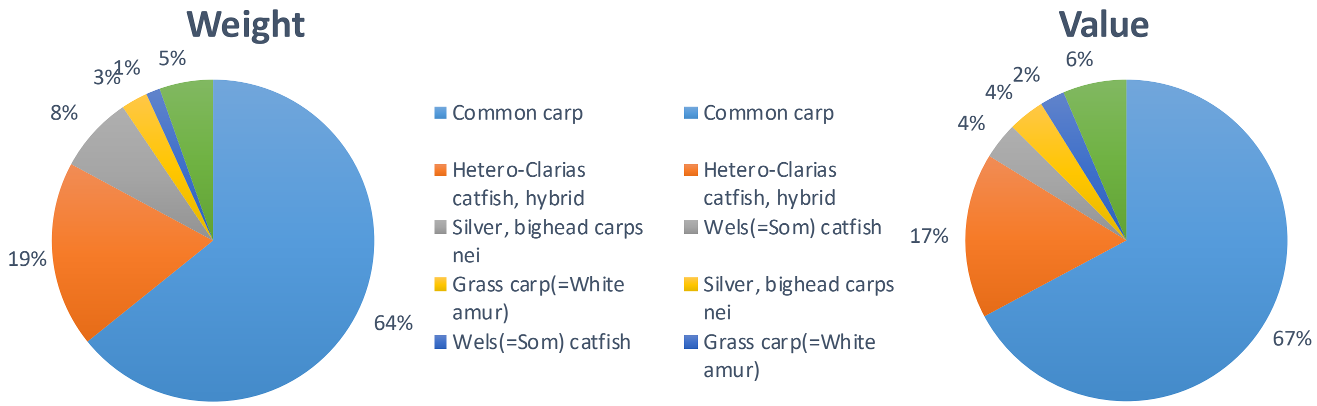
According to available FAO statistics, the common carp was the main specie produced by the Hungarian aquaculture sector, representing 64% in terms of weight and 67% in terms of value of total production in 2018.

The second most important specie is the North African catfish (hetero-clarias, hybrid variant) with 19% of the total weight and 17% of the total value. Silver carp represents 8% of production value and 4% in volume. There are also some relevant productions of Wels catfish and grass carp.

Aquaculture prices show an increasing trend for recent years for all the main species even only a slightly for the carp species.

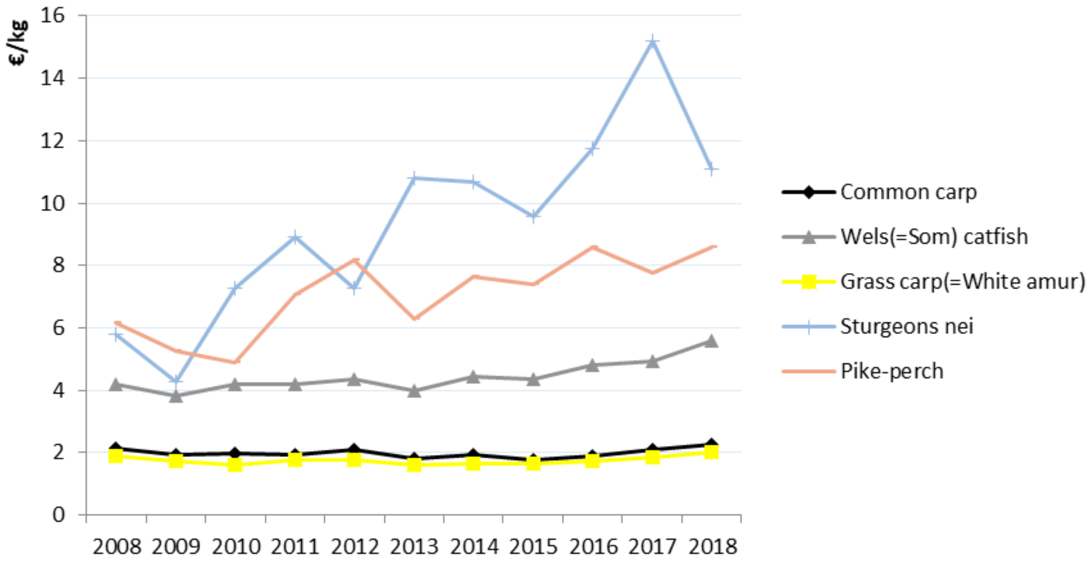
The common carp price in Hungary was 2.2 €/Kg in 2018. The price of grass carp 2.0 €/Kg, and for Wels catfish was 5.6 €/Kg in 2018.

Figure 4.13.1 Main species in terms of weight and value in Hungarian production: 2018.



Source: FAO (2021)

Figure 4.13.2 Average prices for the main species produced in Hungary: 2008-2018.



Source: FAO (2021)

Data Coverage and Data Quality

The data collection of freshwater aquaculture is not mandatory under the DCF and EU-MAP programmes of the EU data collection. So landlocked countries are not obliged to provide economic data for this report. This EWG welcomes the submission of data from Hungary for the first time. For consistency reasons it was preferred to use FAO data. We are going to continue working to improve overall data quality. The analysis of the Hungarian aquaculture sector is therefore based on data extracted from FAO.

4.14 Ireland

Overview of Irish aquaculture

The Irish aquaculture sector contracted in overall output volume and value, dominated by the cyclical nature of organic salmon production. The rope mussel and farmed oyster output continued to grow modestly as bottom mussel and trout output, employment and business numbers reduced.

4.14.1 Total Production and sales

Overall Irish output decreased by more than 19% by volume and 13.5% by value from 2017 to 2018. The trends are predominantly influenced by the finfish sector, which was down 33% by volume and 14% by value. The sectoral trend is specifically set by Atlantic salmon production that is following a cyclical trend of production based on alternating heavy and light inputs of smolts, necessitated by a lack of capacity. The less severe drop in overall value is due to an increase in salmon unit value. Other finfish production, mainly Rainbow trout, has also contracted in output and companies continue to be amalgamated.

The shellfish sector output experienced a less dramatic downturn with a decrease of 7.3% by volume and 1.5% by value, the latter again partially offset by modest increases in unit value. Bottom-grown mussel production decline was the main trend driver for shellfish. However, the rope mussel and farmed oyster sub-sectors showed modest production increase over 2018 with rope production increasing to 9 200 tonnes and farmed oyster breaking the 10 000-tonne mark for the first time. Minor shellfish culture production has declined. Native oyster production has received a major setback with the increased availability of French oysters depressing export unit value, while the home market has switched to Gigas consumption owing to the recent historical lack of Edulis (native) supply.

The level of overall aquaculture output has followed a cyclical trend varying from 30 000 to 50 000 tonnes over 10 years as the outputs of salmon farms, historically the most economically important aquaculture sector and to a lesser extent, bottom grown mussel, fluctuated over the period. Overall, value has seen a net gain from under €100 million to €180 million, despite limitations to output. This was made possible by steady increases in unit value in conjunction with growing recognition of product quality. Aquaculture remains mainly export-driven, marine based, with a smaller land-based or freshwater aquaculture sector. Apart from practice in native oyster culture, there is a move away from seasonal employment in the shellfish sector, due to associated rising costs.

4.14.2 Industry structure and total employment

Employment in 2009 was over 1 900 persons and after some fluctuations has returned to this level in 2018, having dropped to lows between 1 700 and 1 800 persons in 2012. FTE meanwhile varied mainly from just over 900 to 1 050 in the same period. Female employment level, over this time, has remained relatively static, ranging from 120 to 150 or from 6.4% to 8.2% of total employed.

The Shellfish sector was the biggest employer over the period and included the greatest proportion of part-time or seasonal work. The finfish sector by contrast, provided mainly full-time employment and the best average wage, in excess of €40 000 annually.

Employment has remained stable from 2017, even increasing slightly by 22 persons despite a challenging year, estimated as 1 952 persons, with an FTE of 1 086 in 2018. Full-time employment has increased in proportion to part-time and seasonal. Employment costs are noted as rising causing a shift towards taking on more permanent staff in the shellfish sector

The number of production units has also remained stable at 282, although these are controlled by fewer businesses; 238 from 248 as these continue to amalgamate in 2018. The majority of businesses and their production units are small, employing less than 5 persons and generating €250 000 or less annually. There has been an overall shift towards fewer of the smallest PU size category operating in the face of pressure to operate businesses full-time and to move towards more capital-intensive production. This can be clearly seen in the rope-mussel sector and less so in the oyster sector as new small units start up.

Table 4.14.1 Production and sales, industry structure and employment for Ireland: 2008-2018.

Variable	2008	2010	2012	2014	2016	2017	2018	Change 2017-18	Develop. 2018/(08-17)
Sales weight (thousand tonnes)	**45.0**	**46.7**	**36.2**	**31.7**	**44.0**	**45.7**	**37.2**	-19%	-11%
Marine	9.2	15.9	12.4	9.7	16.7	18.9	12.2	-35%	-6%
Shellfish	34	29	23	21	26	26.2	24.4	-7%	-11%
Freshwater	1.9	1.3	1.0	1.1	0.9	0.6	0.6	-14%	-54%
Sales value (million €)	**47.2**	**122.5**	**130.3**	**116.3**	**167.7**	**200.6**	**179.5**	-11%	40%
Marine	47.1	77.6	75.7	58.8	106.0	138.6	119.6	-14%	51%
Shellfish	39	39	47	52	57	60.0	58.2	-3%	21%
Freshwater	8.0	6.4	7.3	5.3	4.7	2.0	1.6	-19%	-73%
Number of enterprises	**304**	**302**	**279**	**277**	**289**	**282**	**281**	0%	-3%
Marine	17	24	19	18	20	28	26	-7%	27%
Shellfish	264	258	241	244	255	249	249	0%	-1%
Freshwater	23	20	19	15	14	5	6	20%	-66%
Employment	**1,972**	**1,715**	**1,708**	**1,821**	**1,948**	**1,916**	**1,952**	2%	6%
Marine	146	184	195	145	180	204	225	10%	33%
Shellfish	1,706	1,454	1,448	1,620	1,719	1,698	1,707	1%	6%
Freshwater	120	77	65	56	49	14	20	43%	-70%
FTE	**1,287**	**952**	**956**	**941**	**1,027**	**1,018**	**1,086**	7%	8%
Marine	130	156	171	115	160	176	191	9%	33%
Shellfish	1,065	737	738	788	829	831	878	6%	8%
Freshwater	92	59	47	39	38	12	16	40%	-67%

Source: EU Member States DCF data submission

4.14.3 Overall Economic performance

The data is segmented according to EUMAP, with the 4 segments presented in complete compatibility with the DCF segment equivalents.

Table 4.7.2 indicate that rising total incomes has almost kept abreast of rising total costs in the period 2008 to 2018, though the latter increased by 11% in the last year. The years 2013 and 2015 were unprofitable as a whole with recovery from 2016 onwards. Labour costs have gradually risen, with the best wages found within the salmon and oyster segments. In 2018, output and turnover dropped significantly (turnover €200 million to €179 million) as costs continued to rise, causing a narrowing of margins, reflected in the indicators, such as GVA (€157.3 to €104.7 million) and Profit Margin (€19.1 million, down from €83.4 million). Despite this, employment actually rose slightly, over the year, from 1 923 to 1 952 persons.

Table 4.14.2 Economic performance of the **Error! Reference source not found.** aquaculture sector: 2008-2018.

Variable	2008	2010	2012	2014	2016	2017	2018	Change 2017-18	Develop. 2018/(08-17)
Total income	98.1	124.2	136.5	126.5	176.1	201.7	181.2	-10%	31%
Total operating costs	93.0	105.3	115.7	105.7	130.3	137.2	152.1	11%	34%
Total wages	25.6	28.3	40.3	30.0	29.3	27.7	31.8	15%	9%
Gross Value Added	27.7	46.2	60.6	49.2	71.0	92.1	60.9	-34%	16%
Depreciation of capital	4.0	13.3	8.1	5.0	5.7	9.0	9.3	4%	31%
Earning before interest and taxes	1.0	5.6	12.8	15.8	40.3	55.5	19.8	-64%	11%
Financial costs, net	1.7	2.4	2.1	6.4	4.9	-29.1	0.5	102%	104%
Net profit	-0.7	3.1	10.7	9.4	35.4	84.6	19.2	-77%	10%
Total value of assets	133.1	170.9	189.7	199.8	190.9	194.0	240.5	24%	39%
Capital productivity (%)	20.8	27.0	32.0	24.6	37.2	47.5	25.3	-47%	-16%
Return on Investment (%)	0.8	3.3	6.7	7.9	21.1	28.6	8.2	-71%	-16%

Source: own elaboration from EU Member States DCF data submission

4.14.4 Main species produced and economic performance by segment

The greatest volume of Irish aquaculture production to 2018 is of blue mussel (*Mytilus edulis*) 38%, followed by Atlantic salmon (*Salmo salar*) 33% and Farmed oyster (Pacific cupped) (*Crassostrea gigas*) 27%. The greatest value is generated by salmon production, all to organic certifications, 66%, followed by farmed oyster at 25%. The latter supports the greatest level of employment, 833 (FTE 568)

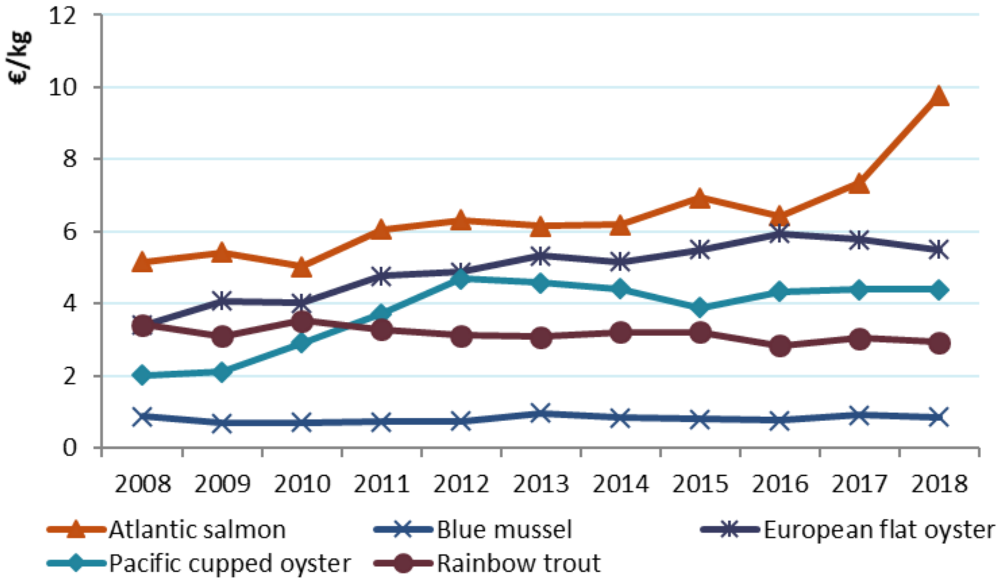
Figure 4.14.1 Main species in terms of weight and value in **Error! Reference source not found.** production: 2018.

Source: EU Member States DCF data submission

Organic salmon unit value has risen steadily to just under €10 in 2018 and Irish organic product has maintained its good market placing though this remained undersupplied. Farmed oyster unit price rise slowed and steadied to a little over €4 000 per tonne average. Within this, unit prices vary greatly, with some Bays achieving €6 000 per tonne at farm gate. Bottom cultured mussel unit prices tend to be better (€1 283 per tonne in 2018) than that of rope cultured (€646 per tonne in 2018) but the latter output dominates. Rope-grown product for the fresh market reaches

€750 per tonne or more. Other segments struggle to maintain unit value due to economies of scale with European flat oyster dropping in value as consumers abandon it in favour of the more readily available gigas oyster.

Figure 4.14.2 Average prices €/kg for the main species produced in Ireland: 2008-2018.



Source: own elaboration from EU Member States DCF data submission

Segment 1: On-grown Salmon

Output: Atlantic salmon on-grown production output declined in 2018, following a cyclical trend of production based on alternating heavy and light inputs of smolts, necessitated by a lack of capacity. Output is down 34.7% in volume to just under 12 000 tonnes whole-round and value, is down 14.2% to €114.5 million. Smolt production fell to 220 tonnes worth €5.1 million indicating a resultant scarcity-driven increase in unit value.

Employment and Production units: Employment in the salmon sector, mainly full time, increased by 30 persons, despite output decrease, with a total of 230 in direct employment at primary production sites and up to 464 directly employed in the salmon sector as a whole. Salmon on-grown production occurs in sea-cages, at 34 sites of 15 production units, owned by 5 companies, off the coasts of Donegal, Mayo, Galway, Kerry and Cork. These are supplied by smolt production units located at several land-based facilities. All stages of the production cycle occur within the Irish industry.

Structures: and Production cycle: Offshore-exposed are Polar circle cages of 20 000 m^3 capacity, located off-shore. Production cycle is from 9 to 18 months depending on market size requirements. Smolts are transferred in spring to on-growing sites, then to finishing sites in preparation for harvesting. Maximum national production capacity is on or below 20 000 tonnes, though in practice, normally less, in keeping with strict organic stocking requirements. Capacity is restricted by available licenced sites, about 4 300 000 m^3. The sector is capital intensive, with the greatest cost normally being feed; €19.6 million in 2018.

Markets: The consumer-ready product, mainly whole-round or head-on-gutted, is grown to exclusively organic certification standards, is exported to diverse markets; to the EU, North America and the Near and Far East. The less severe drop in overall value for 2018 is due to an increase in salmon unit value to an average €9.55, whole-round.

Economic Performance: The sector has managed to remain profitable throughout most of the 10-year period, experiencing a non-profitable year in 2013. Income has increased from over €60 million in 2009 to over €160 million in 2017 but so too have risen overall costs. Between 2017 and 2018, output dropped off sharply, in line with the cyclical nature of Irish organic production, which affected overall aquaculture economic performance indicators. GVA dropped from €121.9

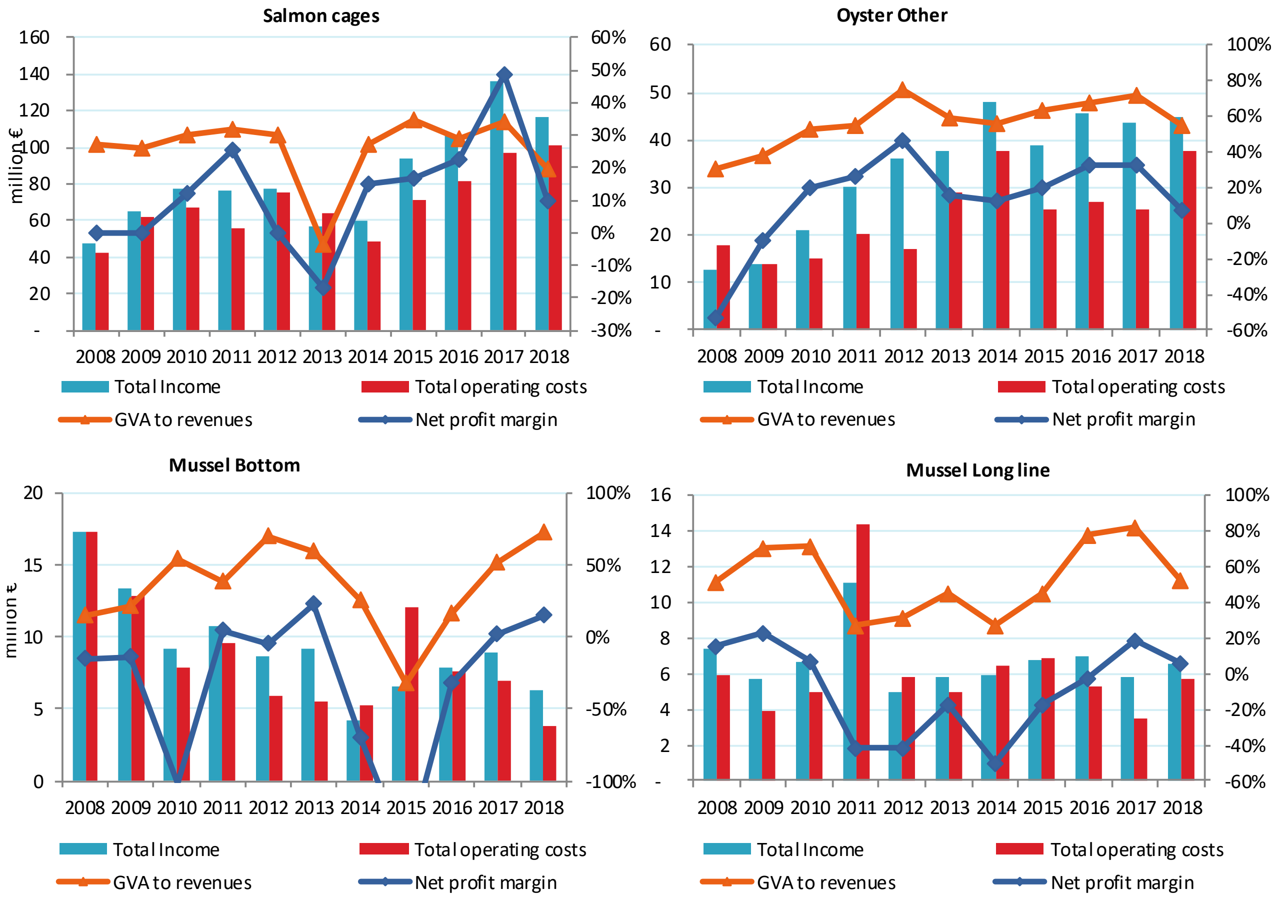
million to €71.7 million and Net profit dropped from €65.9 million to €11.45 million. Other indicators showed similar trends: labour and capital productivities dropping by 51% and 41.3%, respectively. FEI indicates a sector in a holding position, expected of a sector constrained by insufficient production room.

Table 4.14.3 Economic performance of main **Error! Reference source not found.** aquaculture segments: 2008-2018.

Variable	2008	2010	2012	2014	2016	2017	2018	Change 2017-18	Develop. 2018/(08-17)
Salmon cages									
Number of enterprises	16	24	19	18	20	20	19	-5%	-2%
FTE	126	156	171	115	160	149	171	15%	22%
Average wage (thousand €)	60.8	85.5	127.6	52.0	36.9	53.1	46.5	-12%	-31%
Labour productivity (thousand €)	101.1	150.8	135.0	138.9	192.5	274.0	116.0	-58%	-24%
Total sales volume (thousand tonnes)	9.2	15.9	12.4	9.7	16.7	18.7	12.0	-36%	-8%
Total income (million €)	47.6	77.7	77.2	59.6	106.6	135.8	116.4	-14%	46%
Total operating costs (million €)	42.0	67.4	75.6	48.8	81.2	97.3	101.2	4%	52%
Gross Value Added (million €)	12.7	23.6	23.1	15.9	30.7	46.3	23.1	-50%	3%
Net profit (million €)		9.4	-0.2	8.9	24.3	65.9	11.5	-83%	-31%
Total value of assets (million €)	65.2	58.9	90.2	86.2	76.1	75.4	106.5	41%	49%
Net investments (million €)	4.4	0.0	0.3	16.1	2.8	1.1	4.4	307%	70%
Capital productivity (%)	19.5	40.0	25.6	18.5	40.4	61.4	21.7	-65%	-31%
Return on Investment (%)		16.1	-0.2	11.3	32.5	46.7	10.9	-77%	-43%
Future Expectation Indicator (%)	6.8	-1.5	-1.7	17.5	2.7	-2.8	0.8	129%	-36%
Oyster Other									
Number of enterprises	131	131	124	132	145	148	148	0%	11%
FTE	347	333	367	428	510	519	568	9%	41%
Average wage (thousand €)	26.9	16.1	22.1	38.7	25.2	24.7	30.5	23%	24%
Labour productivity (thousand €)	11.0	32.8	73.5	62.3	59.9	38.2	29.7	-22%	-34%
Total sales volume (thousand tonnes)	6.2	7.1	7.4	8.9	9.7	9.8	10.2	4%	26%
Total income (million €)	12.7	20.9	36.2	47.9	45.6	43.7	44.9	3%	37%
Total operating costs (million €)	18.0	15.2	17.3	37.6	27.1	25.5	37.9	49%	66%
Gross Value Added (million €)	3.8	10.9	26.9	26.7	30.5	31.3	24.7	-21%	25%
Net profit (million €)	-6.8	4.1	16.6	6.2	14.9	14.5	3.1	-78%	-55%
Total value of assets (million €)	29.0	25.1	33.3	56.1	59.6	71.7	79.1	10%	85%
Net investments (million €)	0.0	3.2	1.6	1.0	2.7	5.8	3.0	-48%	35%
Capital productivity (%)	13.1	43.5	80.9	47.5	51.2	43.6	31.3	-28%	-30%
Return on Investment (%)	-23.0	16.6	51.5	16.7	26.5	20.9	4.0	-81%	-76%
Future Expectation Indicator (%)	-4.8	6.6	-0.5	0.2	0.0	3.6	-1.1	-129%	-245%
Mussel Bottom									
Number of enterprises	36	42	38	24	28	25	26	4%	-18%
FTE	178	150	115	86	72	78	74	-5%	-35%
Average wage (thousand €)	13.8	24.1	28.6	24.4	35.7	33.1	25.2	-24%	-5%
Labour productivity (thousand €)	13.9	33.2	51.6	12.2	13.7	37.0	40.5	10%	73%
Total sales volume (thousand tonnes)	17.0	13.2	6.5	3.2	6.5	7.5	4.7	-37%	-51%
Total income (million €)	17.3	9.2	8.6	4.2	7.9	8.9	6.3	-29%	-34%
Total operating costs (million €)	17.3	7.8	6.0	5.3	7.6	6.9	3.8	-45%	-58%
Gross Value Added (million €)	2.5	5.0	5.9	1.0	1.0	4.6	4.5	-1%	50%
Net profit (million €)	-2.7	-9.4	-0.4	-3.0	-2.6	0.1	0.9	548%	133%
Total value of assets (million €)	4.4	46.3	31.3	24.8	19.8	19.5	22.8	17%	-4%
Net investments (million €)	0.0	0.0	0.4	2.4	1.2	0.0	1.5		199%
Capital productivity (%)	55.8	10.8	19.0	4.2	5.0	23.5	19.9	-15%	19%
Return on Investment (%)	-36.3	-16.9	2.2	-9.8	-4.1	3.8	5.9	53%	168%
Future Expectation Indicator (%)	-37.1	-19.9	-5.1	3.9	0.2	-6.4	1.1	118%	113%
Mussel Long line									
Number of enterprises	70	60	59	63	59	57	57	0%	-9%
FTE	213	126	154	134	136	136	136	0%	-7%
Average wage (thousand €)	12.3	24.1	15.5	18.4	28.1	16.7	19.2	16%	-8%
Labour productivity (thousand €)	16.1	37.2	10.3	10.9	37.6	19.8	15.1	-23%	-32%
Total sales volume (thousand tonnes)	10.1	8.8	8.6	8.2	9.8	8.6	9.2	7%	-1%
Total income (million €)	7.3	6.6	5.0	5.9	6.9	5.8	6.6	13%	-2%
Total operating costs (million €)	5.9	4.9	5.8	6.4	5.3	3.5	5.7	65%	-8%
Gross Value Added (million €)	3.4	4.7	1.6	1.5	5.1	4.7	3.4	-27%	3%
Net profit (million €)	1.2	0.4	-2.1	-3.0	-0.2	1.1	0.4	-67%	144%
Total value of assets (million €)	15.9	19.0	14.5	19.6	19.3	17.8	22.6	27%	27%
Net investments (million €)	2.1	0.4	0.0	0.9	0.3	0.6	0.9	48%	-60%
Capital productivity (%)	21.6	24.7	10.9	7.4	26.5	26.6	15.3	-43%	-19%
Return on Investment (%)	7.4	4.6	-12.5	-9.0	5.2	8.1	1.6	-80%	152%
Future Expectation Indicator (%)	11.6	-2.3	-6.8	-1.9	-2.0	-1.8	1.8	203%	-64%

Source: own elaboration from EU Member States DCF data submission

Figure 4.14.3 Economic performance in € million, indicators for the main **Error! Reference source not found.** segments: 2008-2018.



Source: own elaboration from EU Member States DCF data submission

Segment 2: Farmed Oyster:

Output: The Farmed oyster (Gigas) sector continued to expand modestly by 2.4% in volume in 2018, breaking the 10 000 tonne ceiling to 10 122 tonnes. Overall value increased by 2.3% to €44.3 million, unit value nationally remains unchanged at €4 380 per tonne (Triploids plus Diploids).

Production units & Employment: Combined oyster employment is over 1 300 persons, (FTE 642), mainly on Gigas oyster farms. Just under half of this total is full time employment. Production on 154 production units, run by 139 businesses is widespread along the coast with concentrations of production in the South-East and North-West regions.

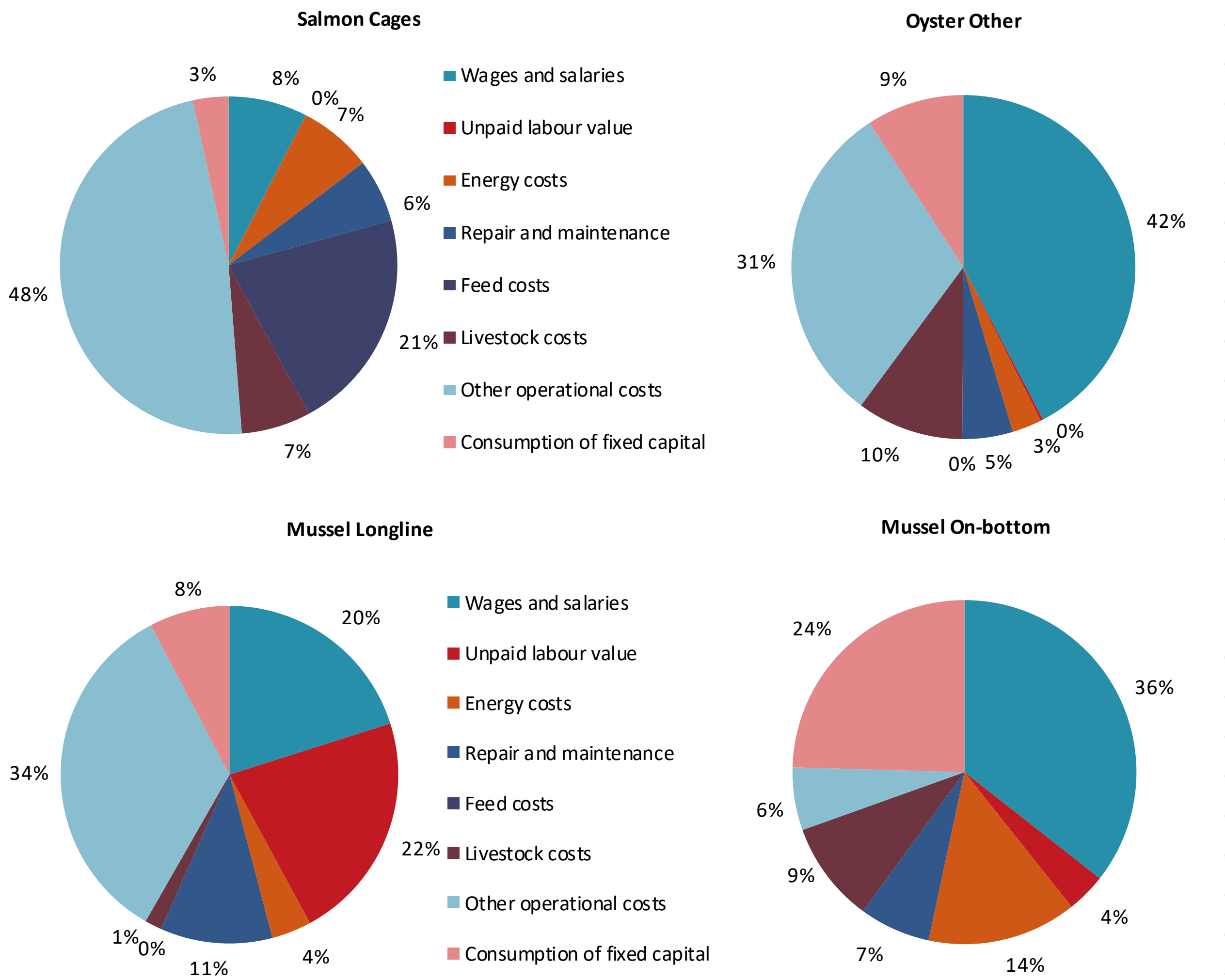
Current structures: Intertidal**;** in use are predominantly trestle bags but SEPA baskets, Floating/suspended baskets and shelved baskets are increasingly used throughout the licenced area. Small seed 6-8mm is mainly imported from French and UK hatcheries. Bigger half-grown stock is bought from sites within the state, specializing in earlier stages of the production cycle and some 2-3mm stock is supplied by local hatcheries. The full production cycle is from 3 to 5 years though an increasing number of units specialize in a part of the cycle, reducing stock turnover time. Current maximum capacity; 10 500 tonnes is restricted by available licenced ground; under 2 000 hectares.

The Market: The market for Irish grown oysters was mainly the EU, mostly France taking 74% of total export volume with smaller volumes going to the Netherlands, the UK, Germany Spain and Italy. There are also buyers from Canada, The United Arab Emirates and South East Asia. The latter, principally China and Hong Kong, took in 6.73% of total exported volume; 553 tonnes. Increasingly, home-branded product is being sold directly to retail. 7 570.4 tonnes (74%) was sold consumer ready at sizes from 45 to over 150 grams, Value ranged from €2 200 per tonne to

€6 000 per tonne, depending on the Bay and ploidy. The remaining 2 622 tonnes was sold to other finishing farms as half grown, averaging €4 037 per tonne. 89.1% of output was triploid, with a unit value of €4 477 per tonne. Diploid output had an average unit value of €3 386.6 per tonne. 8 359 tonnes, all grades, all ploidies were exported in total in 2018.

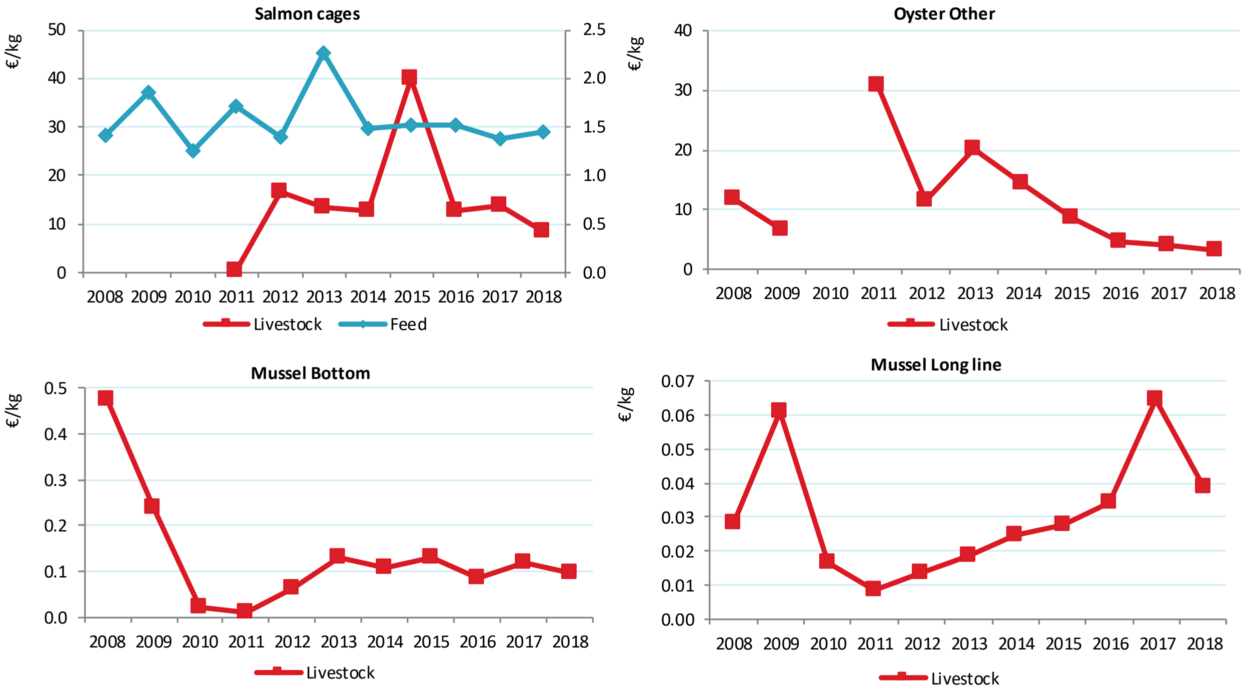
Economic Performance: There has been variability in the margin between costs and income over a mainly profitable period, with 2013 to 2015 being the most difficult years. The overall trend has been an increase in overall output and unit value, keeping in relative balance with profitability from 2009 to 2018. Greatest costs are labour and seed supply. In 2018, Rising costs and drop-off in increasing unit value increase in the sector outweighed the continued but slowed increase in general output. GVA dropped by 9% and net profit by a more pronounced 76.9%, caused by rising labour and other operational costs. Labour and capital productivity decreased by 16.7% and 17.6% respectively over the year. FEI indicates a lack of future growth but this sector, unlike others, is experiencing an increase in businesses from the arrival of new entrants onto new licenced grounds so it is expected in fact to continue growing, albeit slowly.

Figure 4.14.4 Cost structure of the main segments in Ireland: 2018.



Source: EU Member States DCF data submission

Figure 4.14.5 Feed and livestock average prices €/kg for the main **Error! Reference source not found.** segments: 2008-2018.



Source: own elaboration from EU Member States DCF data submission

Segment 3: Rope Mussel

Output: Rope mussel sector production in 2018 increased; by 7.5% in volume to 9 192 tonnes and 3.3% in overall value; €5.94 million with a slight decrease in average unit value; 646 in 2018 from €673 per tonne in 2017 (fresh and processed markets). While red tide closures obstruct continuous production flow, the biggest impediment to the sectors growth remain the reliance on those markets that have a large home production stock, leading to periods of over-supply.

Employment and Production units: The number of businesses operating; 55 and number of employed; 228, continues to decline as the sector continues to streamline into larger units with specialist crews and equipment servicing a greater number of these. There is a move away from seasonal employment due to rising associated costs. Seed is sourced mainly from collectors situated close to on-growing areas in the spring or from collected rock seed, Growth cycle varies from one to two and a half years depending on the bay and fresh product is of mainly 55-70 mm shell length (110-80 pieces per kilogram). Production is concentrated in the Southwest; Cork and Kerry and to a lesser extent in the North West, from Killary harbour to Mulroy Bay.

Structures: Subtidal, sheltered; Suspended, Head-Rope systems used varies from Bay to Bay; Continuous new Zeeland rope is favoured by larger operators in such locations as Bantry, Killary and Roaring Water Bays, Swedish Strap is used in Kenmare Bay, Traditional rope is used among the smaller operators in Roaring Water Bay and Recycled pergolari material is used in Killary Harbour. Maximum capacity is 15 000 tonnes, within 900 hectares, though this is rarely reached due to restrictions in harvesting opportunity and market strength.

Markets: Unit value for the fresh market varied considerably from bay to bay, from €490 per tonne to €764 per tonne depending on market timing and stock condition at time of harvesting window. France took 60% of fresh exports, while the Netherlands, UK and Italy took up smaller volumes. 23% of total volume went to processors for an average €598 per tonne, which was then mainly exported. It is unclear from current surveying technique what proportion of total output went to the home market though localized attempts to expand this are occurring for example from Mulroy and Roaring Water Bay.

Economic Performance: Although there are no significant seed supply or feed costs, the margins in this sector have been relatively tight over the 2008 to 2018 period, with high labour costs and poor unit value of product determining profitability, year on year. From 2017 to 2018 though, the sector has shown a recovery of output with mixed economic messages: GVA is up by 9.5% but net profit has decreased from just over €1million to €360 000. Labour productivity has increased by 22.7% while capital productivity has decreased by 6.3%. Labour is being contracted out to specialist harvesting crews, supplied by the bigger production units. FEI indicated a segment in a holding position, which is reflective of one dependent on a distant export buyers market, and seemingly little or no opportunity to expand output or increase unit value except by circumstances of supply elsewhere.

Segment 4: Seabed cultured mussel

Output: The bottom mussel sector production declined in 2018; by 37% by volume to 4 697 tonnes and by 31% in value to €6 million in 2018, with an average unit value of €1 283, mainly within range €800 to €1 900 per tonne. The industry continues to depend almost exclusively on the level of annual wild seed settlement for its stock input, while cost effective alternative sources are pursued.

Employment and Production units: The sectors businesses, recently decimated in number by several poor seed settlement years continues in an unstable fashion in the face of overall declining seed stocks. Despite the seed shortage, poor unit prices, and debilitating uncertainty both in terms of seed management and political issues, the segment shows remarkable resilience and continues with 24 businesses, employing 108 persons directly, mainly full-time. The sector operates currently in Carlingford Lough, Wexford Harbour Castlemaine Harbour and Lough Foyle.

Production cycle: Structure: Max capacity is 5 700 licenced hectares plus order ground which has held up to 30 000 tonnes at production peak. Production is limited by stock management issues, rather than licenced ground capacity Wild seed is transferred from 20mm shell length (600 pieces per kilogram) from the Irish Sea or from local seed beds and harvested from one to two and a half years later at 55 to 70 mm shell length (80 to 110 pieces per kilogram).

Markets: Product is exclusively exported, mainly to the Netherlands and France with the Dutch taking in 55% and the French 41 % of exports in 2018. Unit value averaged €1 283 per tonne in 2018. The smaller size product (all is sold fresh) may be on-grown or sold as consumer-ready with the Dutch market favouring the larger sizes for consumption.

Economic Performance: These have been difficult years for the bottom mussel sector where the costs of running / maintaining a boat and crew and securing seed have eroded profit margins, particularly in 2010, 2014-2016. An increase in output and profit was experienced from 2017 to 2018. The economic indicators showed mixed trends: GVA down 42% but net profit up from €136 809 to €885 987. Labour productivity slipped from €57 thousand to €43 thousand, and capital productivity from 23% to 14%. FEI indicated 0 development and the sector, dependent on an unreliable supply of raw material and under threat in terms of available production grounds, faces an uncertain future.

4.14.5 Outlook

Trends and triggers

The major trends through 2017 and 2018 were that of continued steady growth for oysters and rope mussel production, the expected cyclical downturn in salmon production, due to the constraints of licenced production space, the up to 18 month production cycle and the demands of organic certification standards, uncertainty for the bottom mussel sector and continued consolidation in trout segment.

Rope mussel and Off-bottom oyster output continues to grow steadily. The rope mussel segment continues to amalgamate businesses and gradually shed employment. The Farmed oyster segment, on the other hand, continues to increase its number of businesses and employment, with some retirements also. The segment is slowly expanding its market base away from the dominant French one to the Netherlands, Italy, other EU states and the Far East. Bottom grown mussel production continues to be relatively low and uncertain to predict, long term as there appears to be no sign of a re-emergence of the extensive wild seed beds that underpinned the greater production of this segment in the early 2000's. Both mussel segments are vulnerable in their market placements, relative to that of their competitors who are home suppliers of the market destinations.

All 4 major segments are export-driven. The Organic salmon has hitherto fore been under-supplying the market and continues to be restricted by the setbacks to increasing production space, partly caused by lack of social licence. Specifically new licences granted, remain unused as their awards are appealed in protracted processes. More recently, The UK has announced its intention to increase its organic production, farther threatening the Irish product placement.

The figures for 2019 continue the trend of 2018. Salmon and bottom-grown mussels remained depressed, under 12 000 tonnes and 5 000 tonnes of output respectively, while rope mussel and off-bottom oysters continued to grow steadily above 10 000 tonnes each. The trout segment continued to defend its niche in the home and high quality export markets, continuing to protect employment level and consolidating business.

4.14.6 COVID-19 impact

Surveys carried out during the height of the lockdown in May showed that rope mussel production had stopped completely from end march and that only top grade oysters were selling and at significantly reduced prices. Sales losses reached up to 70% in some bays though this was partially caused by disease incidence, along with lockdown induced sales losses. Organic salmon continued to sell but at slightly depressed prices. The small trout sector product had lost its placing in high-end retail as well as losing services supply as buyers switched to economy products, making their small-scale production unviable and so depressing this. Bottom mussel sector was relatively unaffected at this stage, as sales had mainly been completed as normal, before full lockdown effects kicked in. For Ireland, the biggest impediment to sales was not necessarily a decrease in demand though that was a significant factor of itself. The change in the nature of the demand as the hospitality sector shut down and consumers switched to economically priced products, along with the rising costs associated with lack of available transport options to supply it were major drivers. By July, rope mussel fresh sales picked up strongly and by September, oyster stocks were selling once more, if at lower prices.

In all this time, employment was preserved, through a wage payment assistance scheme and in November a once-off seed loss compensation scheme was created for the Oyster and Rope mussel sectors. The overall national output for year-end 2020 is predicted to remain at similar to 2018 and 2019 levels, with the rise in oyster and rope mussel outputs reversed and salmon output recovery halted. Employment will hold stable or drop slightly, while FTE will have dropped in the face of inability to retain full-time staff with rising costs. The emerging year-end 2020 picture of the over-all effect of the covid lockdown on the industry masks the effects at segment and regional level seen at different points of the lockdown period. These overall figures mask the profound effects of the lockdown and the emerging Brexit costs on long-term viability of smaller enterprises and local output at bay-level. Farther consolidation of businesses, reduction in segments and Bays used for Aquaculture production is expected.

4.14.7 Data Coverage and Data Quality

Data quality and availability

In general, output, operational input and basic employment data have been collected by census for many years and validated by a well-established regional officer unit. The long-established census is well supported by industry and forms the basis of the annual aquaculture report. The returns range either side of 80% by total business number and the data supplied is considered of good quality for national level though this quality decreases for the smaller segments and some Bay areas as it becomes more difficult to guarantee business-level confidentiality.

Abridged accounts are surveyed online for up to 33% of the industry overall for the variables; Depreciation, financial costs, net investment, total assets, wages and salaries and total debts. Finally, a sample questionnaire is sent to a non-random 25% profile of the total population to extract the remaining costs data and the more recent social variables.

Strategy weakness: The survey up to now, has been largely dependent on goodwill. This results in certain questions remaining unanswered due to sensitivity or other difficulty. Data therefore for the variables; Energy, Repairs and Maintenance, and Other operational costs has been sparse and suitable only for crude national estimation. This lack of data for some variables is acute for certain segments and makes national estimations time consuming and doubtful in accuracy.

As most Irish companies are micro-enterprises, online accounts are limited to providing data for the 5 variables mentioned above or less, depending on the level of presentation. Data extraction from this source is slow and prone to consistency of interpretation error, due to the lack of standardisation in accounts format. The strategy of supplying DCF data was geared initially to reduce the additional survey burden imposed on small businesses while preserving the quality of census returns. This was done by a two-component survey strategy; census and non-random sample survey. The strategy goal was met but at a cost of time and administration difficulty. Again gathering detailed data for the smaller segments proved time-consuming and poor in returns, due to difficulties of preserving confidentiality.

Data collection has been by a combination of online, email, text, phone call and postal routes, adding to the time spent in collection and collation. Attempts have been made to collect online, using interactive forms but this did not suit the means of many clients.

Census data becomes partially available from mid-march, of the following year for inclusion in the 'Business Of Seafood' Report and fully available by mid-April when it is formatted for the 'Annual Aquaculture Report' in June. The remaining data is assembled by December year n+1.

Other data issues or missing data

Data collection has been long established for DCF, now EUMAP and clients have become steadily more IT proficient and are abandoning the use of post. A recent assistance scheme, based upon level of survey participation and Data supplied, exposed the difficulties and weaknesses of the collection strategy of both data collectors and suppliers and has provided an opportunity to simplify collection strategy. For the survey of year 2020, the sample questionnaire survey was abandoned and its questions merged into the census. While this has slowed down the rate of response, the overall response and the quality of data provided is looking very positive. Data collection for small segments remains a difficult issue, as does the survival of the segments themselves.

4.15 Italy

Overview of Italian aquaculture

The performance of Italian aquaculture was 350 thousand tonnes sold for an income exceeding €380 million. In terms of employment, the FTEs are just over 1 600. Investments (2018) were positive, after a long downward trend. ROI (29%) still makes the industry a good investment that can attract new capital. Italy provides the data for all the main production sectors including freshwater species.

4.15.1 Total Production and sales

Aquaculture of marine and freshwater species recorded, during 2018, a sales volume of 150.3 thousand tonnes for €380 million. The performance was produced thanks to 592 companies and over 4 760 employees, corresponding to 1 609 FTEs.

The leading segment, in terms of volumes sold, was shellfish, with 96 thousand tonnes, followed by the freshwater segment, with 41 thousand tonnes and, finally, the marine species segment that traded 13 thousand tonnes.

The sales values recorded for the three macro-aggregates were significantly confirmed by the shellfish sector, which recorded exchanges for €156 million, followed by over €128 million in the freshwater sector and over the €95 million recorded in the sales of marine fish species. In 2018, there was a -1% decrease in volumes sold compared to the previous period and -3% less in value. The freshwater segment certainly pushed the sector (+24% in volume of sales) in fact it mitigated the decreases in the marine (-9%) and shellfish sector (-8%).

The development of sales divided between the three macro-segments underlines a significant suffering of the marine sector. In it, development contracted by over 80% in volumes sold and over 61% in sales value. All this correlated to a drastic reduction in installations (which decreased by about 38%). The development of the freshwater segment has reacted better in terms of contraction in value, unlike the marine segment. In the freshwater segment, in fact, against a -35% number of companies, it recorded a -57% of volumes sold, but the prices have maintained more, in fact the reduction in development referred to the value generated by the freshwater segment has been -11%.

In the case of freshwater products, Italian companies show that they are able to maintain fairly stable prices, mainly due to the historicity of economic activity. The volumes sold are conveyed through a structured value chain and the product is mainly conveyed on the Central European market (mainly carp and part of trout).

Added to this is a more stable price, also due to the quantity of trout and freshwater offer sold as a live product. This product is bred and sold alive mainly in lakes and ponds for recreational / sport fishing.

4.15.2 Industry structure and total employment

In 2018, Italian aquaculture counted on 592 companies. The number of companies was updated in 2016, in accordance with the survey of the number, which occurs every three years. The production sector with the highest number of active companies is the shell sector, with 400 organizations.

As regards the fish aquaculture sector, the freshwater one records the highest number, with a total of 146 companies. The mariculture fish segment accounts for 46 companies. The sector that, from 2008 to 2018, recorded constant growth in terms of numbers of farms was the shellfish segment (+20%). The number of companies that mainly operate in marine waters has decreased in number by almost 40%, finally the freshwater-based sector has decreased its number by 35%.

The most developed aquaculture sector in the entire observed period was that of shellfish, which noted a +20% development. Over the years, in addition to the traditional installations for mussels with long-line technology, clam farms have increased as well as oyster production.

The attractiveness of the shellfish sector is probably greater because investors are comforted by a lower initial investment and a slice of the market that can be attacked as it is still and nevertheless satisfied by imports. Even for shellfish, however, the bureaucratic and administrative delays are very similar to those required for fish farms, and this aspect is highly dissuasive to attract new investors.

Employees of the entire sector, in absolute values, amounted to 4 761, of which approximately 78% are employed in the shellfish sector. In terms of employees, shellfish only had 3% of new employees in 2018 compared to the changes recorded on average between 2008/2017, while workers decreased by over 43% in the freshwater segment and by about 33% in the marine fish sector.

By comparing the data between the number of employees and the number of FTEs, the employment dynamics of the three macro-aggregates are understood.

Table 4.15.1 Production and sales, industry structure and employment for Italy: 2008-2018.

Variable	2008	2010	2012	2014	2016	2017	2018	Change 2017-18	Develop. 2018/(08-17)
Sales weight (thousand tonnes)	**222.6**	**270.8**	**191.2**	**185.8**	**148.2**	**152.1**	**150.3**	-1%	-20%
Marine	112.1	80.9	70.0	56.1	11.7	14.3	13.0	-9%	-81%
Shellfish	12.6	16.2	11.7	24.0	95.6	104.7	96.2	-8%	195%
Freshwater	97.9	173.7	109.5	105.7	40.9	33.0	41.1	24%	-57%
Sales value (million €)	**439.5**	**585.3**	**464.9**	**566.9**	**344.9**	**390.8**	**380.3**	-3%	-28%
Marine	257.6	264.0	249.6	239.2	84.6	103.2	95.4	-8%	-61%
Shellfish	113.2	138.5	79.9	181.0	137.8	183.5	156.0	-15%	7%
Freshwater	68.7	182.9	135.3	146.7	122.5	104.1	128.9	24%	-11%
Number of enterprises	**696**	**692**	**587**	**587**	**592**	**592**	**592**	0%	-6%
Marine	108	105	70	70	46	46	46	0%	-38%
Shellfish	318	323	291	291	400	400	400	0%	20%
Freshwater	270	264	226	226	146	146	146	0%	-35%
Employment	**4,357**	**5,836**	**5,159**	**5,112**	**4,546**	**4,488**	**4,761**	6%	-10%
Marine	848	999	352	630	373	411	375	-9%	-33%
Shellfish	1,932	4,053	3,892	3,422	3,614	3,546	3,703	4%	3%
Freshwater	1,577	784	915	1,060	559	531	683	29%	-43%
FTE	**3,428**	**2,839**	**1,938**	**1,695**	**1,893**	**2,128**	**1,609**	-24%	-24%
Marine		176	113	141	93	100	109	9%	-55%
Shellfish	3,296	2,637	1,694	1,454	1,688	1,933	1,361	-30%	-21%
Freshwater	132	26	131	100	112	95	139	46%	-38%

Source: EU Member States DCF data submission

Starting from the marine segment, it is noted that the sector makes use of mainly full-time employees, in fact against a -9%/2018 decrease in the absolute number of employees, the FTEs increased by the same value (+ 9% / 2018).

Conversely, the trend of the employment picture is recorded in the shellfish segment. In 2018, in fact, the number of employees increased by + 4%, while the FTEs significantly reduced by -30%.

The joint data outlines the typicality of the shellfish sector, in which many employees are also members and workers of breeding cooperatives, so it happens that they are minimally employed compared to real involvement in breeding activities. Sometimes the choices on welfare and social security are linked to employment policies. Therefore, some cost items are leveraged (such as personnel) in order to provide for a double channel of remuneration for employees: a part linked to salary / wages, and a part linked to income / revenues from sales. This means that employees are often part-time.

The freshwater segment confirms a tendency to employ employees who work on average at 20% of the entire conventional working time in agriculture (i.e., referring to the most widely borrowed national collective agreement in the aquaculture sector).

The freshwater sector is also and above all based on small businesses, in which the ties and relationships between employees are strong and therefore often only the regularly contracted employees are counted. Due to the type and specificity of the freshwater aquaculture activities, it is plausible to hire part-time staff who mainly work shifts based on the production areas in which they are located (hatchery, pre-fattening tanks, fattening tanks, fishing and packaging attractiveness, maintenance activities, etc.). In the last year the employed, in numerical terms, have increased by +29% which, on the FTE side, have increased by 46%.

4.15.3 Overall Economic performance

Aquaculture in 2018 marked a contraction of -3% (ref. 2017) of the total income, equal to about €387 million. Operating costs increased by + 10% (ref. 2017), equal to €244 million, as well as the total paid for labour costs (+ 10%) equal to an outlay of almost €75 million.

This situation led to a decrease of -11% of the Gross Added Value (GVA), being in monetary terms €217 million.

The value of depreciation in 2018 increased by +16% compared to 2017. Equally, financial costs (i.e., interest expenditure), marked a rather similar increase. The situation can be interpreted according to the trend, in 2018, has to resort to forms of debt for new investments. In fact, in 2018, almost all the Italian Regions launched calls under the EMFF subsidies. The use of investment support measures denotes the sector's willingness to operate above all vertical integration, investing in transformation activities, but also in new forms of marketing and integration of the value chain. In 2018 there was one of the highest net profits, equal to approximately €126 million which, in perception over the entire period (2008-18) is +63%, although it has dropped by -22% compared to 2017.

Table 4.15.2 Economic performance of the Italian aquaculture sector: 2008-2018.

Variable	2008	2010	2012	2014	2016	2017	2018	Change 2017-18	Develop. 2018/(08-17)
Total income	452.9	616.6	482.1	588.9	354.6	397.4	386.6	-3%	-22%
Total operating costs	462.3	481.2	345.3	490.3	240.1	221.2	244.4	10%	-37%
Total wages	119.6	110.1	71.7	138.1	70.5	67.9	74.6	10%	-23%
Gross Value Added	107.4	235.8	205.7	230.7	185.0	244.0	216.7	-11%	6%
Depreciation of capital	19.8	35.5	22.0	24.5	13.8	12.1	13.8	14%	-39%
Earning before interest and taxes	-29.2	99.9	114.8	74.2	100.8	164.0	128.4	-22%	45%
Financial costs, net	36.5	16.7	6.8	11.7	2.2	1.9	2.2	16%	-80%
Net profit	-65.8	83.2	108.0	62.5	98.6	162.1	126.2	-22%	63%
Total value of assets	409.9	1319.1	721.7	885.9	431.6	399.0	444.8	11%	-44%
Capital productivity (%)	26.2	17.9	28.5	26.0	42.9	61.2	48.7	-20%	65%
Return on Investment (%)	-7.1	7.6	15.9	8.4	23.4	41.1	28.9	-30%	122%

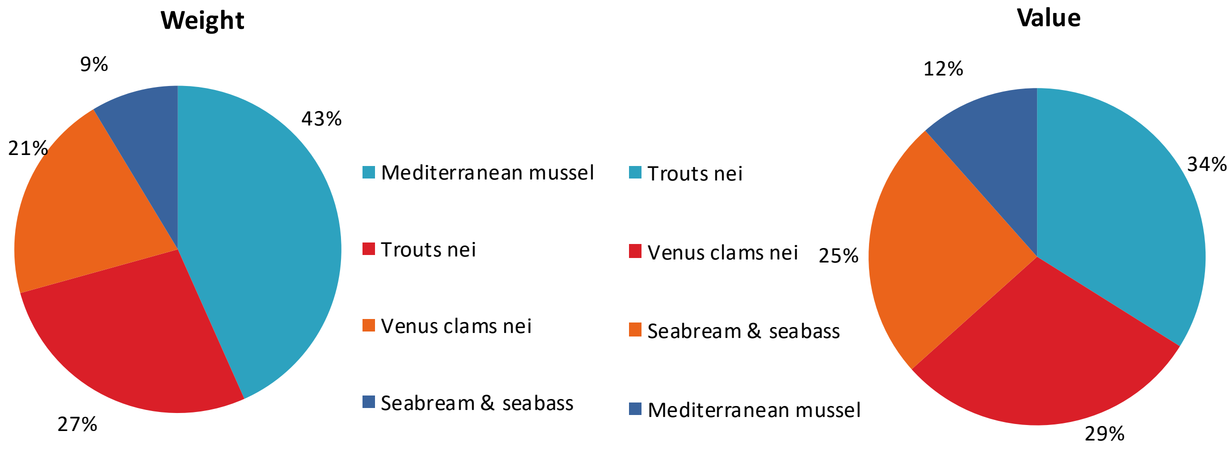
Source: own elaboration from EU Member States DCF data submission

ROI in previous year (2017) was 41%, while during 2018 it is 12 point less (29%). ROI represents an Italian aquaculture industry of capital-intensive type, highly specialized both employed and of sophisticated technologies used. The high capacity for knowledge of aquaculture techniques, has a positive impact on productivity capacity around 49% in 2018) of the Italian sector. The levels of capital productivity from 2008 to 2018 increase around 63%. ROI in previous year (2014) was 8.4%, while during 2015 it is 4 percentage points more (12.5%). Over time, the sector has strengthened companies, making them more reliable thanks to better credibility in the economic system. Furthermore, the entire national sector is investing and working significantly to improve the social acceptability of their work and the role of important players in the market for satisfying the demand for fish products.

4.15.4 Main species produced and economic performance by segment

Aquaculture is an activity historically present in Italy. Fish farming was found in the excavation houses of Pompeii (Naples), where the nobles used to have tanks in which they stored fish. Equally historic is the farming of shellfish, especially oysters. For many years, the oyster sector has been in decline. Situation today, of course, very varied. There are still numerous companies in Italy specializing in the breeding of freshwater, marine and shellfish species. In terms of volumes, the shellfish segment is certainly performing. In terms of production value, seabass and seabream are still considered to have a high commercial value. The tradition combined with the specialization of freshwater aquaculture, allows Italy to be one of the largest producers of trout. The graphs showing the performance of the main 4 Italian production segments are shown below.

Figure 4.15.1 Main species in terms of weight and value in Italian production: 2018.



Source: EU Member States DCF data submission

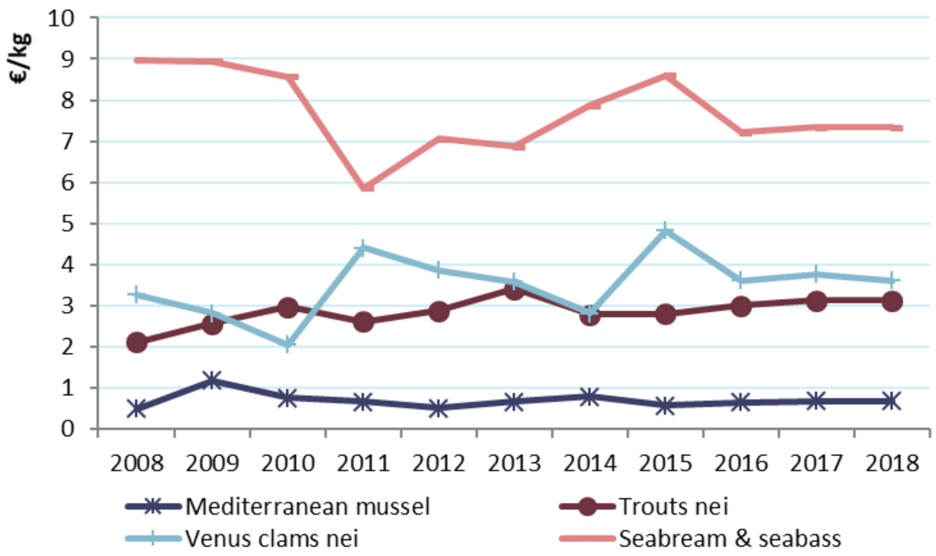
The main species in volume farmed are for shellfish the Mediterranean mussels and Venus clams, while for the freshwater macro-aggregate the trout is the first cultured fish; finally, for the sector of euryhaline species the most farmed species is the seabream. On the hand of value, the most important species is the trout and the clams are one of the last species. The 4 main segments detected in EUMAP, the incidence of mussel (43% in volume, 34% in value), clam (27% in volume and 29% in value) trout (27% in volume and 34% in value) marine species (9% in volume and 25% in value) confirms the segmentation of the market also with respect to the commercial value of aquaculture offers. Evaluating ex-farm prices, the best performing species are marine species (SBSB), especially the commercial sizes over 650g, which have also been sold for more than €7.50 per kg. On average, SBSB have a price of €7.20 per kg. Mussels confirm a rather low ex-farm price of €0.8 per kilo. Mussel's price, however, already very low in past years and that continues to not improve, despite the profuse efforts of manufacturers to qualify production. Unfortunately, the product has been subject to unfavourable weather-environmental periods that have affected the level of quality of the offer, especially regarding edible meat. The trout are on average sold for just over €3.6 per kg the ex-farm price of the clams is €3 per kg. The price of trout has been more stable in the last three years. Stability has been interpreted as greater solidity in relations with the market chain: companies have increasingly established strong relationships with absorption markets that base purchases in accordance with commercial protocols that are clear in terms of volumes and prices. The price curve for the main four species shows a trend which is slightly different for "fish" and "shellfish" species. Considering the trout price curve, it outlines a price that is subject to slight deviations from the average of the last 5 years. This is determined by a product allocated, through consolidated contracts both in the domestic market, large distribution or HoReCa, and in the EU market, in particular in North Central Europe where the product supplies not only large distribution but also sales channels specialized in certified goods. The most fluctuating price is that of clams. Over the years, they have been subject to very unfavourable periods and conjunctures in which the product has been affected by parasites and contaminations.

In general, clams are, among shellfish, those that mainly follow a well-defined value chain. Over 60% of the national clam supply is given directly to the large-scale retail trade.

The trend in the prices of mussels is practically unchanged in the entire period recorded. We are talking about a massive product that is delivered to the market in a pulverized way. The poor organizations of producers, the lack of Producer Organizations (POs) greatly damage the revenues and economic performance of the segment.

The euryhaline species recorded fluctuations in prices which are considerably contained in the last three years. The price trend in the last three years is more stable because companies that have aggregated the offer remained active on the market. This ability to aggregate the offer on the one hand, and vertical integration, on the other, has ensured greater ability to obtain agreements with logistics platforms and commercial chains. When companies work on the basis of planned deliveries at least for each semester, they are better able to optimize financial flows. This is also associated with the possibility of working on biomass according to specific customer requests, so as to customize the aquaculture offer.

Figure 4.15.2 Average prices €/kg for the main species produced in Italy: 2008-2018.



Source: own elaboration from EU Member States DCF data submission

According to the passage in 2016 to EUMAP, Italy has distributed and defined several production segments. Within the framework of the EU MAP, (in agreement with Commission Decision 2016/1251 of the Commission of 12 July 2016, where in Annex 1, Chapter 5, point 5) the segments are 5. The perfectly equal segments for which a comparison was made are:

- Seg.3.6 SBSB cages (which corresponds to segment 3.4 of the DCF)

- Seg. 10.10 MSS long line (which corresponds to segment 7.2 of the DCF)
- Seg. 12.11 Clam on bottom (which corresponds to segment 9.3 of the DCF).

Referring to the costs structure of the main segments, specific comments on the performance of the clam on bottom, mussels long line and finally seabream and seabass in cages, are reported in order. The first Italian segment in terms of total income, is represented from clam on bottom (€115.3 million), followed from seabass and seabream farmed in cages with €64 million and mussel is the 3rd in terms of total income (€44.8 million). The clam sector has a total of 176 companies in which 541 000 FTEs have been employed. The average salary was around €61 000 and this implied a low labour productivity (-29%) compared to the same indicator reported in 2017. The volumes sold in 2018 were 14% lower than the previous year, amounting to approximately 31 thousand tonnes.

Operating costs are approximately €61 million, up 9% compared to 2017. Gross value added in 2018 decreased by 24% (compared to 2017), reaching €87.4 million, also impacting the decrease in net profit which, in value, amounted to approximately 52 million Euros. The clams segment reduced the total value of assets which, in 2018, were (-% / 2017). There were few investments, in fact the indicator recorded a contraction in the last year of% compared to 2017. The clams segment reduced the tital value of the activities which, in 2018, amounted to €68 million (-24% / 2017). There were few investments, amounting to €19.5 million (2018) equal to a contraction in the last year of 36% compared to 2017.

ROI continues to be significant as it can attract interest and investors to the industry, although large barriers to entry create a strong deterrent to new producers. There are numerous bureaucratic and environmental constraints that discourage new capital in the clam sector. The expectation for the future was quite high in 2018 (25%).

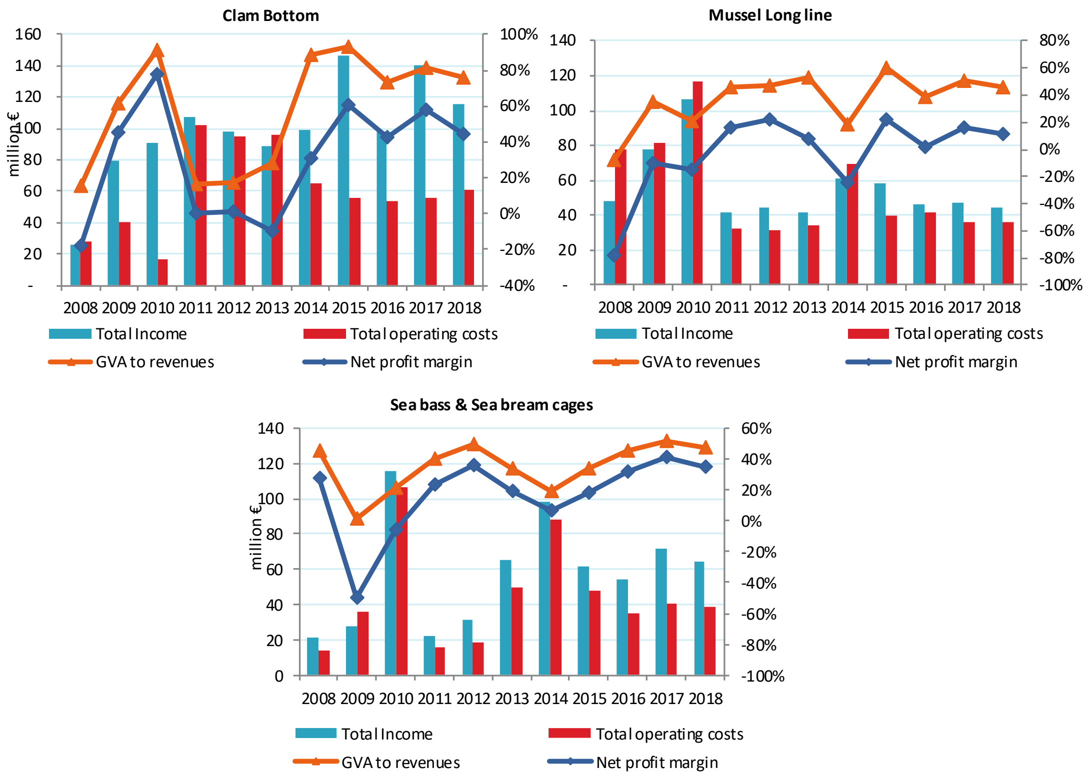
The mussels and clams' sectors are characterized by a complex structure in which still live old traditions and modern capital-intensive farming techniques. Shellfish industry actually, is based almost exclusively on mussels (*Mytilus galloprovincialis*) and clams (*Tapes philippinarum*), limited quantities of clams (Tapes decussatus) and oysters (*Crassostrea giga* and *Ostrea edulis*). Shellfish businesses have been the ones that, in the last three years, have inaugurated the trend towards vertical integration, through the creation of mussel purification centers. These trends, especially in the Veneto and Emilia Romagna areas, have generated greater aggregation of supply and consequent control over price stability. The mussel sector has 224 active companies for a total of 820 FTEs. The average salary paid was about €15 thousand, which increased by 17% compared to the previous year, but which determines a decrease in labour productivity, which was €21.3 thousand (2018 data which is -12% compared to the 2017) which increased in the entire period starting from 2008 by 14%. Sales for the year were 65 thousand tonnes for a total income of approximately €44.8 million. Total operating costs amounted to €36.3 million, and the GVA was €20.7 million, equal to a 7% recovery over the entire period starting from 2008, but down 13% compared to 2017. On the side of the net profit, on the other hand, over the entire period the activity has been very performing, so much so that it has been a percentage increase of 244%. The net profit in 2018 was €5 million (down by 37% / 2017). The total value of assets results more than €60 million, (increased +4%/2017). The data referring to investments points out an entry into the sector of mussels of funds to innovate. This data is linked with the launch of the EMFF and with the specific measures envisaged for the shellfish sector and aquaculture in general. Capital productivity is 34%, which is less than 16% compared to 2017. The indicator that highlights an expectation and confidence in the mussel sector is increasing by + 10% /2017 and equal to 30%. Profitability and ROI, on the other hand, continue a decline and in 2018 is around 9%.

Table 4.15.3 Economic performance of main Italian aquaculture segments: 2008-2018.

Variable	2008	2010	2012	2014	2016	2017	2018	Change 2017-18	Develop. 2018/(08-17)
Clam Bottom									
Number of enterprises	94	158	132	132	176	176	176	0%	26%
FTE	1,594	1,227	673	740	741	953	541	-43%	-45%
Average wage (thousand €)	4.2	7.9	20.5	72.0	38.0	32.5	61.4	89%	105%
Labour productivity (thousand €)	2.5	65.3	24.7	117.5	27.5	44.8	32.0	-29%	-42%
Total sales volume (thousand tonnes)	7.4	40.0	24.0	31.2	25.6	36.2	31.1	-14%	16%
Total income (million €)	25.4	90.5	98.2	99.1	98.1	140.0	115.3	-18%	18%
Total operating costs (million €)	28.0	17.1	95.0	64.8	53.9	56.3	61.1	9%	0%
Gross Value Added (million €)	4.0	80.2	16.6	86.9	72.3	114.6	87.4	-24%	45%
Net profit (million €)	-4.6	70.5	1.3	30.9	41.6	80.8	51.7	-36%	54%
Total value of assets (million €)	18.0	66.7	63.9	62.2	61.6	74.0	67.8	-8%	13%
Net investments (million €)	5.2	21.1	17.7	16.0	19.9	22.9	19.5	-15%	9%
Capital productivity (%)	22.4	120.2	26.0	139.8	117.4	155.0	128.9	-17%	39%
Return on Investment (%)	-23.5	107.0	2.9	51.0	68.0	109.5	76.6	-30%	60%
Future Expectation Indicator (%)	19.5	28.5	25.5	21.7	28.6	27.4	25.4	-7%	-2%
Mussel Long line									
Number of enterprises	224	165	159	159	224	224	224	0%	17%
FTE	1,702	1,410	1,021	714	947	980	820	-16%	-28%
Average wage (thousand €)	15.6	23.2	7.8	29.3	14.3	12.8	14.9	17%	-10%
Labour productivity (thousand €)	-2.3	15.3	20.7	15.4	18.5	24.2	21.3	-12%	14%
Total sales volume (thousand tonnes)	90.5	133.8	85.5	74.5	70.0	68.5	65.1	-5%	-18%
Total income (million €)	47.8	106.1	44.6	61.1	46.4	47.5	44.8	-6%	-22%
Total operating costs (million €)	77.9	116.7	31.2	69.9	41.8	36.2	36.3	0%	-35%
Gross Value Added (million €)	-3.9	21.5	21.1	11.0	18.1	23.8	20.7	-13%	7%
Net profit (million €)	-37.4	-15.7	9.7	-14.6	0.9	7.9	5.0	-37%	244%
Total value of assets (million €)	66.5	101.7	55.1	94.8	67.0	58.3	60.6	4%	-20%
Net investments (million €)	12.3	30.1	24.3	31.7	23.6	18.9	21.4	13%	-9%
Capital productivity (%)	-5.8	21.2	38.3	11.6	27.1	40.9	34.2	-16%	29%
Return on Investment (%)	-54.7	-14.4	18.8	-14.2	1.9	14.3	8.9	-38%	494%
Future Expectation Indicator (%)	9.1	25.5	38.5	28.4	30.3	27.3	30.1	10%	14%
Sea bass & Sea bream cages									
Number of enterprises	35	33	22	22	24	24	24	0%	-9%
FTE	0	153	54	34	73	72	79	10%	-1%
Average wage (thousand €)	12.1	126.0	52.1	255.2	68.3	76.8	69.4	-10%	-7%
Labour productivity (thousand €)	48.4	153.8	275.7	535.0	149.7	220.0	178.8	-19%	1%
Total sales volume (thousand tonnes)	1.7	12.2	3.8	12.8	7.1	9.6	8.4	-13%	11%
Total income (million €)	21.0	116.0	31.2	98.5	54.0	71.6	64.0	-11%	12%
Total operating costs (million €)	13.6	106.1	18.4	88.3	34.7	40.1	39.1	-3%	-13%
Gross Value Added (million €)	9.2	23.5	14.9	18.2	24.3	37.0	30.4	-18%	71%
Net profit (million €)	5.7	-6.5	11.2	6.7	17.0	29.4	22.0	-25%	181%
Total value of assets (million €)	24.1	298.4	34.9	115.1	66.2	72.8	64.2	-12%	-29%
Net investments (million €)	3.2	77.3	4.9	23.8	12.7	9.9	14.7	47%	-20%
Capital productivity (%)	38.2	7.9	42.7	15.8	36.6	50.8	47.3	-7%	71%
Return on Investment (%)	25.2	-0.1	33.3	6.2	26.1	40.7	34.8	-15%	105%
Future Expectation Indicator (%)	8.1	22.5	10.6	18.0	16.3	11.2	18.8	68%	28%

Source: own elaboration from EU Member States DCF data submission

Figure 4.15.3 Economic performance in € million, indicators for the main Italian segments: 2008-2018.



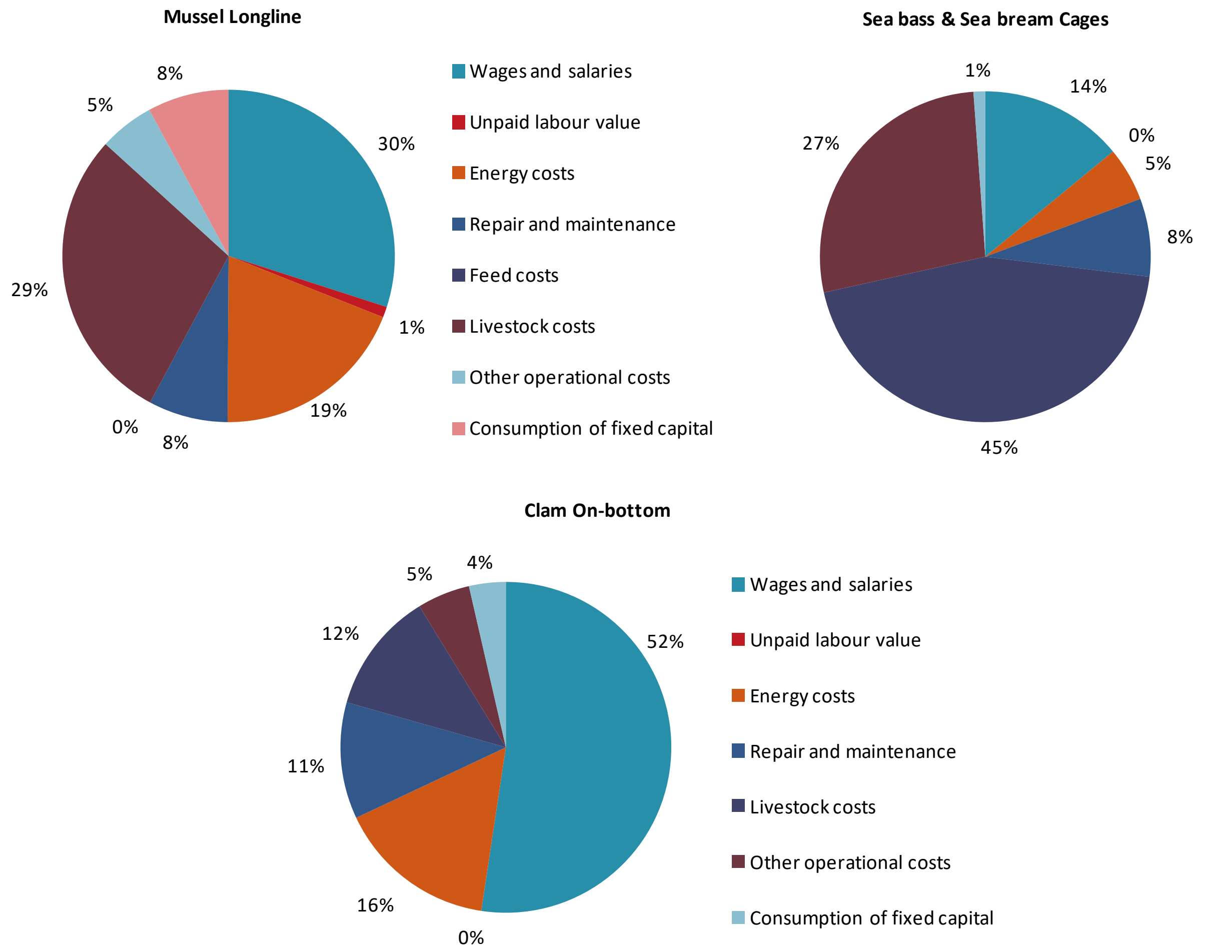
Source: own elaboration from EU Member States DCF data submission

The main segment of euryhaline species is the one in cages. In 2018, 24 organizations were operational and occupied 79 FTEs. Labour productivity registered a decrease of 19% compared to 2017, but increased by 1% since 2008. Wages on average amounted to just over €69 thousand, showing a contraction both in the long term (-7%) and the previous year (-10%).

Although in the entire period (starting from 2008) total sales improved by + 11%, with 8.4 thousand tonnes, 2018 records a decline of 13%, corresponding to total income of €64 million. Operating costs also decreased by 3% to just over €39 million. The GVA is €30.4 million, generating a net profit of €22 million, down by 25% compared to 2017, but certainly high compared to the evolution recorded in the data series starting from 2008. Although total assets were lower than in 2017 (-12%) on the investment side, increases were also reported for the segment of the SBSB in cages, equal to + 47% which, in monetary terms, amounted to €14.7 million. If we consider the future expectation indicator equal to + 68% compared to 2017 and equal to almost 19%, it is clear that the sector is willing to strengthen investments and efforts to give continuity to economic activities. ROI, on the other hand, was around 35%, which portrays a long-term trend of clear recovery.

The structure of operating costs for the seabream and seabass segment confirm two major items: feed which represent 45% and juveniles/fingerlings, which form 27% of total operating costs. The salary is 14% of the total; the other items are below 10%. The mussel segment reveals the highest operating cost around wages (30%). In the entire shellfish sector, salaries are quite high in percentage terms of total operating costs. This is due to the fact that additional activities are often recognized in salaries such as the role of marketing or even the role of seed suppliers. Equally important as wages, in fact, are the costs for seeds (29%). The costs of seeds are on average little variable in the last three years. Only one other cost item is quite significant, namely energy (19%). All other items are no more than 8% in line with the performance of the operating cost structure recorded in the past.

Figure 4.15.4 Cost structure of the main segments in Italy: 2018.



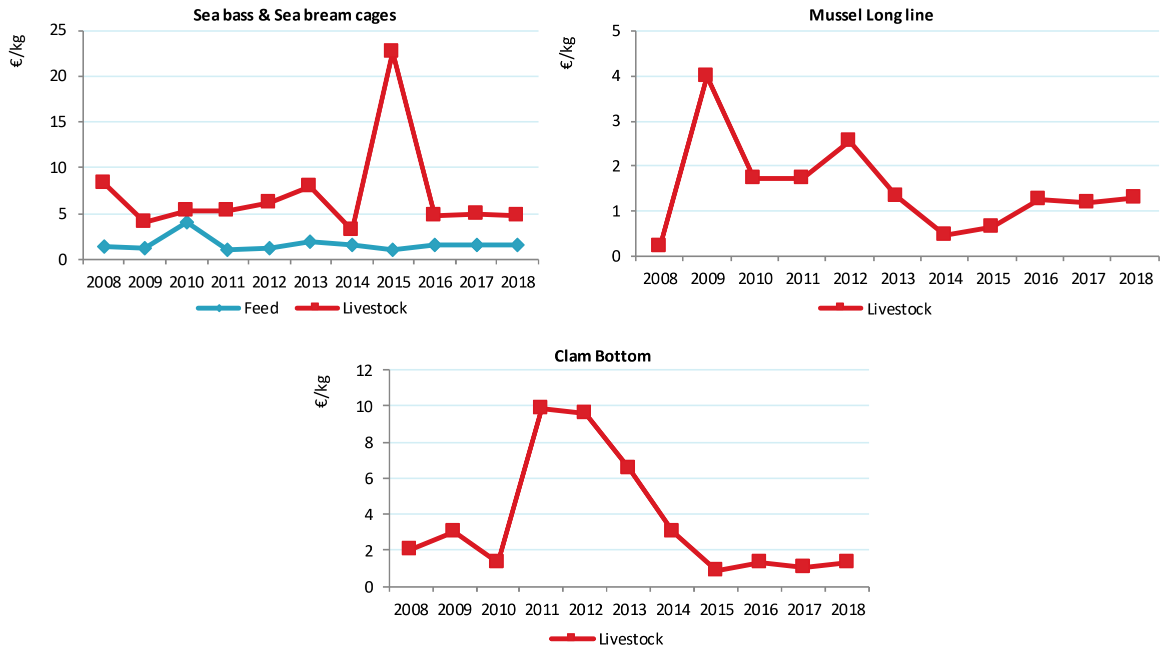
Source: EU Member States DCF data submission

The structure of operating costs in the clam industry has a preponderance of 52% of the costs allocated to wages and salaries. This slice includes both wages and salaries and the purchase of semen directly from the members and workers of the breeding cooperatives. This consideration is reinforced by the cost of the seed which is 12% of the total costs, lower than the cost of energy consumption (16%).

The costs of raw materials for seabream and seabass show a rather constant trend in costs for fry starting from 2016. Italy has the advantage of being among the largest producers of fry of euryhaline species, in particular of sea bream. This allows you to be able to buy fry while containing the costs of transport but also of insurance to cover the mortality of juveniles. In aquaculture farms, the integration of hatchery is now consolidated. In farms where hatchery integration has been implemented, self-production is usually not sufficient to feed the sowing needs. Over the last three years, feed prices have maintained fairly constant prices, and this also emerges from the trends represented. On the feed side, there are few companies that have vertical integration, rather there are agreements based on research and innovation to customize the feed recipes and therefore be more performing according to their own exogenous parameters of the organizations (temperatures, currents, salinity, etc.). For both mussels and clams, the significant item is marked by the purchase of seed.

In both cases, there are cyclical oscillations, generated above all by the availability of seeds. Economies of scale are achieved where consortia and cooperatives of producers have obtained the concession of exclusive areas allocated to nurseries. In this case, producers are able to plan sowing over time and contain price imbalances.

4.15.5 Feed and livestock average prices €/kg for the main Italian segments: 2008-2018.



Source: own elaboration from EU Member States DCF data submission

4.15.5 Outlook

Nowcasts for 2019-20

The data for 2019 and 2020 have been estimated in accordance with official information collected through contacts with stakeholders in the marine, freshwater and shellfish sectors. The contacts and interviews with stakeholders were conducted weekly from March to June 2020 and were then reduced in the summer. From September onwards, official communications and communications made during web-meetings and technical discussion tables between the State and producers followed.

Trends and triggers

The market trend for aquaculture products is demarcated by the commercial strategies that the segments have pursued the most in recent years. The freshwater product has a market diversification quite different from the other segments (marine and shellfish). Freshwater sells about 40% of its production as a live product and as a product for sports activities. The remainder is almost equally sold between large-scale distributions (GDO) and HoReCa. The opening to foreign markets is also confirmed in 2018, especially towards Central European countries that require products such as trout and carp with particular certification and sustainability requirements. These markets recognize the higher price in exchange for greater guarantees of quality and certification. Furthermore, the European market is also a reception area for transformed freshwater products. About 30% of Italian aquaculture (mostly freshwater supply) products are transformed, managing to penetrate new consumer niches. The situation of marine species, represented by economic trends, reflects the choice of commercial channels. Over 80% of the supply of marine aquaculture products is entrusted to logistics platforms and large retailers. Trade agreements support helps stabilize prices and make strategic choices and planned investments. However, Italy remains highly dependent on imports of aquaculture products, especially Greek (40%) and Turkish (20%), although products of good quality, but products raised in cages in Croatia are not particularly competitive with consumer prices. The shellfish segment represents the largest in terms of volumes, but it is certainly the segment where the fragmentation and pulverization of the offer significantly penalize producers' revenues. Much work is being done to qualify the Italian offer. Many efforts are not recognized in terms of the market price. The segmentation of the marketing chain is not very modern, i.e., it is organized very similar to that of fishery products, rather than following the experiences and lessons learned in the aquaculture sector. Clams are closer to sale through organized distribution and the HORECA channel, however leaving 30% of sales through wholesalers and retailers. For oysters, the situation is similar even if the percentages are different, i.e., around 40% is allocated through the HORECA channel and the remainder is shared equally between wholesalers and HORECA. For mussels, there is a reversal of marketing practices: over 70% of mussels are sold through the marketing of wholesalers and HORECA and the residual percentage through platforms of the Organized Channels. Opportunities for the sector have been launched since 2018, in conjunction with EMFF Measures in favour of aquaculture. The investments were mainly aimed at expanding production facilities, where regional plans had foreseen it. Above all, however, investments have been made to process farmed products, also considering relaying and purification plants. Investments in the greater qualification of the offer continue, especially through environmental and organic sustainability certification paths.

4.15.6 COVID-19 impact

In the pandemic period, the whole national aquaculture sector has been very reactive despite the huge anomalies and the general risk. The general considerations concern the three main segments and are:

- great cohesion between all aquaculture/mariculture associations
- great desire to coordinate shared actions to ensure continuity of economic activity
- profusion and commitment to protect employees in terms of guaranteeing salaries, but above all in terms of safety and minimization of the risk of contagion.

The management of the pandemic was obviously managed, within each aquaculture sector, in a different way, because it was conditioned by the most widespread practices in it for commercial exchanges. To better explain the situation, we will proceed to describe how and what estimated effects were produced by COVID-19 during the 10 months of 2020. Nationally, social protection measures have been activated for aquaculture workers and for aquaculture companies, too.

In addition, in May, round tables were launched between state institutions and regions together with producers and their representatives, to reshape some measures of the EMFF. Although the process has started, however, few farmers have collected the subsidies provided specifically for the sector. The information was collected through personal contacts with various national stakeholders.

Shellfish farming, despite having stopped sales, continued in the management and maintenance of farms, safeguarding the live product. Many costs in the months of sales shutdown have increased, especially because the shellfish have been repositioned at the long-line facilities. In fact, where the product had reached the sales size, the risk was that of losing the product attached to the systems, due to the excessive weight not supported by the long-lines and even risking destabilizing the structure of the installations.

After the first two months, the commercial problem also affected planning for the purchase of seed, so that the continuity of the production system is guaranteed. The effects of a shift in the sowing of juvenile seeds will have significant repercussions during 2021. From a labour cost point of view, the farms continued to work, so the use of layoffs was limited. The work was also reorganized, so as to allow compliance with the distancing and the procedures in place to limit the contagion. Therefore, indirect costs have been those of strictly managing safety in the workplace.

The shellfish sector, following the Covid-19 emergency, experienced a period (two months) of total blockage of commercial activities and following the decline in demand for fresh products, both mussels and clams and oysters. In the two months of March and April 2020, the companies represented highlighted and documented commercial losses of between 40 and 100% of turnover. The vertical collapse was mainly linked to the diversification of the commercial channels used for the sale of shellfish. In general, the three most farmed shellfish species in Italy, namely clams, mussels and oysters, do not have the same sales channels. Specifically, the mussel sector suffered a 70% drop in volumes sold in March / April 2020. This was due to the closure of both HORECA and collective catering restaurants and the residual percentage of product sold to fishmongers dropped. In times of pandemic, Italians preferred to stock up on food products, so the fresh mussel was not among the basket of Italians' favourite food items. For clam farms, the first two months of the pandemic were decisive for a reduction of about 35% in sales. The more contained reduction compared to the sales of mussels and oysters were due to the way the clam offer was marketed: producers usually deliver more than 50% through the logistics platform of organized distribution. This sales channel has neither contract nor rescinded supply contracts. The negative repercussions on the sale of clams mainly resulted from the closure of HORECA. The collapse in sales in the first two months of the pandemic also affected oysters. Sales decreased by about 60%, all the part sold through the HORECA related business. Sales through large-scale distribution have kept the volumes previously agreed as supply almost unchanged. The initial shock starting from March was metabolized already towards the beginning of May, where there were signs of recovery and return from the previous block. On the price side, the situation represents damage, as the prices for shellfish have undergone initial reductions of up to about 15% of the initial price and recovering this gap is rather difficult in the short term. This is mainly due to competition between producers, on a national level and competitiveness with imported products. Freshwater species suffered a disastrous six-month period starting in March 2020. The biggest selling point was the impossibility of moving live biomass in European countries. The percentage of live product sold is about 30% of the annual turnover. Further limitations concerned the uneconomic nature of transforming the product, where the transformation had to be outsourced. The transformation involved costs of around €3 per kg. The choice, in most cases in which there was no internal transformation in the farms, was to continue to keep the product in the tank, regarding the daily nutrition protocols and the oxygen supply activities. This has raised energy costs and also impacted on labour costs. There was little use of social subsidies such as layoffs. The organization of work was further affected by additional costs because different work shifts were organized in order to reduce the number of workers present on the farm. The effects of Covid-19 in the marine species sector was mainly catalysed in the first weeks of the pandemic. The contraction was generated because the logistics failed to absorb the offer, including the one planned and already contracted. Many wholesale fish markets have opened and closed in leopard spot. In addition to this was added the impossibility of road hauliers to reach the places of marketing. Great impact was generated by the long closure of the Lombardy region where it is the main Italian wholesale fish market. The same effects were also recorded in Veneto and in other regions in Adriatic side.

4.15.7 Data Coverage and Data Quality

Italian data collection covered the main segment and all data referring to the segment didn't have confidentiality aspects to take in count.

4.16 Latvia

Overview of Latvian aquaculture

Latvian aquaculture sector cultured mainly of freshwater aquaculture species. The primary species cultured in 2019 were Common carp, Rainbow trout and Sturgeon contributing 96% and 94% respectively to the total produced volume and value. The total production volume in 2019 was 689 tonnes corresponding to the value of €4.4 million.

4.16.1 Total Production and sales

During the period from 2015 to 2019, the development of aquaculture in Latvia shows the deterioration trend mainly due to the decrease in the production capacity by 33% between 2018 and 2019 (see Table 4.7.1). However, the aquaculture sector capital productivity between 2015 and 2019 show increase by 34% and also increase in the sales value by 9% during the same period (see Table 4.7.2). The annual total Gross sales of aquaculture production includes sales of fish and crustaceans' sales of juveniles and prepared aquaculture production sold during the reported year, contributing 689 tonnes in volume and value of €4.4 million in 2019.

Production amount of aquaculture products are not restricted with quota or other restrictions, thus, in comparison to fishing, the initiation of business in this sector is simpler. Nevertheless, the development of producing aquaculture is largely hindered by the high production costs of the breeding and the problems with the sales of final products. The main item offered at the market – trade size carps during relatively short summer can usually be grown only in the long three-summer.

4.16.2 Industry structure and total employment

Latvia is rich of the water resources and has a good location of inland waters and a stable, ecologically pure environment, which facilitates the development of aquaculture. The aquaculture enterprises mainly concentrated in the regions of Kurzeme and Vidzeme. A considerable number of agricultural holdings have commenced their business in aquaculture in addition to their other business activity. The main activities of the Latvian aquaculture enterprises are the following:

- Artificial breeding of young fish for restocking in coastal seawater and inland freshwater.
- Fish cultivation in freshwater open land ponds and land-based farms in special tanks and growing up for market sale.
- Short term fish cultivation in freshwater ponds for commercial angling.
- Fish cultivation in household ponds for self-consumption or hobby angling.

For Latvian countryside aquaculture is important business activity and is the employment provision field. The 79 economically active aquaculture enterprises employed 323 persons in 2019 (see Table 4.7.1). The aquaculture sector plays noticeable role in the Latvian regions development. The political and economic instability in the result having relatively little impact on changes of employment level in the aquaculture sector compared to other sectors.

The number of the economically active aquaculture enterprises decreased by 9% between 2015 and 2019. About 90% of enterprises classified as small enterprises where the number of employees is less than 5 people. The total number of persons employed in aquaculture has increased by 34% between 2015 and 2019 and number of FTE stay relatively stable. The noticeable increase by 8% from 2015 and 2019 has been in average wage per one FTE (see Table 4.7.3). The average monthly salary has risen to €1 132 in 2019 what is quite equal to the national average salary in 2019.

The data was submitted according to the EU-MAP segmentation as the segment "Other freshwater fish Other methods (seg.8.5)" due to the small number of enterprises involved in the aquaculture activity in Latvia. However, the segment includes three fish farming techniques: ponds, tanks and raceways and recirculation systems. Total number of ponds registered for fish farming and its area were 648 ponds and 4 951 ha in 2019. There were 1 194 tanks and raceways with the volume of 15 161 m^3 and 46 recirculation systems with the volume of 9 946 m^3. The use of the recirculation aquaculture systems becoming more popular in recent years and the cases when the owners chose to use such equipment increased by 31% from 2015 to 2019.

Table 4.16.1 Production and sales, industry structure and employment for Latvia: 2015-2019

Variable	2015	2016	2017	2018	2019	Change 2018-19	Develop. 2019/(15-18)
Sales weight (thousand tonnes)	1.3	1.5	0.9	1.0	0.7	-33%	-41%
Sales value (million €)	4.2	3.9	3.6	4.4	4.4	-1%	9%
Number of enterprises	88	85	88	87	79	-9%	-9%
Employment	236	250	245	235	323	37%	34%
FTE	168	169	173	182	175	-4%	1%

Source: EU Member States DCF data submission

4.16.3 Overall Economic performance

The total income from the aquaculture generated by the Latvian aquaculture enterprises increased by 3% between 2015 and 2019 up to €6.1 million including €4.4 million from gross sales per species, €120 thousand from the other income and €1.6 million of subsidies (see Table 4.7.2 and 4.7.3). In its turn, the total operating costs increased by 7% during the same period and was €5.6 million in 2019.

Table 4.16.2 Economic performance of the Latvian aquaculture sector: 2015-2019.

Variable	2015	2016	2017	2018	2019	Change 2018-19	Develop. 2019/(15-18)
Total income	6.3	6.0	5.3	6.0	6.1	2%	3%
Total operating costs	5.6	5.0	4.9	5.7	5.6	0%	7%
Total wages	2.0	2.1	2.1	2.5	2.4	-6%	9%
Gross Value Added	0.7	1.1	0.9	1.4	1.2	-10%	22%
Depreciation of capital	2.5	1.7	1.7	1.7	1.5	-11%	-20%
Earning before interest and taxes	-1.9	-0.7	-1.3	-1.5	-1.1	-23%	16%
Financial costs, net	-0.1	0.1	0.0	0.1	0.0	-100%	-100%
Net profit	-1.8	-0.8	-1.3	-1.6	-1.1	-30%	18%
Total value of assets	32.7	26.4	28.1	28.2	25.7	-9%	-11%
Capital productivity (%)	2.2	4.1	3.1	4.8	4.7	-1%	34%
Return on Investment (%)	-5.7	-2.7	-4.7	-5.2	-4.4	-16%	4%

Source: own elaboration from EU Member States DCF data submission

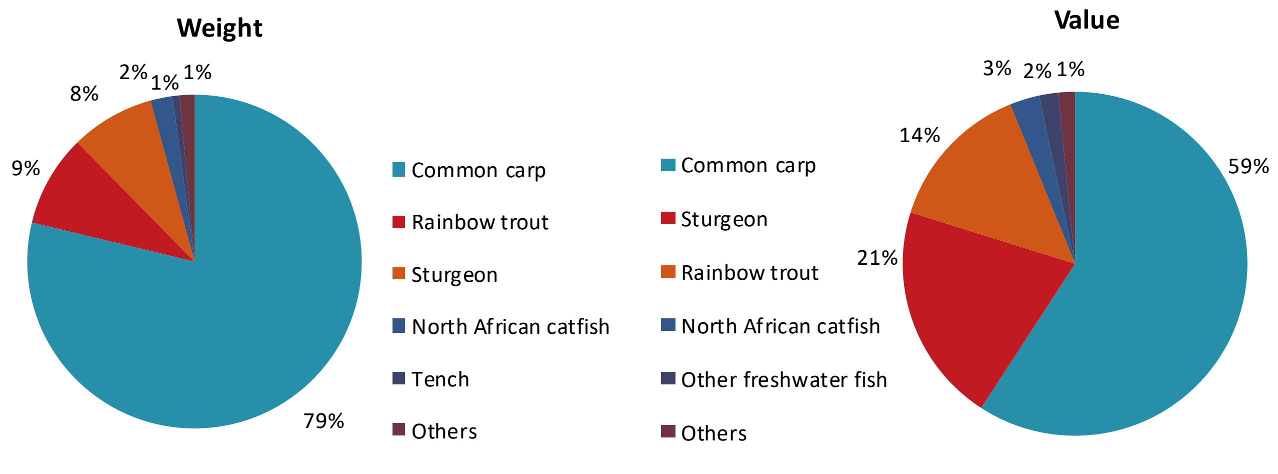
The wages and salaries contribute the largest share to the costs structure or 33% followed by consumption of fixed capital and Other operational costs with the shares 22% and 12% respectively (see Figure 4.7.4). The Energy costs contribute only 12% to the total costs structure in 2019.

In terms of profitability the total amount of Gross Value Add (GVA) is €1.2 million and reported Net profit of €-1.1 million. The sector show losses annually between 2015 and 2019. The reason could be overestimated declared values for the consumption of fixed capital. Before organizing the collection of new data, the methodology and components of this variable should be checked in more detail. There is a possibility that firms that have other activities in addition to aquaculture will attribute all depreciation charges to aquaculture only.

4.16.4 Main species produced and economic performance by segment

Common carp was the main species produced by the Latvian aquaculture sector representing 79% in weight and 59% in value of the total production in 2019 (see Figure 4.7.1). Other important species are Rainbow trout and Sturgeon covering 9% and 8% of weight respectively and 14% and 21% of value respectively in 2019.

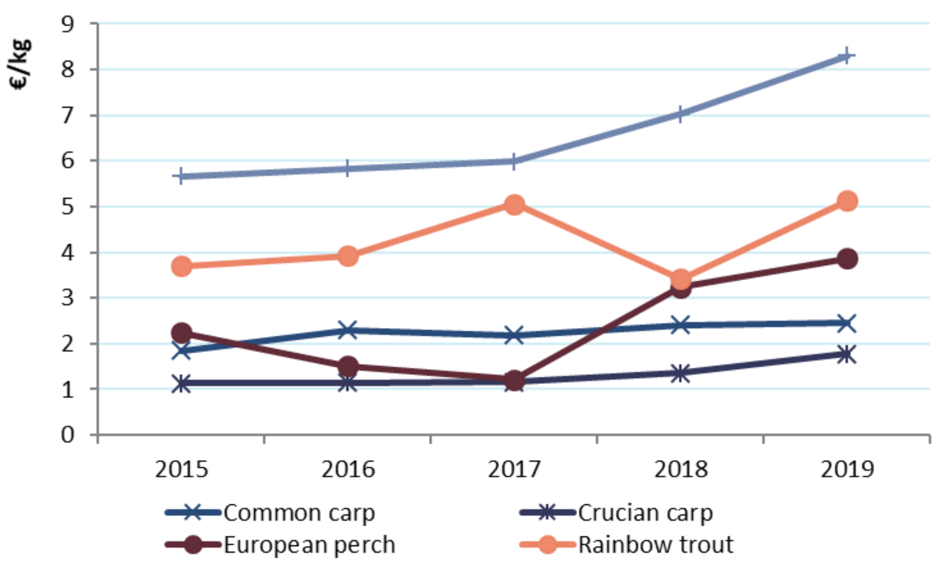
Figure 4.16.1 Main species in terms of weight and value in Latvian production: 2019



Source: EU Member States DCF data submission

The average first-sale price for aquaculture products in Latvia was €5.2 per Kg during the period 2015-2019 and for Common carp was €2.3 per Kg (see Figure 4.7.2). The average price for Rainbow trout and Sturgeon was €4.5 per Kg and €8.3 per Kg respectively in 2019. The average prices for Sturgeon, Rainbow trout and European perch demonstrate an increasing trend between 2015-2019.

Figure 4.16.2 Average prices €/kg for the main species produced in Latvia: 2015-2019.



Source: own elaboration from EU Member States DCF data submission

The section by the segment cannot be provided in whole detail due to the small number of enterprises in the aquaculture sector. The data was submitted according to the EU-MAP segmentation in table 9 as one segment "Other freshwater fish Other methods (seg.8.5)".

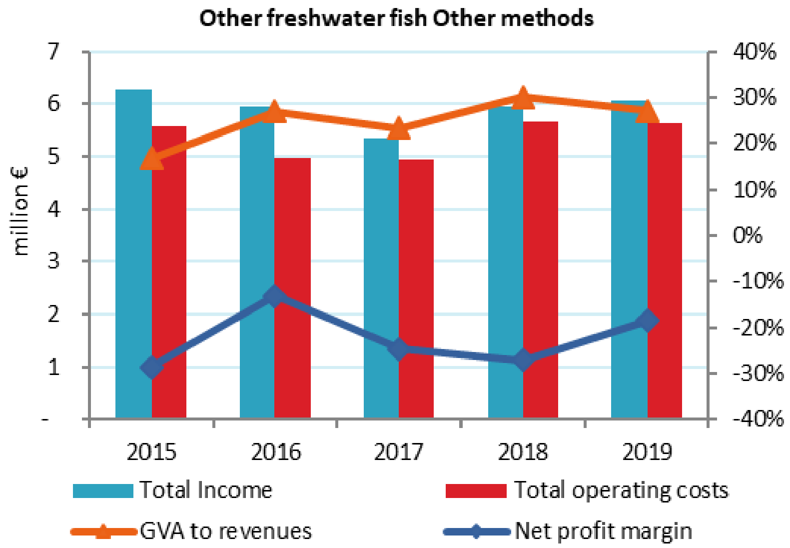
Full description and information with the relevant references to the tables and figures are provided under main section.

Table 4.16.3 Economic performance of main Latvian aquaculture segments: 2015-2019.

Variable	2015	2016	2017	2018	2019	Change 2018-19	Develop. 2019/(15-18)
Other freshwater fish Other methods							
Number of enterprises	*88*	*85*	*88*	*87*	*79*	*-9%*	*-9%*
FTE	*168*	*169*	*173*	*182*	*175*	*-4%*	*1%*
Average wage (thousand €)	*12.2*	*12.2*	*12.1*	*13.9*	*13.6*	*-2%*	*8%*
Labour productivity (thousand €)	*3.0*	*4.3*	*3.5*	*5.7*	*3.8*	*-34%*	*-9%*
Total sales volume (thousand tonnes)	*1.3*	*1.5*	*0.9*	*1.0*	*0.7*	*-33%*	*-41%*
Total income (million €)	*6.3*	*6.0*	*5.3*	*6.0*	*6.1*	*2%*	*3%*
Total operating costs (million €)	*5.6*	*5.0*	*4.9*	*5.7*	*5.6*	*0%*	*7%*
Gross Value Added (million €)	*0.7*	*1.1*	*0.9*	*1.4*	*1.2*	*-10%*	*22%*
Net profit (million €)	*-1.8*	*-0.8*	*-1.3*	*-1.6*	*-1.1*	*-30%*	*18%*
Total value of assets (million €)	*32.7*	*26.4*	*28.1*	*28.2*	*25.7*	*-9%*	*-11%*
Net investments (million €)	*1.2*	*1.5*	*5.5*	*3.0*	*0.0*	*-100%*	*-100%*
Capital productivity (%)	*2.2*	*4.1*	*3.1*	*4.8*	*4.7*	*-1%*	*34%*
Return on Investment (%)	*-5.7*	*-2.7*	*-4.7*	*-5.2*	*-4.4*	*-16%*	*4%*
Future Expectation Indicator (%)	*-4.2*	*-0.7*	*13.4*	*4.5*	*-6.0*	*-233%*	*-285%*

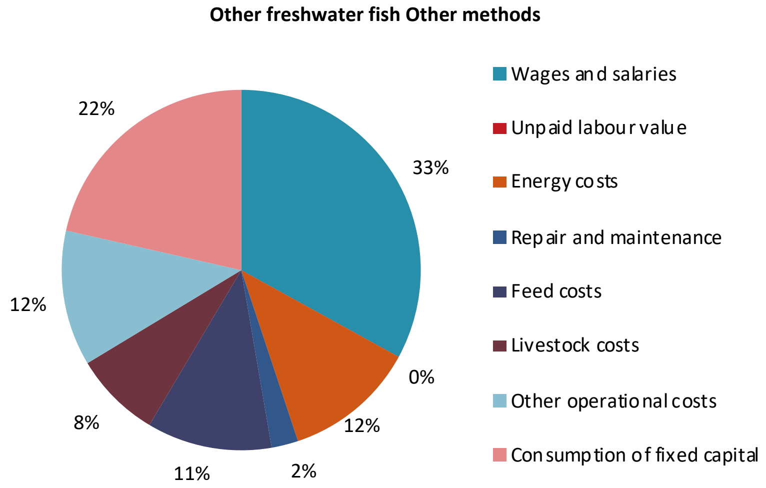
Source: own elaboration from EU Member States DCF data submission

Figure 4.16.3 Economic performance in € million, indicators for the main Latvian segments: 2008-2018.



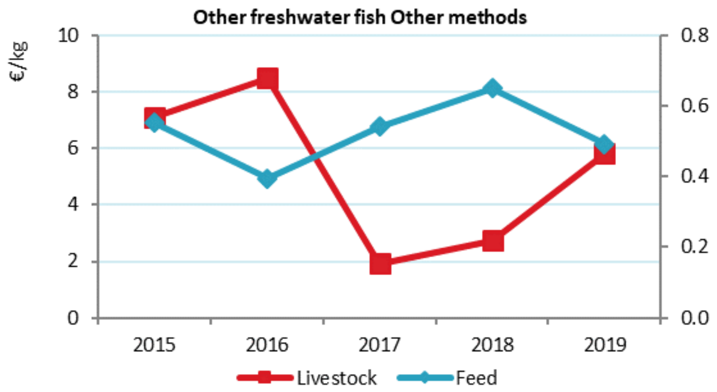
Source: own elaboration from EU Member States DCF data submission

Figure 4.16.4 Cost structure of the main segments in Latvia: 2019.



Source: EU Member States DCF data submission

Figure 4.16.5 Feed and livestock average prices €/kg for the main Latvian segments: 2015-2019.



Source: own elaboration from EU Member States DCF data submission

4.16.5 Outlook

Nowcasts for 2019-20

The data for 2019 was provided in the frame of the Call for social and economic data on the EU aquaculture sector 2020 and is included to the tables and figures. The final data for 2020 will be available in the end of November 2021.

Trends and triggers

The investments in the modernization of aquaculture enterprises and introduction of new technological solutions increased significantly from 2015 to 2018 and was around €3.0 million in 2018. The total number of aquaculture enterprises focused on the market, raise the quality and safety of the produced production, as well as facilitate the extension of assortment of the produced production. Investments in the protection measures compensated losses caused by the wild predators, thus the production produced by the company will remain competitive in the market.

There are two main directions for fish farming in Latvia which will be developed:

- fish farming for market and consumption.

- fish breeding for fish restocking and reproduction in natural streams and lakes (fish recourses reproduction).

In addition to the National Fish resources, restocking program the Latvian Fisheries Fund also supports fish and crayfish restocking in public waters. The state hatcheries restocked around 16 million of fish larvae, juveniles and smolts in Gauja, Venta, Daugava and Lielupe rivers and in the small rivers in 2019. For the fish cultivation in Latvian freshwater open land ponds annually are restocked about 12-26 million of fish larvae, juveniles and smolts.

The Institute of Food Safety, Animal Health and Environment "BIOR" is responsible for the implementation of the National Fish resources restocking program. In BIOR there are 5 State-owned Fish Hatcheries – Tome, Dole, Karli, Brasla, Pelci designated for breeding of salmon and sea trout smolts, pike, pike- perch, river lamprey larvae and juveniles. The program is established in order to ensure the fish fry compensatory releases to lower the damage to fish resources caused by Hydropower Stations as well as to restore damages and losses facilitated by different human activities in public water bodies. Every year they restock around 20 million fish larvae, juveniles and smolts in public waters, however, it is not sufficient; therefore, the private hatcheries should be involved as well.

One of the opportunities for private hatcheries is the specialization in fish resources restocking for public water bodies. Year by year the input of private hatcheries in restocking program is growing and varies from 10% to 25%.

The 43% of Latvian aquaculture enterprises are situated at Natura 2000 areas. These enterprises produce aquaculture production with applying environmental safety methods where recirculation systems are used. The enterprises received special licence from the State Environmental Service, which obligate to follow the environmental safety standards and should comply with Directive 2006/118/EU on the protection of groundwater against pollution and deterioration.

Further industrial processing of fish products from aquaculture is slowly developing in Latvia. The insignificant amount of sold aquaculture production provides evidence that only part from the enterprises produces goods for market. The big share of the aquaculture production is sold fresh. There is no trade system which would comprise and efficiently organize the traffic of aquaculture products supply from small private producers.

However, the Aquaculture in comparison to other fisheries sectors has good development opportunities, due to decrease of fish resources in the sea, aquaculture shall be developed as an alternative source of fish resource. Latvia has good location of inland waters (lakes, rivers) and a stable ecologically pure environment. Amount of aquaculture production is not restricted by quota or other restrictions, thus, in comparison to fishery this sector offers more convenient initiation of business. Nonetheless, in comparison to neighbouring countries Latvia does not have so good climatic conditions for production of aquaculture products in the open land ponds (too warm conditions for the fish of cold waters and too cold - for the fish of warm waters). It may negatively affect in terms of production costs and affect the competitiveness of the industry in international level in the future.

4.16.6 COVID-19 impact

On March 12th, the Latvian government decided to declare a state of emergency until June 9, 2020. The list of measures proposed by the Latvian government to mitigate the negative impact from Covid-19 to the economic situation in Latvia. In the frame of these measures, the following compensations were foreseen in spring 2020:

- compensation for the temporary cessation of fishing activities and aid for storage of fishery products.
- compensation to the aquaculture enterprises for the reduction in sales in aquaculture.
- compensation to the fish processing enterprises for the turnover reduction.

On the 2nd of June, it was decided by the Ministry of Agriculture to provide an additional financial support for the aquaculture enterprises suffered from the COVID-19 crisis. The aim of the support is to reduce the drop in sales and turnover for the aquaculture production.

Small aquaculture enterprises which take a major share in Latvian aquaculture (around 90% of enterprises has less than 5 employee) are the most vulnerable during the COVID-19 crisis. The main factors affecting the aquaculture product chain during the pandemic are deterioration of the supply system, labour shortages, loss of certain markets and changes in consumer structure. Some aquaculture businesses that specialize in the production of expensive fish species or products may suffer from falling demand when consumers can choose cheaper products. The socio-economic consequence and structural changes in workforce negatively impact the sustainability of the sector.

Turnover is expected to decline by 14% due to a decrease in the share of sales focused on the supply of fresh fish for Latvian restaurants that cannot operate at full capacity in the conditions of the pandemic. Operational costs are expected to increase for feed and livestock, as well as for repairs and maintenance. In turn, a decrease is expected in wages due to optimization of staff. Overall, operating expenses are expected to rise by about 5%.

4.16.7 Data Coverage and Data Quality

Data quality and availability

The freshwater data collection is not mandatory for Latvia under the EU-MAP because the total production in the country is less than 1% of the total Union production volume and value. However, Central Statistical Bureau of Latvia (CSB) carries out data collection for the aquaculture sector. The variables such as produced production by species in tonnes and value, total area of fishponds, volume of rearing tanks and number of employments, economic variables are included in the questionnaire form "1- Aquaculture".

The CSB gathers also structural business statistic data extracting the information from official account reports received from enterprises (according to the EUROSTAT definition under NACE Rev. code. 0322 "Freshwater aquaculture".

Due to the small number of aquaculture enterprises and data confidentiality protection the collected data clustered in one segment "Other freshwater fish Other methods (seg.8.5)".

Other data issues or missing data

The following data issues should be taking into account:

- the preliminary data was provided for Persons employed and FTE for 2019.
- the variable Consumption of fixed capital is based on assumption for 2015-2019. The methodology for the calculation of the consumption of fixed capital should be checked and adjusted.
- the data for the variable's Financial income, Financial expenditures and Net Investments was not submitted for 2019. The information will be available for the future data submission.

4.17 Lithuania

Overview of Lithuanian aquaculture

In 2019, Lithuanian aquaculture industry produced 4.2 thousand tonnes of freshwater fish production corresponding to €13.5 million. Compare to 2018, weight and value of production increased by 12% and 8% respectively. Total number of employees increased to 426, corresponding to 320 FTE.

4.17.1 Total Production and sales

Lithuanian aquaculture sector in 2019 produced 4.2 thousand tonnes (FAO, 2021) of total freshwater fish production from which 3.8 thousand tonnes were destined for consumption. The total value of production was €13.5 million in 2019, whereas production destined for consumption is valued for €12.0 million. Compare to 2018 total value of production increased by 7.7%. Total value of aquaculture production has been constantly increasing from 2008. For example, compare to 2008, weight of the total aquaculture production increased by 40.1% in 2019, whereas value improved by 103.0% during the same period (FAO data). In Lithuania aquaculture production comes from two main aquaculture methods, pond aquaculture (including tanks and raceways) and RAS. Total weight and value of pond production, compare to 2018 increased by 7.2% and 4.7% respectively. RAS aquaculture production is sustaining remarkable growth. For example, during 2018-2019 period RAS production weight and value improved by 65.0% and 23.8% respectively.

Table 4.17.1 Production and sales for Lithuania: 2008-2018.

Variable	2008	2010	2012	2014	2016	2017	2018	Change 17-18	Develop. 2018/(08-17)
Production weight (thousand tonnes)	3.0	3.2	3.6	3.8	4.4	3.7	3.8	*0%*	*1%*
Production value (million €)	6.6	6.1	7.7	8.9	12.2	12.2	12.5	*3%*	*42%*

SOURCE: FAO (2021)

4.17.2 Industry structure and total employment

Main segments

In 2019, Lithuanian aquaculture sector consisted from 54 aquaculture units. Sector subdivided to three main segments. The largest segment consists of freshwater species produced in ponds (including tanks and raceways), second is African catfish in RAS and third segment combines other freshwater species produced in RAS. Segment consisting of freshwater species produced in ponds, tanks and raceways represents the largest share of national production. It produces mainly carp, sturgeon, rainbow trout as main species and other fresh water species in less extent. It contributes to the 87% of national production in terms of weight. In 2019, around 18% of total pond production was certified as organically produced. Production of organic pond aquaculture has a constant decline from 2013. For example, during 2013-2019 period weight of organic aquaculture production decreased by 44.7%. The reason is that organic production price is uncompetitive and certification system of aquaculture is incomplete. Organically produced species are sold at price of regular production, whereas organic feed are more expensive and requirements are more constrained. In 2019, pond aquaculture enterprises generated €549 thousand net profit with 5% net profit margin. Compare to 2018 net profit margin remained unchanged.

African catfish, produced in RAS is the second largest segment, contributing to 7% of national aquaculture production weight and 9% of total production value. This segment is relatively new, developed from 2012. Other freshwater species produced in RAS compose third segment which contributes to the national totals with 6% of production weight and 9% of value. It supplies broader variety of high added value species, mainly European eel, rainbow trout, tilapia, Alpine char and etc. RAS segments is under the growing stage, investments and operating costs are higher than income, and therefore it results in negative earnings. In 2019, RAS enterprises generated €1.7 million net loss.

In 2019, Lithuanian aquaculture sector consisted from 9.96 thousand ha from which 5.49 thousand ha were for regular production and 4.47 thousand ha were certified for organic production. Compare to 2018 total area of ponds increased by 4.1%. Pond aquaculture units also exploit tanks and raceways which in 2019 were accounted for 7.78 thousand m^3, with 4.9% decline from 2018. Total volume of RAS in 2019 increased by 21.6% to 6.56 thousand m^3.

In 2019, aquaculture sector employed 426 persons corresponding to 320 FTE. Total number of employees increased by 4% compared to 2018. Pond aquaculture units employed 328 persons, 1% increase compare to 2018, whereas number of employees in RAS increased by 15% to 98 persons. The main driver of increase in the employment was establishment of new RAS aquaculture units, whereas pond aquaculture enterprises maintained more or less stable employment level during recent years. In 2019, around 64% of total employees fall into 40–64 age group. Approximately 24% of employees belongs to 25–39 age group. Employees of 15-24 age group contributed to 5% of total employees in aquaculture sector. Male and female gender distribution in 2019 was 76% and 24% of total employees, respectively.

Labour productivity in terms of value of production per FTE increased by 3% in 2019 and reached €42.1 thousand per employee. Pond aquaculture labour productivity was €41.8 thousand per FTE in 2019 with 2.7% annual increase, whereas RAS labour productivity was €43.8 thousand per FTE with 6% annual increase.

Main species produced

In 2019, the most important species in terms of production weight and value were carps accounting for 74% and 63% of national totals respectively. Compared to 2018 carp production, it increased by 6% to 3.11 thousand tonnes. The average first-sale price for fresh common carp for consumption decreased by 4% in 2019 to €2.59 per Kg. Carps are usually grown in polyculture with other cyprinids as bighead carp, white amur, tench and other freshwater species as European pike and European catfish. Average market price for carps has a tendency to increase from 2015 after the downtrend from 2008 to 2014. The reason of price recovery is the investments to fish processing units in aquaculture farms generating higher value products compare to the fresh production and therefore increasing average price.

The second most important species in terms of production weight is African catfish. In 2019, Lithuanian aquaculture sector produced 311 tonnes of African catfish with 42.8% increase from 2018, whereas value increased by 28.9%. Average market price for fresh-chilled African catfish remained almost unchanged at €2.79 per Kg in 2019, whereas constantly increasing supply of production has a decline effect on average price for fresh production, which in 2019 decreased by 36% compared to 2012. However, development of vertical integration management in aquaculture farms when producers invested to the processing facilities and direct sales or e-commerce infrastructure to generate higher value resulted in the rebound of average price per sales.

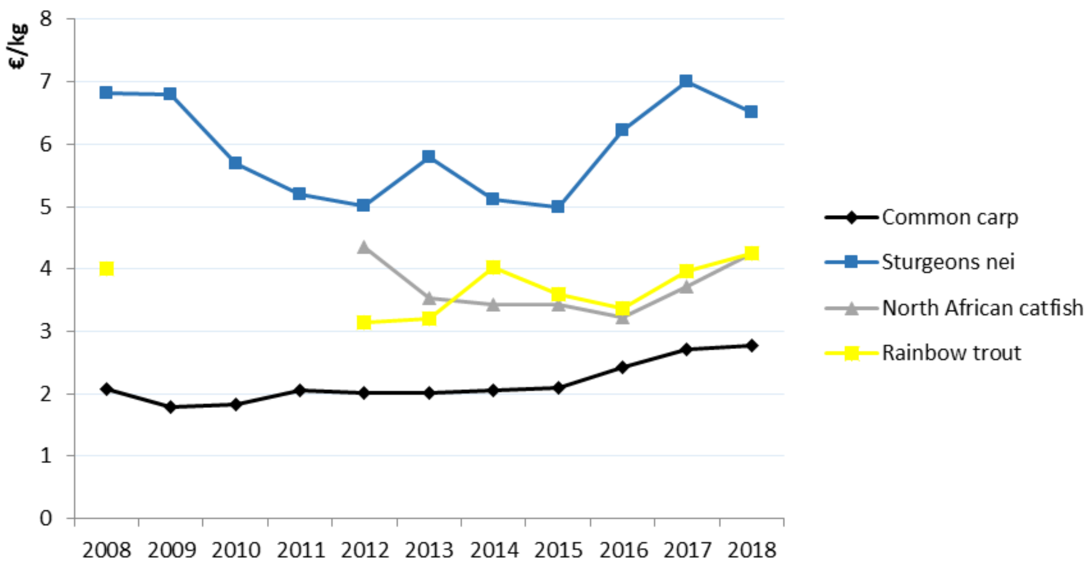
Rainbow trout was third largest species produced by aquaculture industry with 182.4 tonnes of annual production. Compared to 2018, rainbow trout production volume increased by 64%. Around 85% of total Rainbow trout production is sold fresh-chilled. Average price for fresh rainbow trout declined by 17.3% in 2019 to €3.33 per Kg. From the total rainbow trout production, 70% is produced in RAS, whereas rest part comes from ponds, open raceways and tanks. In 2019 average price of trout produced in RAS was 30% lower compare to other production methods.

In 2019, aquaculture farms produced 171.4 tonnes of sturgeons and compared to 2018 weight and value of production increased by 6.7% and 6.1% respectively. In 2019, the average price for fresh-chilled sturgeon in the internal market was €5.15 per Kg and compared to 2018 it improved by 2.2%. Average export price for sturgeon was €9.0 per Kg in 2019.

Figure 4.17.1 Main species in terms of weight and value in Lithuania production: 2018.

Source: FAO (2021)

Figure 4.17.2 Average prices for the main species produced in Lithuania: 2008-2018.



Source: FAO (2021)

4.17.3 Trends and triggers

Current production trends and main drivers

Lithuanian aquaculture production has a growing trend, industry adjusts to different market conditions and consumer demands. Pond aquaculture has a developed stable production capacity which results in constant production quantities and permanent species, whereas RAS segment is developing its capacity. Breakthrough of RAS was observed in 2012 when first African catfish and rainbow trout RAS farms were established. From 2012, RAS capacity increased to 6.6 thousand m^3 generating 565.5 tonnes of production. Recently RAS segment is trending to supply market with new species as Alpine char, whiteleg shrimps, red claw crayfish and tilapia.

Main drivers:

- Higher demand of aquaculture production in the internal market, increased consumption of fisheries products.
- Increased competitiveness through investments including EMFF funds.

- Diversification of income by vertical integration through fish processing facilities, restaurants and direct sales to consumers.
- Development of e-marketing of aquaculture products.
- Adaptation of aquaculture technologies to the consumer needs for newly developed aquaculture products and variety of species.
- Maintenance of the cultural heritage and supply the market with traditional products.
- National aquaculture sector strategy and EMFF funding for aquaculture sector sustainability, development and innovations.
- Development of capacity of hatcheries and nurseries for freshwater species.
- Export limitation for live-fresh aquaculture production. Poland, which is one of the major export markets for pond aquaculture production has been recently suspended imports of live juvenile imports.
- Volume of aquaculture exports from Lithuania is declining since 2008. Increase of production is used for processing and sales in the internal market.
- Increased control of the marketing of live aquaculture production in the Lithuanian supermarkets by reducing the sales from aquarium.

Market structure

In 2019, 87% of total aquaculture production was sold in the internal market. Compare to 2018, volume of exports declined by 32% to 556.8 tonnes. Considerable decline in exports were related to the ban of live production exports from Poland, which is the one of the main export markets of pond aquaculture producers. Around 61% of total exported production was sold in Latvia. In the long term, weight of exported production is constantly declining. For example, compare 2019 to 2010, volume of exported aquaculture production dropped by 62%. As the largest quantities of production comes from pond aquaculture units, exports were mostly live-fresh carp to Poland and Latvia in the form of juveniles as well as for consumption. As both, Poland and Latvia are increasing supply from local producers, export from Lithuania have declined. Therefore, Lithuanian aquaculture producers had to adjust to these market conditions and successfully directed supply to the processing by adding value to the raw production and better accessing other markets and consumers. The majority part of production in the internal market is sold as fresh mainly in supermarkets and also directly from farms. Many producers developed e-marketing infrastructure and sells products through internet directly to the consumers. Growing trend of aquaculture production, increase demand on juveniles and livestock from hatcheries. For example, in 2019 value of sales of juveniles increased by 17% compare to 2018 and in the total aquaculture production value had 11%.

EMFF

During the implementation of 2014-2020 EMFF Operational Program for Lithuania the highest interest for the investments were under the Union Priority 2 (UP2 "Fostering environmentally sustainable, resource efficient, innovative, competitive and knowledge-based aquaculture") measure "Productive investments to aquaculture" applying for around €13.2 million. In 2019, the call of applications under the measure "Productive investments in large-scale aquaculture production" area of activity "Productive investments in aquaculture" has been started with already 4 applications. Under this measure, support for one project will be up to €2 million, but the change in the volume of production and sales after the project implementation must be at least 250 tonnes per year. A significant part of the priority budget is foreseen for projects under the new Instrument "Animal Health Measures" activity "Initiatives to reduce the dependence of aquaculture on veterinary medicines", which appeared in the OP only from September 2019. The best performing UP2 measure was "Aquaculture performing environmental functions" where 95% of the value of the product indicator of the measure has been already reached. During the OP implementation lack of interest for the investments related to the improvement of energy efficiency and renewable energy.

Outlook

Based on preliminary LAFPMIS data, total aquaculture production volume in 2020 was 4.3 thousand tonnes corresponding to €13.5 million value and compare to 2019 remained almost unchanged. RAS Production volumes in 2020 is foreseen to increase by 9% with the growth of value by 7%. Result was influenced by contribution of new producers as well as increase of sales in large scale RAS units. Pond aquaculture production remained almost unchanged with slight decline of 2% in value of production. Decrease in value was a result from the lower prices in the market during COVID19 pandemic. Data for 2020 shows that aquaculture producers are further increasing capital by investing in the sector indicating the positive expectations of industry. Employment in terms of FTE in 2020 is expected to remain at the same level as in 2019. Increase of employees from new producers were followed by decline of FTE as a result of downtime from pandemic constraints.

4.17.4 COVID19

The impact on the sale volumes of aquaculture production depended on the sector segment. Large-scale pond and RAS aquaculture producers which has long-term contracts with retail supermarkets did not reduce volume and value of sales and the pandemic had minimal impact on production realization. Some large-scale producers depending on the contracts, due to the reduced wholesale price, decreased the quantities of production in the market and chose stocking option. Stocking of market-size fish will result in the increase of expenditures on production storage resulting in higher prime costs. During the pandemic period, significantly increased food consumption in the internal market leading to higher demand of aquaculture production from local producers compensated decline of exports. Demand was mostly relevant in large supermarkets, as the access to smaller market units was constrained.

The closure of local markets and the restriction of the movement of buyers had a significant impact on the sales of products to smaller aquaculture farms, which mainly produce African catfish and rainbow trout in small-scale RAS systems. Although the sale of food products was not banned by measures of pandemic control, the closure of local markets significantly reduced buyers access to marketed products. Later, when the movement between municipalities was restricted, the sales of products in smaller settlements were affected by the lack of passing buyers. Seasonality is not a relevant factor for RAS aquaculture producers, so the decrease in customer flows during the pandemic period had a negative impact on sales throughout the year. Companies in this segment depend on direct consumers who buy products directly from companies or in the local markets.

4.17.5 Data Coverage and Data Quality

Lithuania only produces freshwater aquaculture and since freshwater aquaculture is not compulsory under the DCF, it did not submit aquaculture data under the DCF regulation. Therefore, FAO data was used in this analysis. Data for 2020 is taken from Lithuanian Agricultural and Food market Information System (LAFPMIS), data is included to Official Statistics Programme of Lithuania.

4.18 Malta

Overview of Maltese aquaculture

In 2018, Maltese aquaculture industry produced 19.3 thousand tonnes of marine fish corresponding to €242.7 million in sales value. Compared to 2017, sales weight and value increased by 23% and 35%, respectively. Total number of employees increased to 320, corresponding to 258 FTE.

4.18.1 Total Production and sales

The sector is dependent on marine fish aquaculture. In 2018, 19.3 thousand tonnes of marine fish were sold by the Maltese aquaculture sector, a significant increase of 23% compared to previous year 2017 following an increasing trend since 2008. Actually, a rise of 121% in the volume of sales is shown when compared 2018 over the period 2008-2017. This was also reflected in the sales value, where sales from aquaculture production in Malta amounted to €242.7 million in 2018, a rise of 35% compared to 2017 and 166% increase compared to the period 2008-2017.

4.18.2 Industry structure and total employment

Seven aquaculture enterprises operated in both 2017 and 2018, one more compared to previous years. The number of employed individuals in the sector as from 2014 has been gradually increasing each year. Compared to the year prior, in 2017 employment increased significantly by 25%, whereas if compared to the period 2008-2017 employment increased by 57%. In 2018, the total number of persons employed in the Maltese aquaculture sector was 320, corresponding to 258 FTEs. As similar to number of individuals employed, FTE in 2018 shows an increase of 19% compared to 2017 and a much higher increase of around 47% over the period 2008-2017.

Table 4.18.1 Production and sales, industry structure and employment for Malta: 2008-2018.

Variable	2008	2010	2012	2014	2016	2017	2018	Change 2017-18	Develop. 2018/(08-17)
Sales weight (thousand tonnes)	**6.7**	**5.4**	**7.0**	**8.6**	**13.7**	**15.7**	**19.3**	23%	121%
Marine	6.7	5.4	7.0	8.6	13.6	15.7	19.3	23%	123%
Freshwater	0	0	0	0	0.1	0.0	0.0		
Sales value (million €)	**93.6**	**54.3**	**83.2**	**97.3**	**164.0**	**180.4**	**242.7**	35%	141%
Marine	93.6	54.3	83.2	97.3	163.1	180.4	242.7	35%	143%
Freshwater	0	0	0	0	0.9	0.0	0.0		
Number of enterprises	**6**	**6**	**6**	**6**	**6**	**7**	**7**	0%	15%
Marine	6	6	6	6	5	7	7	0%	19%
Freshwater	0	0	0	0	1	0	0		
Employment	**221**	**227**	**167**	**179**	**224**	**256**	**320**	25%	57%
Marine	221	227	167	179	221	256	320	25%	58%
Freshwater	0	0	0	0	3	0	0		
FTE	**169**	**161**	**153**	**153**	**224**	**216**	**258**	19%	47%
Marine	169	161	153	153	221	216	258	19%	48%
Freshwater	0	0	0	0	3	0	0		

Source: EU Member States DCF data submission

4.18.3 Overall Economic performance

In 2018, total income increased by 35% when compared to 2017, continuing the positive trend which began in 2010. The same picture is shown for total operating costs where they were increased as well compared to 2017 (+12%), but at a much less percentage than the increase in total income, having a positive impact in Net profit. Despite the fact that in 2017 the Maltese sector faced net losses of almost €32 million, in 2018 it enjoyed Net profit of €2.3 million, a rise of over 100%. Unsurprisingly, Gross value Added (GVA) and Capital productivity followed the same trends as Net Profit since they were negative in 2017 but in 2018 they both became positive and increased significantly by 161% and 156% respectively when compared to the previous year.

Variations in expenditure, capital costs and capital value were observed when compared to previous years. These variations from year to year probably derived from the fact that the population is very small (only 7 enterprises in total) and thus any significant change in any of the enterprises would result in a large variation in data.

Table 4.18.2 Economic performance of the Maltese aquaculture sector: 2008-2018.

Variable	2008	2010	2012	2014	2016	2017	2018	Change 2017-18	Develop. 2018/(08-17)
Total income	93.7	54.5	83.2	97.3	164.0	180.4	242.7	35%	139%
Total operating costs	77.8	42.4	88.1	87.3	149.3	210.2	236.2	12%	141%
Total wages	4.1	3.3	3.5	3.5	3.8	4.9	8.6	75%	131%
Gross Value Added	19.8	15.4	-1.4	13.6	18.5	-24.8	15.1	161%	124%
Depreciation of capital	8.8	6.3	1.5	1.4	1.3	2.0	4.2	108%	-9%
Earning before interest and taxes	7.1	5.7	-6.4	8.6	13.3	-31.8	2.3	107%	241%
Financial costs, net	1.1	1.1	-1.4	0.0	0.0	0.0	0.0	0%	-100%
Net profit	5.9	4.6	-5.0	8.6	13.3	-31.8	2.3	107%	191%
Total value of assets	18.7	13.7	9.5	29.0	26.4	41.5	44.9	8%	101%
Capital productivity (%)	105.9	112.0	-15.2	46.8	70.1	-59.9	33.7	156%	-14%
Return on Investment (%)	37.8	41.9	-67.9	29.7	50.5	-76.7	5.1	107%	193%

Source: own elaboration from EU Member States DCF data submission

4.18.4 Main species produced and economic performance by segment

The aquaculture industry in Malta is marine-based. The greatest part of production volume and value is by far attributed to the capture-based aquaculture for Atlantic Bluefin tuna since it represents the 90% and 94%, respectively. Following this, other important segment is Gilthead seabream, which accounts for the 9% of total production volume and 5% of the total value. Other species include the Greater amberjack and the European seabass, which all together account only for 1% of both total volume and total value.

On a regional scale, Malta attributes for low volumes of seabass and seabream and other species except for Bluefin tuna. Bluefin tuna fattening attributes for a significant share in the Mediterranean.

Bluefin tuna is the dominated species for the Maltese aquaculture. It receives very high prices especially in the Japanese market, which it is the main market for this species. It is noted however, that since 2011 the average price is showing a decreasing trend.

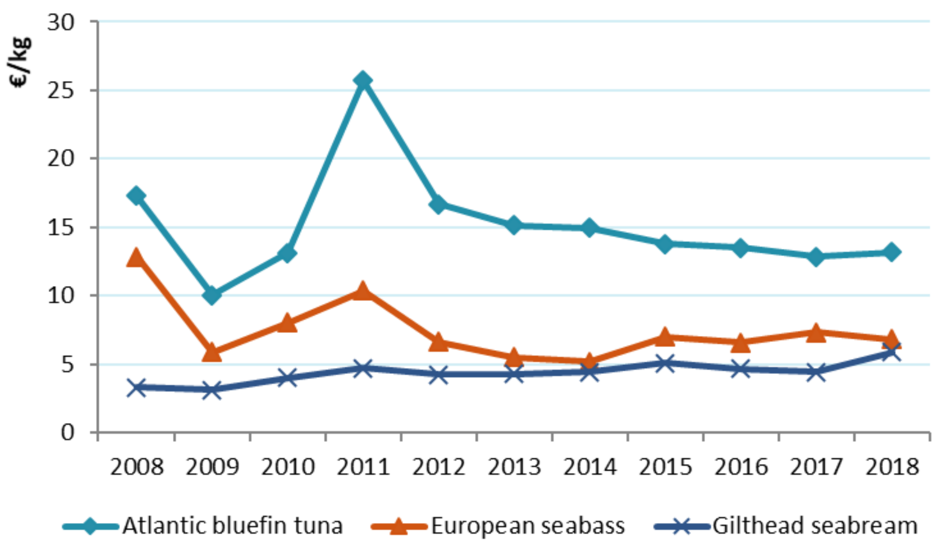
The lowest average price per kilogram remained for the Gilthead seabream, the second most important species. The trend in the prices of Gilthead seabream is practically unchanged in the entire period recorded.

The price of European seabass tends to fluctuate over the years being reported. Due to the price increments recorded in 2015, 2016 and 2017 the gap between European seabass and Gilthead seabream seemed to be slightly widening, once again. However, this has changed in 2018 where the prices of the two species became the same.

Figure 4.18.1 Main species in terms of weight and value in Malta production: 2018.

Source: EU Member States DCF data submission

Figure 4.18.2 Average prices €/kg for the main species produced in Malta: 2008-2018.



Source: own elaboration from EU Member States DCF data submission

4.18.5 Economic performance by segment

The largest segment in the Maltese aquaculture sector is the 'other marine fish cages', which mainly consists of Atlantic Bluefin tuna aquaculture and small contribution from the production of brown meagre and amberjack. The tuna is captured in the wild and fattened in the offshore cages. A very minor amount of other marine fish species is also included. Six aquaculture enterprises operated in both 2017 and 2018.

In 2018, total income increased by 36% when compared to 2017 reaching the €228.6 million, continuing the positive trend, which began in 2010. Taking into account the period 2008 – 2017 the amount of total income in 2018 corresponds to a rise of almost 150%. There was an increase of 14% in total operating costs reaching €222.2 million in 2018 compared to previous year.

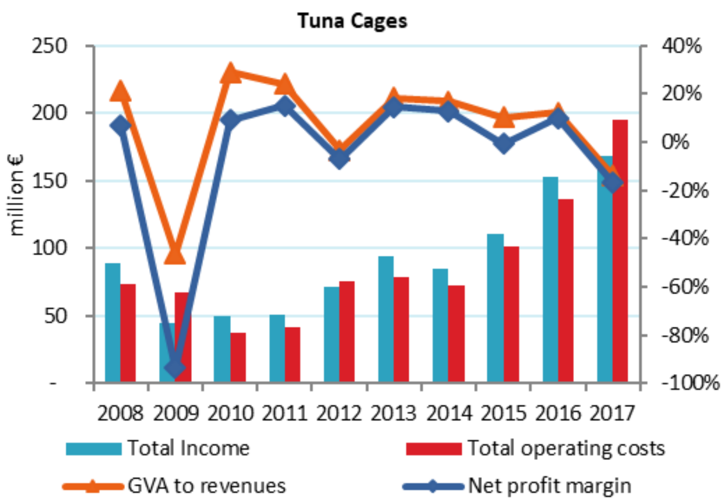
The GVA in 2018 was €13 million, equal to a 112% recovery over the entire period starting from 2008 and also 155% compared to 2017. On the side of the net profit, over the entire period the activity has been very performing, so much so that it has been a percentage increase of 254%. The net profit in 2018 was €2.8 million (up by 110% from 2017). The total value of assets results around €38 million, increased by 13% compared to 2017. The data referring to investments points out an entry into the sector of funds to innovate in 2018 since the increase in investments is over 350% if compared over the period 2008 – 2017. This data is linked with the launch of the EMFF and with the specific measures envisaged for the aquaculture sector. Capital productivity is 34.3% which is around 150% compared to 2017, where this indicator was negative. Despite the fact that the indicator that highlights an expectation and confidence in this sector is decreasing by 15% /2017 and equal to about 16%, it shows a big increase of nearly 200% if compared to the entire period 2008- 2017.

Table 4.18.3 Economic performance of main Maltese aquaculture segments: 2008-2018.

Variable	2008	2010	2012	2014	2016	2017	2018	Change 2017-18	Develop. 2018/(08-17)
Other marine fish cages									
Number of enterprises	*5*	*5*	*4*	*5*	*4*	*6*	*6*	*0%*	*28%*
FTE	*145*	*111*	*113*	*107*	*74*	*153*	*198*	*29%*	*70%*
Average wage (thousand €)	*23.4*	*23.3*	*19.6*	*22.1*	*33.9*	*22.5*	*33.1*	*47%*	*43%*
Labour productivity (thousand €)	*131.4*	*130.5*	*-21.0*	*133.1*	*251.9*	*-127.1*	*52.5*	*141%*	*-21%*
Total sales volume (thousand tonnes)	*5.7*	*4.3*	*4.3*	*5.7*	*11.3*	*13.1*	*17.3*	*32%*	*160%*
Total income (million €)	*89.4*	*49.7*	*71.3*	*84.4*	*152.5*	*168.4*	*228.6*	*36%*	*149%*
Total operating costs (million €)	*73.6*	*37.8*	*75.9*	*72.5*	*136.4*	*195.3*	*222.2*	*14%*	*152%*
Gross Value Added (million €)	*19.1*	*14.5*	*-2.4*	*14.2*	*18.6*	*-23.5*	*13.0*	*155%*	*112%*
Net profit (million €)	*6.0*	*4.6*	*-5.1*	*10.8*	*15.2*	*-28.5*	*2.8*	*110%*	*254%*
Total value of assets (million €)	*18.0*	*13.3*	*7.9*	*22.9*	*20.5*	*33.4*	*37.8*	*13%*	*105%*
Net investments (million €)	*4.0*	*1.3*	*0.5*	*0.4*	*1.3*	*7.8*	*9.6*	*24%*	*351%*
Capital productivity (%)	*106.0*	*109.0*	*-30.3*	*62.0*	*90.9*	*-70.3*	*34.3*	*149%*	*-15%*
Return on Investment (%)	*39.8*	*42.8*	*-75.1*	*47.1*	*73.9*	*-85.3*	*7.3*	*109%*	*466%*
Future Expectation Indicator (%)	*-25.8*	*-36.7*	*-10.1*	*-2.7*	*1.9*	*18.6*	*15.9*	*-15%*	*197%*

Source: own elaboration from EU Member States DCF data submission

Figure 4.18.3 Economic performance in € million, indicators for the main Maltese segment: 2008-2018.



Source: own elaboration from EU Member States DCF data submission

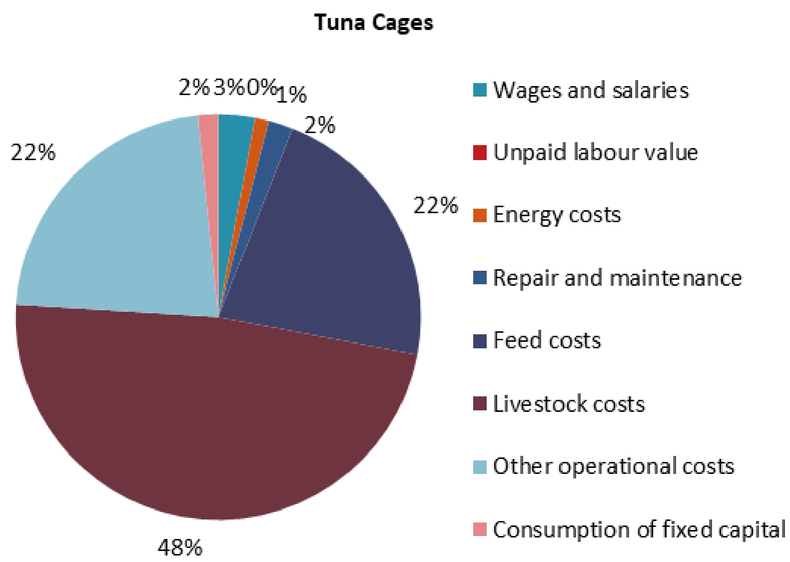
Variations in expenditure, capital costs and capital value were observed when compared to previous years. These variations from year to year probably derived from the fact that the population is very small (only 6 enterprises in total) and thus any significant change in any of the enterprises would result in a large variation in data.

Labour productivity in terms of value of production per FTE increased by 141% in 2018 and reached €52.5 thousand per employee. However, this corresponds to a decrease of 21% if compared over the 2008-2017. The labour productivity was negative in 2017.

The second most important segment is the marine production of sea bass and seabream in cages. This sector consists only of one firm. Thus, for confidentiality reasons its economic performance is not provided.

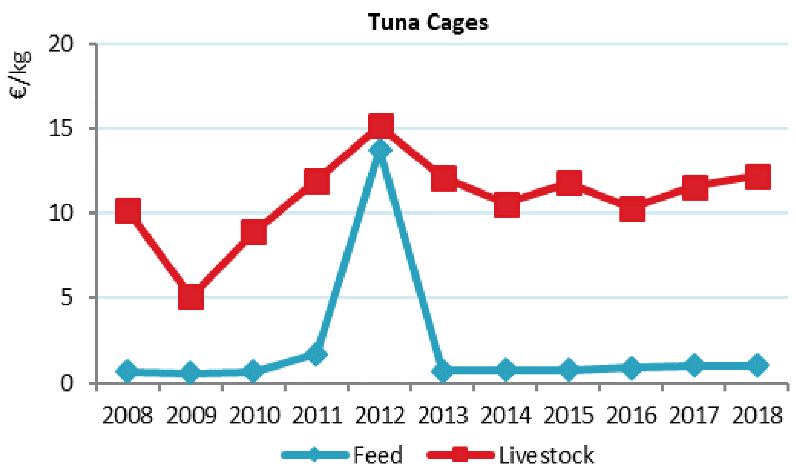
The structure of operating costs for the main sector of Maltese aquaculture, the tuna cage, shows that three expenditure represent more than 90% of the total costs. The main expenditure is the livestock cost which accounts for 48% of the total costs of the sector and it is followed by the feed and other operational costs which each expenditure represents the 22% of the total costs.

Figure 4.18.4 Cost structure of the main segment in Malta: 2018.



Source: EU Member States DCF data submission

Figure 4.18.5 Feed and livestock average prices €/kg for the main Maltese segment: 2008-2018.



Source: own elaboration from EU Member States DCF data submission

4.18.6 Outlook

Maltese aquaculture production has a growing trend. The increases in TAC for Bluefin Tuna made in ICCAT recommendation 14-04 were a major driver for the positive growth of this segment for both 2015 and 2016. ICCAT recommendation 17-07 which increased further the TACs for Bluefin tuna in the Eastern Atlantic and Mediterranean, supported further the segment due to the increase of the production capacity of the Maltese aquaculture companies operating in this segment.

Progress in research and innovation of the Maltese Aquaculture Sector as planned in the National Aquaculture Strategy may produce high outputs for other species at lower costs which may result in future growth and profits.

4.18.7 Data Coverage and Data Quality

In Malta, the aquaculture sector is divided into two main segments, these being:

- Sea bass and sea bream cages
- Other marine fish cages

However, due to the limited number of enterprises, only one, in the sea bass and sea bream cages sector, it is not possible to present data on this segment, due to confidentiality reasons.

4.19 The Netherlands

Overview of Dutch aquaculture

The Dutch aquaculture sector is dominated by the shellfish (blue mussel and oysters) produced in marine coastal waters. Blue mussel was by far the largest of both shellfish species with a 95% (49 thousand tonnes) of the total weight sales and 80% (€53.8 million) of total gross sales in 2018. After difficult years with minimal net profits of €2.5 million (2017), the year of 2018 resulted into a higher net profit of €9.3 million for the Dutch mussel sector. The net profit margin increased from 5% (2017) to 16% (2018). For 2019, it is expected that there will be a lower economic performance by the Dutch shellfish aquaculture. Compared to 2018 the project total sales weight will decrease (-31%) as well as total sales value (-27%). Mainly due to a high mortality rate and slower growing (and therefore later readiness to harvest and market) of shellfish compared to other MS producing similar species.

For the economic structure (cost and income indicators) only data for segment 10.11 (mussels on-bottom) were included for 2017 and 2018. The financial (operating) costs for segment 11.11 (mussels on-bottom) were lacking for these both years and therefore excluded for the economic performance indicators in this report. The segment of freshwater aquaculture is not included as this segment is not participating in the DCF for the Netherlands anymore since 2015. Therefore, figures and tables should be interpreted with caution:

- 2008-2014: shellfish (blue mussel and oysters) and freshwater aquaculture
- 2015-2016: shellfish (blue mussel and oysters)
- 2017-2018: shellfish (only blue mussel)

There is no marine (finfish) aquaculture in the Netherlands.

4.19.1 Total Production and sales

The Dutch aquaculture sector produced a total of 51.9 thousand tonnes of shellfish in 2018, which corresponded to an increase of 12% compared to 2017. The total production value was around €68 million in 2018 (+11% from 2017). Compared to the annually average for the last ten year time period (2008-2017), the volume of shellfish production (weight) increased by 6% in 2018. The total sales value (in euro) of shellfish was rather stable over the similar period with an increase of 1% for 2018.

4.19.2 Industry structure and total employment

In 2018 (Table 4.7.1), the total population of mussel and oyster aquaculture farms was 69, distributed over mussel production (48 companies) and oyster production (21 companies). The Dutch aquaculture sector is dominated (97%) by small enterprises with less than 5 employees. In total 243 persons were active within the Dutch shellfish producing companies in 2018. This was slightly less (-2%) to the previous year. Most of the persons were employed in the mussel producing companies (181 employees) in 2018. In total 12 persons were registered as unpaid labour. The resting 50 employees were active in the oyster companies. Since all persons working in the shellfish are full time employed, the FTE is equal to the number of persons. Despite the dominance of individual operating shellfish companies, recently (2019-2020) there were a couple of joint ventures within the Dutch shellfish aquaculture industry. Processing companies did vertically integrate by buying out some shellfish producing or/and other shellfish processor companies. It is expected that this development of consolidation will continue in the nearby future as larger shellfish companies want to reduce risks of lacking raw materials throughout the seasons. Consolidation could also be a strategy by companies to strengthen their sales by diversifying their distribution channels and to scale (up) sales volumes.

Table 4.19.1 Production and sales, industry structure and employment for the Netherlands: 2008-2018.

Variable	2008	2010	2012	2014	2016	2017	2018	Change 2017-18	Develop. 2018/(08-17)
Sales weight (thousand tonnes)	**38.3**	**74.6**	**53.9**	**63.1**	**55.6**	**46.5**	**51.9**	12%	-5%
Shellfish	38	60	44	57	56	47	52	12%	6%
Freshwater		14.2	10.0	5.7					
Sales value (million €)	**105.4**	**109.1**	**101.3**	**92.1**	**56.7**	**60.7**	**67.5**	11%	-24%
Shellfish	69	76	76	68	56.7	60.7	67.5	11%	1%
Freshwater	36.8	33.0	25.2	24.3					
Number of enterprises	**130**	**119**	**111**	**110**	**66**	**69**	**69**	0%	-32%
Shellfish	80	77	74	74	66	69	69	0%	-6%
Freshwater	50	42	37	36					
Employment					**229**	**234**	**231**	-1%	-2%
Shellfish					229	234	231	-1%	-2%
Freshwater									
FTE	**215**	**364**	**350**	**205**	**228.6**	**234.5**	**231.1**	-1%	-17%
Shellfish	215	203	200	205	228.6	234.5	231.1	-1%	8%
Freshwater		161	150						

Source: EU Member States DCF data submission

4.19.3 Overall Economic performance

For the economic performance the data of financial (operating) costs for segment 11.11 (oysters on-bottom) were lacking for 2017 and 2018. Therefore only segment 10.11 (mussels on-bottom) was included for the economic performance.

From 2017 to 2018, total income (excluding oysters) increased by 9% to a total of €57 million. Majority (94%) of this total consisted of gross sales where the rest (6%) was contributed by other income.

The expenditures (excluding oysters) also known as total operating costs were in total €42 million in 2018. This was a 6% decrease from 2017 but an increase (12%) of the annually average expenditures from last decade (2008-2017).

In 2018 expenditures were dominated by other operational costs (43%), wages and salaries (32%), repair and maintenance costs (13%), energy cost (11%) and imputed value of unpaid labour (2%). All costs decreased between 2017 and 2018 however the largest contribution of decreased total expenditure was affected by the repair and maintenance costs (-20%, €-1.3 million). Energy costs have decreased (-4%) in particular because of the lower fuel prices. In Table 4.7.2, total wages is demonstrated with minus 5% from the last year. Total wages is the sum of two expenditure indicators: 1) imputed value and unpaid labour and 2) wages and salaries.

The gross value added (excluding oysters) increased by 30% from 2017 to 2018. This large increase could be explained by higher income (+9%, €+4.9 million) and lower operating costs excluding total wages (-6%, €-1.9 million). The EBIT more than doubled (+148%) and net profit was almost four times higher (+274%) in 2018 compared to the previous year. However, it must be emphasized that the EBIT and net profit were relative low in 2017 with €4.7 million and €2.5 million, respectively. The year of 2016 had a slightly lower performance in economic terms. The net profit was €5.4 million. However, this was including oysters. If only blue mussel were taken into account, it was a loss giving year with a net profit of minus €2.0 million. The total value of assets increased with 7% to €104.3 million in 2018 (relative to €97.4 million in 2017). The total level of debts decreased with 11% (to total of €73 million) over the same period.

Table 4.19.2 Economic performance of the Dutch aquaculture sector: 2008-2018.

Variable	2008	2010	2012	2014	2016	2017	2018	Change 2017-18	Develop. 2018/(08-17)
Total income	117.0	113.8	103.5	70.8	61.4	52.3	57.2	9%	-34%
Total operating costs	60.6	60.5	59.7	39.1	49.7	44.3	41.7	-6%	-20%
Total wages	7.8	8.7	10.0	10.6	18.1	15.0	14.3	-5%	24%
Gross Value Added	64.1	62.0	53.8	42.2	29.8	23.1	29.9	30%	-35%
Depreciation of capital	6.8	7.7	2.7	2.4	3.1	3.3	3.8	14%	-21%
Earning before interest and taxes	49.6	45.6	41.1	29.3	8.6	4.7	11.8	148%	-60%
Financial costs, net	6.2	4.9	4.2	2.9	3.2	2.3	2.5	11%	-39%
Net profit	43.4	40.8	36.8	26.3	5.4	2.5	9.3	274%	-63%
Total value of assets	179.1	94.1	97.1	110.3	101.0	97.4	104.3	7%	-13%
Capital productivity (%)	35.8	65.9	55.4	38.3	29.5	23.7	28.7	21%	-29%
Return on Investment (%)	27.7	48.5	42.3	26.6	8.5	4.9	11.3	132%	-56%

Source: own elaboration from EU Member States DCF data submission

4.19.4 Main species produced and economic performance by segment

Dutch aquaculture is dominated by the shellfish sector as the largest in sales weight and in sales value. The cultivated shellfish species could be differentiated between mussels (*Mytilus edulis*) and oysters (*Ostrea edulis* and *Crassostrea gigas*). Production of shellfish takes place in the coastal areas with a concentration in the South-Western province of Zeeland and the Wadden Sea.

In 2018, total sales weight of Dutch shellfish increased (11%) in one year to 51.9 thousand tonnes. However, compared to 2016 (55.7 thousand tonnes) this was a decrease of 7%. From a ten years period (2008-2017) it was a 12% increase from the average annual production weight (54.5 thousand tonnes). In terms of value, total sales increased (11%) to €68 million in 2017-2018. Despite decreased production volume compared to 2016, the total sales increased with 19% in a two year time period. This higher value was due higher landing prices per tonne (1000 kilogram) of blue mussels. Probably because of high quality (higher percentage of mussel meat with larger shells) which are perceived as premium value by the market. Another clarification could be that blue mussel producers from other MS had also a decreased supply (in volume). So in total the supply in EU for blue mussels decreased (scarcity principle) which drove higher prices by the market players (mussel processors) which compete for purchasing raw materials to fulfil the demand from their customers.

Aquaculture production in the Netherlands can be divided into three main segments:

- Segment 1: blue mussel on bottom cultures
- Segment 2: oysters on bottom cultures
- Segment 3: finfish, mainly European eel and catfish

Segment 1: Within this sector, blue mussel (Mytilus Edulis) is the most important species in total sales volume (weight) and sales (value). In 2018, the blue mussel had a share of 95% of the total shellfish weight of production and 80% of total sales (value) (Figure 4.7.1). This division was and is stable from last ten years. Due to the growing use of the mussel seed collectors, the supply of mussel seed becomes more and more stabilized. The mussel sector (49.3 thousand tonnes) is by far larger than the oyster sector (2.6 thousand tonnes) in total sales volume in 2018.

Segment 2: Oyster production started to decrease from 2013 onwards due to high mortality rates of Japanese oyster (*Crassostrea gigas*) larvae and spat caused by herpes disease and the exotic Japanese oyster drill (*Ocenebra inornata*). The cupped oysters had a share of 4% (2.2 thousand tonnes) of the total sales of weight in 2018 (Figure 4.7.1). This was 15% (€10.3 million) on the total sales value in the same year. The other cultivated species was the European flat oyster with a 1% (0.3 thousand tonnes) of the total shellfish weight of sales and a 5% (€3.4 million) of total sales.

Segment 3: From 2015, the finfish aquaculture sector (mainly European eel and catfish) is unfortunately not participating anymore in the DCF. A rough estimation could be made based on the numbers at the website of NEVEVI as the Dutch association for finfish aquaculture. In 2018, there were an estimated 30-35 companies active in this segment with total sales volume of 5-10 thousand tonnes and a total sales value of €30-40 million in 2018.

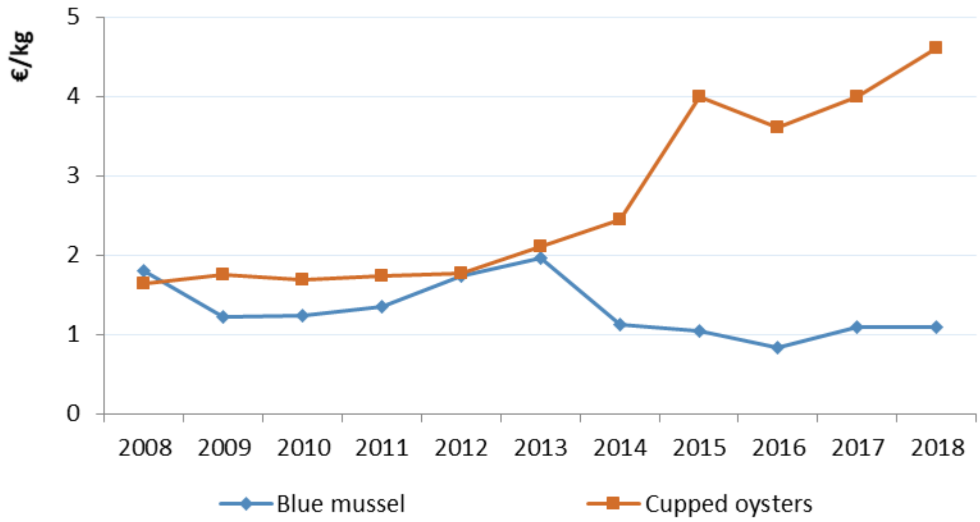
Figure 4.19.1 Main species in terms of weight and value in Dutch production: 2018.

Source: EU Member States DCF data submission

The average annual price (euro/kilogram) for Dutch blue mussel fluctuated the last ten years (Figure 4.7.2). Highest average price was in 2013 with a price of €1.96 per kg. In 2016, it was at the lowest level of the last decade with €0.83 per kg. After an increase of 31% (from 2016) the average price was stable at €1.09 per kg in 2017 and 2018. The most common indicators for the price for Dutch blue mussels were the quality (mussel meat and size of shelf), time of year to be harvested (consumption ready or not in summer as high season) and competition from other MS for supply of blue mussels. While profit margin was high (52%) in 2008, it decreased to loss giving with -4% (2016) and improved to a 16% (2018). In particular, higher costs like investments for mussel seed collectors and high mortality rate were reasons of lower profit margins.

The average price of cupped oysters increased since 2012. Oysters are more and more perceived as a premium product for out-of-home consumption and presented as an experience in restaurants and bars. It is often consumed as a raw (live and fresh) product. In contrary to aging consumers of mussels, oysters are getting more attention by young people according to the Dutch trading companies of oysters. However, there is a possibility that these annual average prices were mixed with imported oysters. The European flat oyster is not demonstrated (Figure 4.7.2), since only from 2015 price data were available. The price level of this species is even higher than the cupped oyster, starting from €6 per kg. The production volume of this species strongly decreased (-58%) to a total of 0.3 thousand tonnes from 2017-2018 due to stronger competition by French oyster producers. The volume of sales from this MS is far more larger than the Dutch volume. From 2017-2018 this was a reason that the market preferred the French produced oysters as a disadvantage for Dutch flat oyster producers.

Figure 4.19.2 Average prices €/kg for the main species produced in the Netherlands: 2008-2018.



Source: own elaboration from EU Member States DCF data submission

Table 4.7.3 includes only segment of mussel on bottom (segment 10.11). For the years 2017 and 2018, no data about costs were available for the segment of oysters on bottom (segment 11.11).

Segment: Mussel on bottom

- In Table 4.7.3 it is demonstrated that there were 48 Dutch mussel enterprises in 2018. This 11% less than the ten year average as the number was still 59 companies in 2008. In particular single family owned companies are more and more vulnerable to consolidation by larger companies in the sector after financially loss giving or marginal profitable years from 2016.
- The profitability of the Dutch mussel sector improved in 2018 compared to 2017 with a large increase (274%) of net profit to a total of €9.3 million. Relative to the loss giving year of 2016 the improvement was even larger. However it should be emphasized that there were years (e.g. in 2013) that annual net profit was around €20-30 million for the mussel sector.
- The average wage was despite marginal net profits (2017 and 2018) or even losses (2016) relative higher than before 2016. This is mainly due to postponed investments or by postponed repair and maintenance. This latter as a cost indicator decreased with 20% (€-1.2 million) from 2017-2018. The net investments decreased with 79% (€-4.5 million) in this period.
- Despite lower sales volume (in 2018) from two years ago (2016) the total income increased to €57.2 million. The average price/kg increased with 31% over these two years (Figure 4.7.2).
- In Figure 4.7.3 it is shown that the GVA to revenues increased from 39% (2016) to 44% (2017) and in the end 52% in 2018. The net profit margin was negative (-4%) in 2016 but improved to small profits of a 5% (2017) and 16% (2018).
- Figure 4.7.4 provides an overview of the cost structure (including consumption of fixed capital). The main costs were other operational costs (38%) and wages and salaries (30%) in 2018. Within other operational costs, rental costs for the area where the mussels are farmed are important, as well as the costs that relate to the mussel seed collectors. In an agreement with the Dutch Ministry and environmental NGOs, the mussel sector started a transition from wild seed fisheries to sustainable alternatives (mussel seed collectors) in 2020. Although the collectors work quite well and guarantee a quite stable mussel seed production, the work requires a lot of labour.

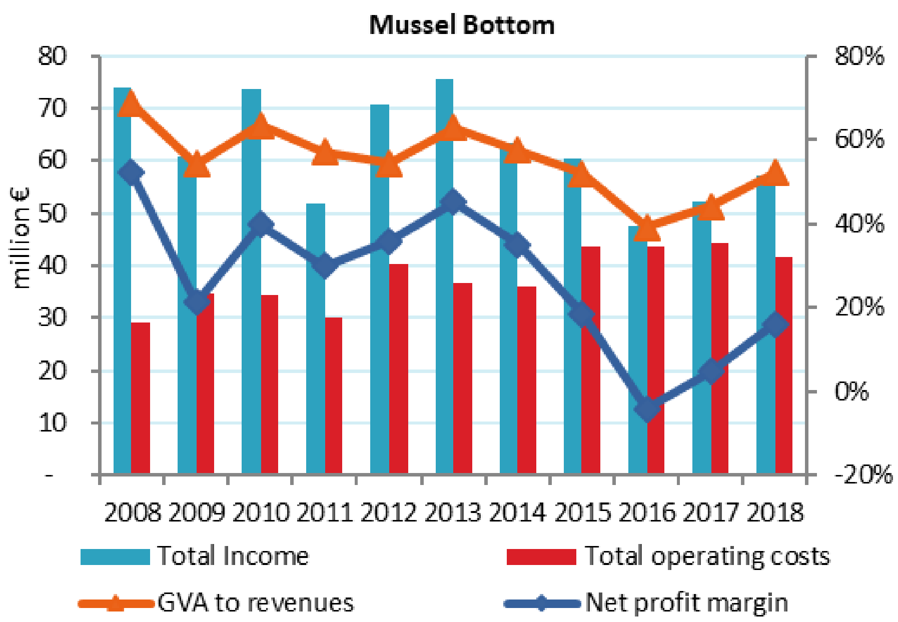
- No figure with feed and livestock is provided to show the average price per kg mussel seed. Since there is almost no trade in mussel seed at all. The costs that come with the mussel seed collectors are included in “other operational costs”.

Table 4.19.3 Economic performance of main Dutch aquaculture segment: 2008-2018.

Variable	2008	2010	2012	2014	2016	2017	2018	Change 2017-18	Develop. 2018/(08-17)
Mussel Bottom									
Number of enterprises	*59*	*57*	*55*	*55*	*47*	*48*	*48*	*0%*	*-11%*
FTE	*162*	*153*	*152*	*157*	*181*	*184*	*181*	*-2%*	*10%*
Average wage (thousand €)	*36.6*	*49.8*	*53.4*	*58.8*	*74.8*	*75.6*	*74.4*	*-2%*	*29%*
Labour productivity (thousand €)	*313.5*	*306.1*	*253.2*	*232.6*	*102.9*	*125.1*	*165.1*	*32%*	*-26%*
Total sales volume (thousand tonnes)	*36.2*	*56.2*	*39.7*	*54.1*	*52.7*	*43.9*	*49.3*	*12%*	*8%*
Total income (million €)	*73.9*	*73.8*	*70.7*	*63.4*	*47.6*	*52.3*	*57.2*	*9%*	*-9%*
Total operating costs (million €)	*29.0*	*34.5*	*40.3*	*36.2*	*43.6*	*44.3*	*41.7*	*-6%*	*12%*
Gross Value Added (million €)	*50.8*	*46.8*	*38.5*	*36.5*	*18.6*	*23.1*	*29.9*	*30%*	*-16%*
Net profit (million €)	*38.5*	*29.3*	*25.3*	*22.3*	*-2.0*	*2.5*	*9.3*	*274%*	*-51%*
Total value of assets (million €)	*178.3*	*93.6*	*92.0*	*105.4*	*99.0*	*97.4*	*104.3*	*7%*	*-10%*
Net investments (million €)	*14.6*	*7.0*	*6.7*	*5.8*	*7.7*	*5.8*	*1.2*	*-79%*	*-86%*
Capital productivity (%)	*28.5*	*50.1*	*41.8*	*34.6*	*18.8*	*23.7*	*28.7*	*21%*	*-10%*
Return on Investment (%)	*23.5*	*35.4*	*31.0*	*23.9*	*1.2*	*4.9*	*11.3*	*132%*	*-43%*
Future Expectation Indicator (%)	*6.5*	*0.9*	*5.3*	*3.5*	*4.9*	*2.6*	*-2.4*	*-194%*	*-151%*

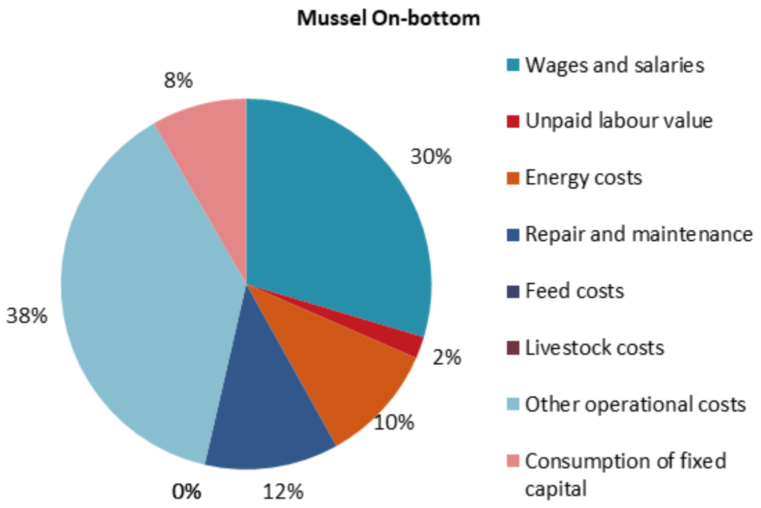
Source: own elaboration from EU Member States DCF data submission

Figure 4.19.3 Economic performance in € million, indicators for the main Dutch segment: 2008-2018.



Source: own elaboration from EU Member States DCF data submission

Figure 4.19.4 Cost structure of the main segment in the Netherlands: 2018.



Source: EU Member States DCF data submission

4.19.5 Outlook

Nowcasts for 2019-20

In 2019, the sales weight is expected to be around 36 thousand tonnes of shell fish. This means a strong decrease (-31%) compared to 2018. The total sales value is expected to decrease with 27% to a total of €49 million in 2019, where it was €68 million in 2018. Specifically for blue mussel the projected decrease of sales weight is 33%. However, a higher average price/kg (+17%) is expected and will partly compensate the income despite reduced sales weight. With emphasis of the word 'partly' because still the predicted total sales value for blue mussels will decrease with 21% to a total of €42.3 million from 2018-2019. The high mortality rate and slower growing (therefore smaller shells with less mussel meat) of Dutch mussels are main reasons for these expected lower economic performance in 2019. For oysters the sales weight will slightly increase (+4%) but projected prices are under pressure (estimated minus 50-51%) in 2019 compared to the previous year. Mainly due to high mortality rates and more competition from other MS with faster growing oysters and therefore more price competitive to the EU market.

The combination of mussel seed collection by bottom trawling and other technologies will improve the seed supply in future. In 2018, 20.7 thousand tonnes seed was collected via mussel seed collectors, in 2019 19.3 thousand tonnes. However, when we look at the last 10 years, it is a growing trend. In 2008, it was only 7.9 thousand tonnes. The available amounts of mussel seed in the years 2018 and 2019 are the basis for mussel production in 2020 and 2021 as blue mussels need on average 2 years to grow to enable harvest consumption ready mussels for the market. Sales volumes may reach over 50 thousand tonnes in these years, although storms that lead to loss of livestock always may lead to loss of production. Family enterprises that are less profitable and solvable may be forced by their banks to sell mussels that are not fully grown, or forced to sell in times when prices are low: that may lead to a lower sales volume as well.

In 2020 (and continuously in 2021), some of the area's where mussels are farmed will be relocated to what are believed better locations. That probably will lead to a higher production efficiency.

The profitability of the mussel sector will be affected by the increased supply of mussels from surrounding MS. It is expected that smaller family businesses, which are not vertically integrated, will face problems coming years. It is expected that the larger enterprises will take over the smaller family enterprises that cannot survive.

Projects were started in 2016 to grow oysters off bottom to prevent mortality from the Japanese oyster drill. However, the expected loss to the Japanese oyster drill and the herpes virus may not be that large as in previous years was thought, partly because of the fact that a trawl was invented that trawls and therefore removes the Japanese oyster drills. Another challenge for off bottom oyster production is to expand the area. However, some NGOs are reluctant to these expansion ambitions since off bottom oyster production needs from their perspective more ecological research about consequences for the biodiversity and the foraging function of the nature protected area to birds and other animal species. Th Dutch government has to decide whether it is sustainable and acceptable to provide more permits for upscaling off bottom oyster production.

For the fresh water sector, no data is available.

4.19.6 Trends and triggers

Current production trends and main drivers

The expected decreased economic performance for the mussel culture sector in 2019 is largely explained by the high mortality rates of blue mussels and higher competition by larger import of mussels, and the yearly returning TTX problem. The mussel sector is in transition towards the use of mussel seed collection technologies, rather than bottom trawling. Growing seed on mussel seed collectors is more expensive than trawling for the seeds, and will have an effect on the economic performance. However, by using mussel seed collectors, the sector is more independent from natural seed fall. The sector is facing competition from foreign competitors, which are often owned by Dutch enterprises. Where in earlier years a small harvest meant higher prices, nowadays mussels are imported from other member states, which means that prices will not rise.

The oyster sector has increasing problems with larvae and seed mortality due to the presence of Herpes virus and the Japanese oyster drill in the Dutch waters. To fight the Japanese oyster drill, the "oyster drill trawl" has been invented and there is research being done to grow the oysters off bottom on tables

For the fresh water sector, no data is available.

Market structure

The market structure of the mussel sector changes. For mussel production, the number of producing companies decrease. Smaller family companies are overtaken by (mostly) vertically integrated (family) companies. The market structure of the oyster sector has not witnessed major changes in the last years. For oyster production, the number of companies producing and trading remains stable. The mussel and oyster sector continues to have close contact with research institutes and (local) politics.

For the fresh water sector, no data is available.

Issues of special interest

A part of the total budget of the new Dutch operational program is allocated for aquaculture. The objective for aquaculture is to increase the value of aquaculture production via niche and high-value products. Beside this, the Netherlands will increase environmental and economic sustainability, by creating better cooperation, knowledge sharing and increased technical innovation. Recently, interest for aquaculture in combination with offshore wind energy has increased. This might be a solution to spatial conflicts in the heavily used North Sea, and it might come with some synergy reducing operating costs.

In the last years, academic and business interest in production of seaweeds has grown. The first commercial seaweed farms were established in 2013 and might prove to be an impulse for the aquaculture sector in the Netherlands. However, economic and ecologic values need to be proven.

Producer organisation 'PO Mossel' set up a knowledge/innovation agenda for coming years to improve production efficiency in terms of volume per unit area on current mussel beds. At the moment production efficiency is relatively low and could be improved.

The Dutch oyster association started with experiments for off bottom oyster farming to decrease the oysters' mortality from the Japanese oyster drill and Herpes virus.

4.19.7 COVID-19 impact

In 2020, COVID-19 has affected the supply chain of Dutch shellfish to certain extent. The mussel production is by far the largest aquaculture sector in terms of volume for the Netherlands. This specific sector has the fortune that there was no COVID lockdown during summer season 2020. Therefore many traditional distribution channels in the food service were open at that moment. The Retail is with on average 70% of sales volume the dominant distribution channel for mussel producers. As Retailers are always open, the COVID impact was limited for mussel sales. However, the effect of less tourists and the 1.5 meter distance society has affected the sales of mussels to food service. This distribution channel is in particular important for the higher profit margin compared the more price competitive Retail market. Due to a 20% less sales volumes there were slightly higher prices for mussels (+15%). These higher prices compensates the decreasing sales volumes in terms of generated turnover. For the oysters it was a kind of other story. This sector is relative smaller in production and sales volume than the mussels. However, they are more higher priced in particular in food service channels. This sector had the lack of fortune that there was a second lockdown in the Netherlands and Europe during the normally peak season for sales of oysters in December. They had due to closed restaurants reinvented new ways and channels to sell their produced oysters to consumers. Oysters producers tried to stimulate oyster sales for at-home-consumption via 'take away', 'drive through' and 'online webshops'. Despite the sales and production data of oysters are lacking at this moment (February 2021) it is expected that the turnover decreased by at least more than 20% and costs were higher compared to 2019.

4.19.8 Data Coverage and Data Quality

Data quality

The account statistic for 2016 is based on a sample of 18 aquaculture companies (shellfish), which covers 26% of the total population of 70 farms. These 18 companies provide detailed information to Wageningen Economic Research, that is used for extrapolation to the entire sector. Additional aggregate information on sales volume and value of mussels and oysters is available from Statistics Netherlands, the Dutch oyster association and the mussel producer organisation 'PO mossel'.

For the fresh water sector, no data is available for 2015 and 2016. In earlier years, information on the number of freshwater companies, sales volumes and values was retrieved from the Dutch aquaculture association NEVEVI and own databases of Wageningen Economic Research. Additional aggregate information on sales volume of eel was available from Statistics Netherlands.

Data availability

Data of land-based aquaculture is not collected as planned. Land based aquaculture in the Netherlands is a relatively small (36 farms in 2014), reluctant, fragmented, highly competitive and dynamic. Only information on the number of freshwater companies, production volume and value level could be obtained for this segment. This information was gathered from a desk study and information from the Dutch aquaculture association NEVEVI. Data of the mussel and oyster sector is collected in accordance with the Dutch National Plan. After collecting the information and having it checked by accountants, the companies voluntarily submit data to Wageningen Economic Research. As some companies work with financial years running from July to July, submission of this information can take place late. Once all information is collected, it is processed by Wageningen Economic Research.

Confidentiality

Obviously, the fact that such a low number of companies deliver information is a problem for confidentiality. When collecting data, Wageningen Economic Research explicitly mentions that the information will be treated confidentially. General guidelines that segments should include more than 10 enterprises would be hard to put into practice, given the low number of companies in the oyster segments.

Differences in DCF data compared with other official data sources

In general, the DCF and EUROSTAT data are generally in line with each other. Differences between DCF and Eurostat could be explained by the extrapolation that affects total production levels.

Other data issues or missing data

For 2017 and 2018, data was lacking about the cost structures for segment 11.11 (oysters). Therefore, no economic performance indicators could be calculated.

4.20 Poland

Overview of Polish aquaculture

The total aquaculture production in Poland is approximately 40 thousand tonnes per year. In 2019, the total production of 30 species of fish intended for consumption amounted to 44.7 thousand tonnes and was higher by approximately 1.4 thousand tonnes (3.3%) from the previous season's result. The two main species farmed are carp and trout. The first species represents traditional extensive aquaculture (ponds) with an annual production of approximately 18-20 thousand tonnes. Trout production involves more intensive systems (on rivers) with a total production of 15-16 thousand tonnes per year.

Poland only has freshwater aquaculture. The data collection of freshwater aquaculture is not mandatory under DCF and EU-MAP. Since no data were submitted in the related data call, FAO data were used instead.

4.20.1 Total production and sales

According to FAO data, the total aquaculture production in 2018 was 43.4 thousand tonnes (22% higher than the 10 previous year average) valued at almost €121 million (41% higher than the 10 previous year average). In 2019, the total production of 30 species of fish, one species of crustaceans and fish without specifying the species name, intended for consumption, amounted to 44.7 thousand tonnes and was higher by approximately 1.4 thousand tonnes (3.3%) from the previous season's result. According to the newest Eurostat data, in 2019 sold production increased by almost 8% to 39.7 accounting for €10.4 million (-0.5%).

Table 4.20.1 Production and sales for Poland: 2008-2018.

Variable	2008	2010	2012	2014	2016	2017	2018	Change 17-18	Develop. 2018/(08-17)
Production weight (thousand tonnes)	**36.8**	**30.8**	**32.3**	**40.1**	**38.3**	**38.8**	**43.4**	***12%***	***22%***
Marine	0	0	0	0	0	0	0	0%	0%
Shellfish	0	0	0	0	0	0	0	0%	0%
Freshwater	36.8	30.8	32.3	40.1	38.3	38.8	43.4	12%	22%
Production value (million €)	**73.3**	**67.5**	**81.3**	**96.2**	**109.6**	**110.9**	**121.1**	***9%***	***41%***
Marine	0	0	0	0	0	0	0	0%	0%
Shellfish	0	0	0	0	0	0	0	0%	0%
Freshwater	73.3	67.5	81.3	96.2	109.6	110.9	121.1	9%	41%

Source: FAO (2021)

4.20.2 Industry structure and total employment

Polish aquaculture produces almost exclusively fish, while for crustaceans are cultured two species of crayfish. The dominant fish species in Polish aquaculture is common carp and rainbow trout of which approximately 20 000 tonnes and 16 000 tonnes are produced annually, respectively.

In addition to the production of fish for consumption, Polish aquaculture produces stocking material. The rising demand noted in recent years for this type of material has provided an impetus for the development of fish farms and the modernization of hatcheries and rearing facilities. In 2019, 883.7 million fertilized eggs from 29 species of fish and 775 million juveniles of 31 species of fish and crustaceans were produced. Rainbow trout, European whitefish and pike dominated in the production of fertilized eggs, while European whitefish, carp and pike in the production of juveniles.

Trout farms are generally distributed in the north on the Baltic Sea coast and in southern Poland in the Carpathian foothills in rich terrain with clear, cool waters. Although carp farms are distributed throughout Poland, the larger facilities are located in central and southern Poland where climatic conditions are warmer.

In 2019, the total number of people employed in aquaculture was estimated at 6171, almost 2% lower than in 2018. It is estimated that approximately 30% people are employed seasonally.

4.20.3 Main species produced

As in previous years, in 2018 the fish production charts were clearly dominated by the two main species of Polish freshwater aquaculture, common carp and rainbow trout. The quantitative share of carp in the total aquaculture production was 48%, while rainbow trout was 37%, while other fish species accounted for 15%. The value share of carp in 2018 was 41% while rainbow trout was 40%.

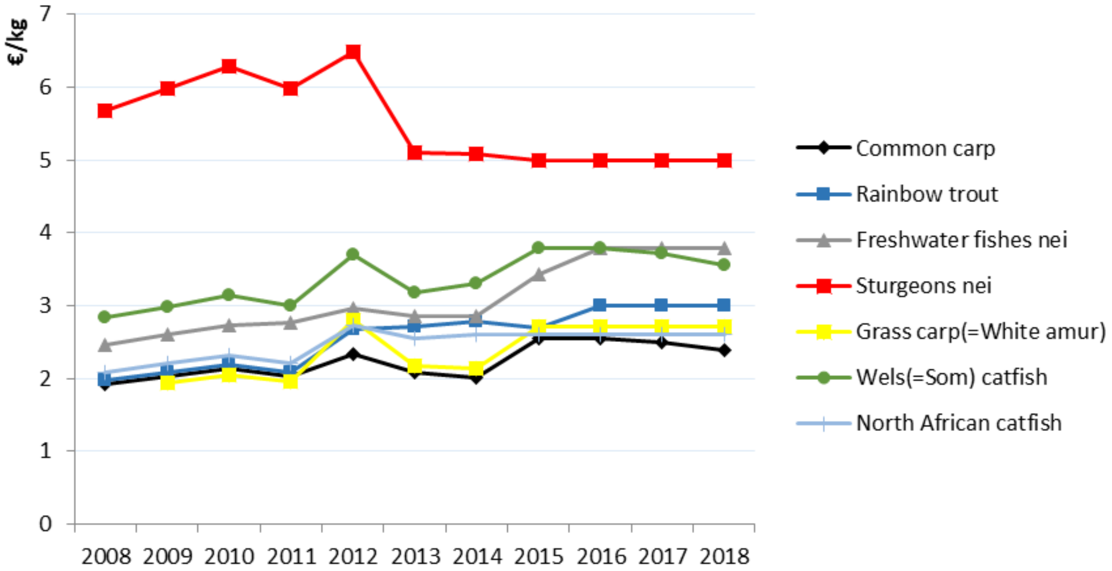
The structure of production in 2019 did not change significantly. Compared to the previous year, in 2019 the production of carp for consumption was higher by 2.4%, that of trout and other salmon species by 4.8%, while the production of other fish species did not change.

Figure 4.20.1 Main species in terms of weight and value in Poland production: 2018.

Source: FAO (2021)

The highest prices are observed for sturgeons, with €5 per kilo in 2018. The average first-price for rainbow trout in 2018 was €3 per kilo in Poland. Common carp prices were on average €2.5 per kilo and €2.7 per kilo for grass carp.

Figure 4.20.2 Average prices for the main species produced in Poland: 2008-2018.



Source: FAO (2021)

4.20.4 Outlook

Nowcasts for 2019-20

Majority of carp produced is sold during Christmas. For several years, a gradual increase in carp sales is being observed in the remaining months. This trend strengthened in 2020. Every year more and more pond farms diversify their sales: opening fish restaurants, fisheries, and selling fish all year round. Additionally, the withdrawal of commercial chains from selling live fish to the final consumer will contribute to the increase in direct sales. On farms, apart from selling live fish, there will be a need for processed fish. In 2020, there was also a resurgence of carp trade-in bazaars and other designated places.

Trends and triggers

The outlook for the development of trout production in Poland is optimistic. This is based on the high degree of modernization at existing facilities and the construction of new trout farms, the increasing share of processed trout on the market (smoked trout, vacuum-packed fillets, etc.), the promotion of trout and carp in Poland and growing export.

For several years, the production of roe intended for consumption has been growing dynamically, especially the most valuable, made from sturgeon fish.

4.20.5 COVID-19 impact

Production in aquaculture was not strongly impacted by the COVID-19 pandemic, but all the additional activities offered by farm owners suffered due to the shortage of tourists and closing HoReCa sector. COVID's impact on aquaculture has softened through the financial programme under the State Aid Temporary Framework adopted by the Commission. Public support, in the form of direct grants, was intended to partially cover interests on loans and help businesses to cover their immediate capital needs, thus ensuring the continuation of their activities. There is an expectation that after the end of the COVID-19 restrictions, the whole sector will return more or less quickly to normal operation.

4.20.6 Data Coverage and Data Quality

Data collection for freshwater aquaculture is not mandatory under the DCF and EU-MAP programmes of the EU data collection. Poland only produces freshwater aquaculture products. Thus, Poland is not obliged to provide economic data for this report. The analysis of the Polish aquaculture sector is therefore based on data extracted from FAO and Eurostat.

4.21 Portugal

Overview of Portuguese aquaculture

The Portuguese aquaculture sector produced and sold around of 11.8 thousand tonnes in 2018, which corresponded to an increase of 8% from 2017 to 2018. The total value of the production was €96.8 million, which corresponded and an increase in value of 19% over the same period. In this context, we collect information for the aquacultures in freshwater, brackish and marine waters.

In 2018, the Portuguese Aquaculture sector was comprised by 846 companies that employed 1 652 workers, of which 348 were women and 1 304 were men, in a proportion of 1:4. The sector is dominated by small companies, 96% of the Portuguese companies had less than 5 employees.

4.21.1 Total Production and sales

The production in aquaculture in 2018, was 11 768 tonnes and generated a revenue of 96 806 million euros. These results translate into an increase of 8.1% in weight, and 18.5% in value, compared to 2017, and it corresponded to a major production of clams, the more valued specie.

Production in brackish and marine waters continued to be the most important, corresponding to about 97% of total production by 2018. The production of fish in brackish and marine waters represented 36% of production, of which 90% were sea bream and turbot.

Table 4.21.1 Production and sales, industry structure and employment for Portugal: 2008-2018.

Variable	2008	2010	2012	2014	2016	2017	2018	Change 2017-18	Develop. 2018/(08-17)
Sales weight (thousand tonnes)	**6.9**	**6.5**	**10.4**	**8.8**	**10.2**	**10.9**	**11.8**	8%	39%
Marine	3.0	2.5	5.6	4.5	3.8	4.1	4.2	3%	13%
Shellfish	3.2	3.3	4.1	3.8	5.7	6.4	7.2	12%	73%
Freshwater	0.7	0.7	0.7	0.5	0.7	0.4	0.4	0%	-33%
Sales value (million €)	**24.2**	**41.7**	**52.6**	**46.9**	**73.7**	**81.7**	**96.8**	19%	87%
Marine	16.8	16.1	28.9	24.3	29.4	26.9	30.6	14%	37%
Shellfish	22	24	22	21	42	53.7	65.1	21%	121%
Freshwater	1.7	1.6	1.7	2.0	1.9	1.1	1.1	0%	-34%
Number of enterprises	**1463**	**1459**	**1432**	**1405**	**1402**	**869**	**846**	-3%	-38%
Marine	84	79	42	40	34	16	19	19%	-61%
Shellfish	1368	1367	1373	1358	1362	846	820	-3%	-38%
Freshwater	11	13	17	7	6	7	7	0%	-31%
Employment	**2347**	**2320**	**2362**	**2247**	**2651**	**1575**	**1652**	5%	-27%
Marine	296	317	303	357	257	74	284	285%	3%
Shellfish	2007	1955	1995	1859	2362	1471	1337	-9%	-32%
Freshwater	44	48	64	31	32	31	31	0%	-23%
FTE		**1,228**	**668**	**696**	**830**	**970**	**796**	-18%	-6%
Marine		305	291	351	245	63	275	336%	6%
Shellfish		875	325	318	557	881	495	-44%	-11%
Freshwater		48	52	27	28	26	26	0%	-26%

Source: EU Member States DCF data submission

On the other hand, freshwater remains stably, in terms of production, sales and number of unit farms. This sector has a little representativeness in Portugal, combine with a low acceptance of this kind of product in the national market and to competitiveness difficulties with other countries in external markets.

Sales have been increasing over the years, in 2018 reached a peak of sales value, namely by the increase of production of the most valued species (carpet shell). Nevertheless, between 2008 and 2017, is to highlight the increase of 39% in weight and 87% in value in the marine sector.

4.21.2 Industry structure and total employment

In Portugal, from 2008 to 2016, economic, social and production, was collected per production unit.

From 2017 since now, the collection data is made by company, for the economic and social data, maintaining the collection of the production per production unit.

The change in the way social data is collected has led to inconsistency of employment data and it is now not feasible to correct the 2017 data.

At the end of 2018, there were 1 515 licensed unit farms, relating to 846 companies, with sales in aquaculture to freshwaters, brackish and marine waters. This represents 17 units less in relation to 2017. In terms of total area, it is practically the same area than before, with an average size of 3.26 hectares per aquaculture establishment[13].

As regards the type of production facilities, the structure remained the same, about 88.1% for the production of bivalve molluscs in intertidal zones. Tanks and ponds for fish production accounted for 9.3% and floating structures (longlines for the production of bivalve molluscs, and cages for the production of sea bream) accounted 2% of all licensed unit farms[1].

The shellfish sector in the entire observed period more than duplicate the value of sales. In additional of traditional clam farms in intertidal areas, installations for mussels with long-line technology in open sea have increased as well as oyster off bottom production.

The implementation of spatial planning, take in consideration special areas for the production of sensitive species, such as areas for shellfish cultivation.

The investment and the attractiveness of the shellfish sector is probably greater because investors are comforted by a lower initial investment.

Employees of the entire sector, in absolute values, amounted to 1 652, of which approximately 81% are employed in the shellfish sector. In terms of employees, compared to the changes recorded on average between 2008/2017, workers increase by over 3% in the marine fish sector segment and decrease by about 32% in the shellfish sector.

By comparing the data between the number of employees and the number of FTEs, the employment dynamics of the three macro-aggregates are understood.

The biggest change observed is in the enterprise’s performance from 2010 to 2011. After 2011, the total number of FTE has been more or less constant, with a decrease in 2018. The accommodation of economic and financial restrictions as well as more efficient processes induced a change of paradigm in employment. The partial time contracts are now, more common in big companies than in years before.

4.21.3 Overall Economic performance

For the segments where the economic indicators are available, the weight of shellfish farming sector (67% of total turnover) influenced greatly the outcomes of national economic.

[13] Estatísticas da Pesca 2017. DGRM.

The labour productivity is measured as gross value added per full time employee.

From 2017 to 2018, total income increase 21%, and the operational cost also increased by 48%, this situation led to an increase of 23% of the Gross Added Value (GVA).

Table 4.21.2 Economic performance of the Portuguese aquaculture sector: 2008-2018.

Variable	2008	2010	2012	2014	2016	2017	2018	Change 2017-18	Develop. 2018/(08-17)
Total income	41.0	41.7	95.0	51.4	109.2	84.5	102.4	▲ 21%	▲ 55%
Total operating costs		38.3	66.9	32.1	36.9	40.2	48.2	▲ 20%	▲ 19%
Total wages		8.9	8.8	8.5	11.4	10.8	14.7	▲ 35%	▲ 55%
Gross Value Added		12.3	36.8	27.7	83.6	55.2	67.7	▲ 23%	▲ 81%
Depreciation of capital		5.1	10.9	12.1	16.3	5.4	5.8	▲ 8%	▼ -39%
Earning before interest and taxes		-1.6	17.2	7.2	55.9	38.9	48.4	▲ 24%	▲ 163%
Financial costs, net		0.2	5.4	5.7	5.3	7.9	0.7	▼ -91%	▼ -85%
Net profit		-1.8	11.8	1.4	50.6	31.0	47.6	▲ 54%	▲ 249%
Total value of assets		223.8	246.3	247.1	92.9	108.8	119.5	▲ 10%	▼ -41%
Capital productivity (%)		5.5	15.0	11.2	90.0	50.7	56.7	▲ 12%	▲ 124%
Return on Investment (%)		-0.7	7.0	2.9	60.2	35.8	40.4	▲ 13%	▲ 185%

Source: own elaboration from EU Member States DCF data submission

The value of depreciation of capital in 2018 increased by 8% compared to 2017, the situation can be interpreted according to the trend, in 2018, with natural obsolescence or wear with use in production, and assets lose value. This loss of value is appropriated by general ledger periodically until this asset has a value reduced to zero.

Depreciation of fixed assets directly used in production will be asper given as cost. In turn, assets that are not used directly in production will have their depreciations accounted for as expense.

Also, as a result of accounting operations at the enterprise level, the sector has registered an improvement in the last year, with 24% increase in EBIT. The total value of assets increased 10% and debts increased 23% respectively. The return on investment also increased in order of 13%, from 2017 to 2018.

Through data for marine overview, we found that some value (Other incomes and Total Value of Assets) affect profitability and productivity indicators in 2017 comparing with 2018. The reason for this situation is related to a company, with an organizational structure different from all the others. As a result of this operation, it is reported a very sharp break in the enterprise assets and a considerable increase in the “Other Income”. Hence, this operation influences the results of all the economic indicators established for the national aquaculture sector. And so, we take the option to remove the company from the sample to avoid extreme thresholds that would jeopardise the analysis of economic indicators.

4.21.4 Main species produced and economic performance by segment

In Portugal, the aquaculture production based on bottom culture (grooved carpet shell) is mainly in estuaries areas and coastal lagoons. For other marine fish, as turbot and sole, is mainly located in the central region of Portugal. Off bottom oyster culture, also appears in estuaries, coastal lagoons and in the sea. Mussel in long line appears in south region of the mainland in open sea. The marine productions of sea bass and sea bream in ponds and cages are located both near the coast and in open sea in the Portuguese mainland coast and in the Autonomous Region of Madeira.

The most important segment (in terms of production weight and sales value), is the clam on bottom farms producing Grooved Carpet Shell, in small areas of land in intertidal zone, usually with less than 1 hectare. In 2018, there were 1 335 unit farms. The total sales volume was 3.4 thousand tonnes with a value of €44 million, represents 29% of the total volume and 45% of the total sales value.

The second most important segment is the marine production of other marine fish on growing (turbot and sole). The production volume was 2.8 thousand tonnes with a corresponding value of €24.6 million represents 25% of total sales volume and 25% of the total sales value. The production techniques used are tanks and recirculation systems (RAS).

The third segment is the oyster off bottom culture in intertidal zones, usually using bags and tables and in the sea using Chinese lanterns on long lines. In 2018, in the segment collected data in 71 companies, and the production was 3.1 thousand tonnes with a corresponding value of €21.2 million. The segment has increased in last year's, and actually covers 26% of the total sales volume and 22% of the total income for the Portuguese production.

Another segment are Sea bass and Sea bream in ponds and cages, merge the segments 3.2 and 3.4. In 2018, collected data in 11 companies in this segment. The production techniques are semi-intensive and intensive in open systems. The total sales volume was 1, 1 thousand tonnes with a corresponding value of €7.3 million. The segment covers 9% in volume and 7% in value of total Portuguese production.

Exports represent 25% of total sales production, and consist mainly in turbot sales (89%) and in mussels and oysters sales (5%)[14].

Figure 4.21.1 Main species in terms of weight and value in Portuguese production: 2018.

Source: EU Member States DCF data submission

The average price of turbot has been increased since 2014 mainly from 2015 to 2016, essentially due to the decreased in the production over the last years. And in 2018, there was an 18% increase in the price of turbot, due to a stabilization of production volume and market destination.

For the sea bass and sea bream prices have slightly increased in the last year, 9% and 4% respectively.

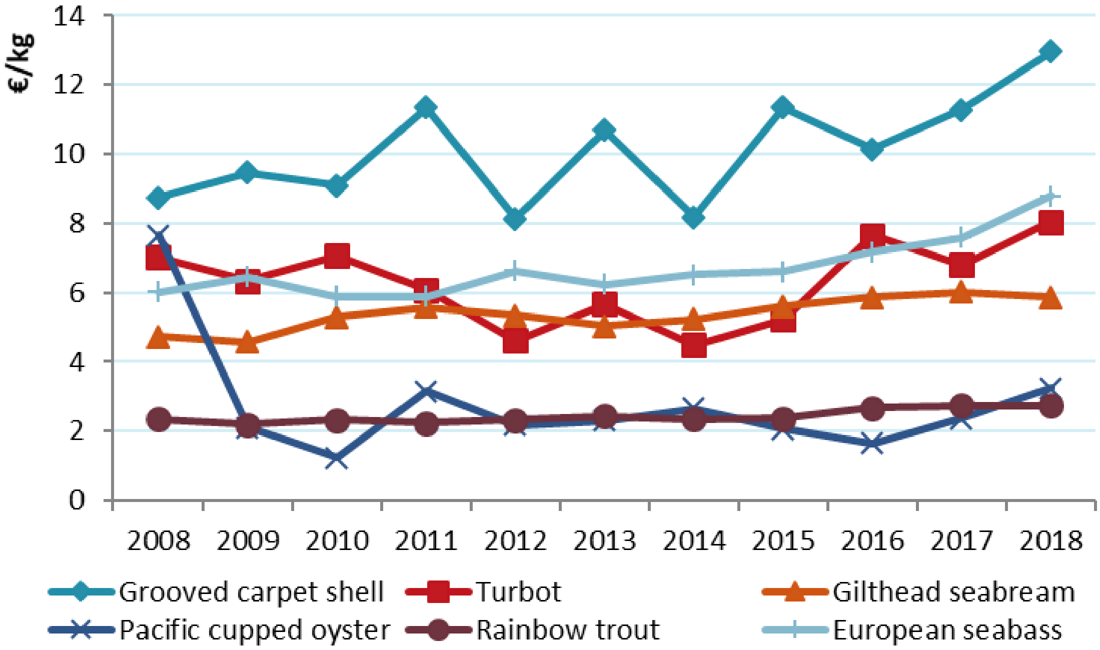
For the rainbow trout the prices has been more stable in the last two years. Stability has been interpreted as a solidity in relations with the market chain.

Concerning the average prices for the oysters group since 2014 it is verified that this value have been increasing, registering a variation of 26%.

[14] Estatísticas da Pesca, 2017. DGRM.

The average price of clam presents variations, due to greater or lesser suffering of this product in the market. This type of extensive production depends on the availability of seeds on the natural environment as well as the environmental conditions. The emergence of diseases and parasites also influence the extensive productions. In general, clams are, among shellfish, those that mainly follow a well-defined value chain.

Figure 4.21.2 Average prices €/kg for the main species produced in Portugal: 2008-2018.



Source: own elaboration from EU Member States DCF data submission

It can be seen that, from 2008 to 2018, the turnover from the Portuguese aquaculture sector had been increasing, along with the sales volume.

The economic performance of the main four Portuguese segments is shown in Table 4.3.3 and the cost structure of the four main Portuguese segments are presented In Figure 4.7.4. According to the passage in 2016 to EUMAP, Portugal has distributed and defined several production segments. The four segments for which a comparison was made are:

- Sea Bass and Sea Bream Cages and Ponds (seg 3.6 and 3.1) which corresponds to Section 6.2 and 6.4 of the DCF)
- Other marine fish Cages and Tanks (seg. 9.6 and 9.2) (which corresponds to Section 3.2 and 3.4 of the DCF)
- Oyster bottom (seg. 11.10 and 11.11) (which corresponds to Section 8.3 and 8.2 of the DCF).
- Clam on bottom (Seg. 12.11) (which corresponds to Section 9.3 of the DCF).

From the table, it can be seen that in 2018 the gross value added and net profit is positive for the three segments except for the Sea bass & Sea bream.

Segment 1: Clam bottom

Is the most relevant segment, with 1 335 unit farms and a turnover of about €44 million, the companies are mostly small familiar units managed by the owner and their relatives. Bottom culture has a very low level of investments and operational costs are mostly wages and salaries.

The production of bivalves in Portugal is one of the activities of greatest economic significance, in the context of exploration of natural resources, due to the favourable conditions of the ecosystem for this activity. This activity is located in coastal areas and in areas between tides.

The main production is that of the clam (*Ruditapes decassatus*), the species of highest sale value in Portuguese aquaculture.

The main constraints to calm production are seed availability, mortality peaks and unfavourable environmental conditions. Is an indigenous species with high economic value, its production in protected areas and natura2000 is promoted.

At this time, a hatchery of bivalve molluscs has entered into operation, is a company producing European endogenous clams. In addition to the production of bivalve seed for sale to producers, the company will end the production cycle in the open sea nursery. This project was framed by public co-financing through an operation approved by the Mar2020 Operational Program (Sustainable Aquaculture Development - Productive Investments).

Segment 2: Other marine fish on growing

The second most important segment is the marine production of other marine fish on growing (turbot and sole). The production volume was 2.8 thousand tonnes with a corresponding value of €24.6 million, and represents 25% of total sales volume and 25% of the total sales value. The production techniques used are tanks and recirculation systems (RAS).

In this segment, one big enterprise with a greater investment unbalanced the cost structure, and the depreciation of capital has become the second most significant cost.

Segment 3: Oyster bottom

The third segment is the oyster off bottom culture in intertidal zones, usually using bags and tables and in the sea using Chinese lanterns on long lines. In 2018, in the segment collected data in 71 companies, and the production was 3.1 thousand tonnes with a corresponding value of €21.2 million. The segment has increased in last year's, and actually covers 26% of the total sales volume and 22% of the total income for the Portuguese production.

The companies are mostly small familiar units run by the owner and its relatives. Is this off bottom culture use tables and bags has a very low level of investments and operational costs are mostly wages and salaries. The use of long lines in open sea entails high investments, other operational costs and wages and salaries.

This segment includes mixed type unit farms (extensive and semi-intensive system). In this segment, in some years, it may be occasionally happened some feed costs related to the fish production. The tendency is to this unit farms turn in bivalve's monocultures.

Segment 4: Sea-bass and Sea-bream on growing

In 2018, collected data in 11 companies in this segment. The production techniques are semi-intensive in ponds and intensive in cages located in open systems. The total sales volume was 1.1 thousand tonnes with a corresponding value of €7.3 million. The segment covers 9% in volume and 7% in value of total Portuguese production.

It is mostly characterized by traditional production using ponds with high maintenance costs and low production densities. The welfare of fish and the environment are taken in high regard and the final product is of high quality. The cages are also included in this segment, characterised by high densities of fish and high livestock and feed costs. In 2016, the depreciation of capital and livestock costs have been higher than the maintenance ones.

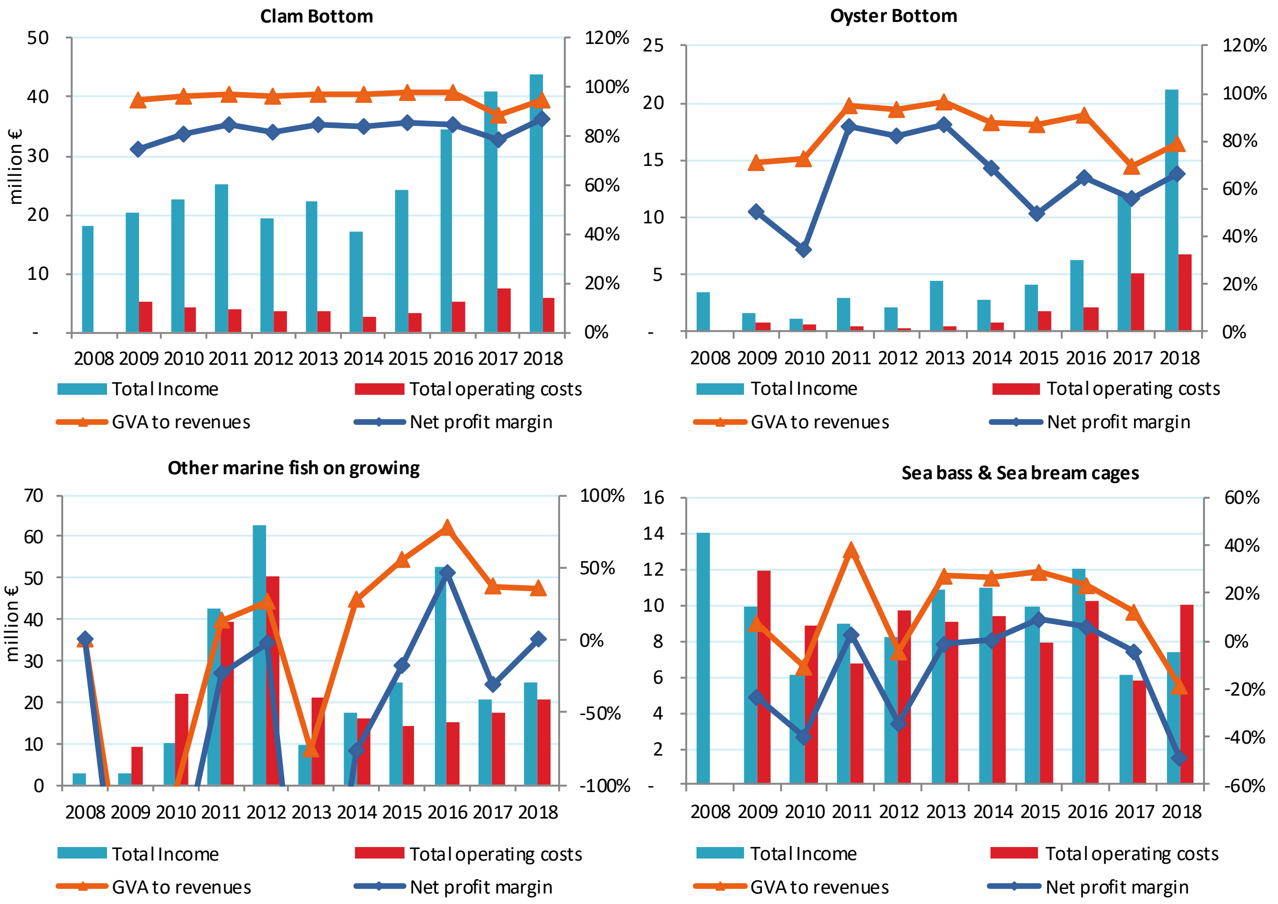
The main species produced in this segment are Sea bass and Sea bream in ponds and cages, merge the segments 3.2 and 3.4.

Table 4.21.3 Economic performance of main Portuguese aquaculture segments: 2008-2018.

Variable	2008	2010	2012	2014	2016	2017	2018	Change 2017-18	Develop. 2018/(08-17)
Clam Bottom									
Number of enterprises	1247	1314	1314	1285	1254	767	729	-5%	-41%
FTE		812	262	212	341	696	318	-54%	-26%
Average wage (thousand €)		4.4	10.7	10.3	12.9	3.4	5.5	63%	-39%
Labour productivity (thousand €)		27.0	71.2	78.9	98.8	29.9	38.8	30%	-43%
Total sales volume (thousand tonnes)	2.1	2.5	2.9	2.4	3.6	4.1	3.4	-16%	26%
Total income (million €)	18.1	22.7	19.3	17.3	34.5	41.0	44.0	7%	74%
Total operating costs (million €)		4.3	3.5	2.7	5.2	7.6	5.7	-25%	31%
Gross Value Added (million €)		22.0	18.6	16.7	33.7	36.3	41.5	14%	73%
Net profit (million €)		18.4	15.8	14.5	29.3	32.2	38.5	20%	86%
Total value of assets (million €)						9.2	9.8	6%	6%
Net investments (million €)						2.5	1.3	-49%	-49%
Capital productivity (%)						394.3	424.5	8%	8%
Return on Investment (%)						357.4	388.0	9%	9%
Future Expectation Indicator (%)						21.9	9.7	-56%	-56%
Oyster Bottom									
Number of enterprises	64	26	43	62	91	60	71	18%	28%
FTE		38	30	46	126	127	125	-1%	102%
Average wage (thousand €)		8.4	7.4	11.7	11.9	10.0	14.4	44%	34%
Labour productivity (thousand €)		22.8	65.1	55.0	45.4	45.1	85.7	90%	32%
Total sales volume (thousand tonnes)	0.8	0.6	0.7	0.9	1.1	1.9	3.1	67%	231%
Total income (million €)	3.5	1.2	2.1	2.9	6.3	12.1	21.2	75%	406%
Total operating costs (million €)		0.6	0.4	0.9	2.1	5.1	6.7	31%	378%
Gross Value Added (million €)		0.9	2.0	2.5	5.7	8.5	16.8	98%	382%
Net profit (million €)		0.4	1.7	2.0	4.1	6.7	14.1	109%	423%
Total value of assets (million €)			0.2	0.5	1.1	7.1	15.6	118%	768%
Net investments (million €)		1.1	0.1	0.6	0.4	0.6	3.6	464%	708%
Capital productivity (%)			1198.3	474.0	514.0	118.3	107.8	-9%	-86%
Return on Investment (%)			1060.6	371.7	370.4	95.2	90.6	-5%	-86%
Future Expectation Indicator (%)			58.3	117.6	25.7	6.2	20.9	237%	-58%
Sea bass & Sea bream on growing									
Number of enterprises	73	70	36	34	28	8	11	18%	70%
FTE		177	82	92	78	30	51	-1%	25%
Average wage (thousand €)		11.8	14.3	14.2	12.6	19	87	44%	2%
Labour productivity (thousand €)		-3.5	-4.2	31.4	35.8	-259	-78	90%	1068%
Total sales volume (thousand tonnes)	2.6	1.1	1.2	1.8	1.6	1.0	1.1	67%	98%
Total income (million €)	14.0	6.1	8.2	11.0	12.0	6.1	7.3	75%	119%
Total operating costs (million €)		8.8	9.7	9.4	10.2	5.8	10.1	31%	-24%
Gross Value Added (million €)		-0.6	-0.3	2.9	2.8	0.8	-1.3	98%	877%
Net profit (million €)		-2.4	-2.8	0.1	0.8	-0.3	-3.5	109%	2224%
Total value of assets (million €)		8.6	12.0	11.5	5.3	7.1	12.8	118%	61%
Net investments (million €)		2.7	4.4	5.3	3.5	2.9	5.8	464%	-7%
Capital productivity (%)		-7.3	-2.9	25.1	53.0	-112.5	-37.6	-9%	1523%
Return on Investment (%)		-27.0	-22.4	1.4	15.5	-137.2	-77.4	-5%	573%
Future Expectation Indicator (%)		26.9	26.7	33.9	46.8	29.6	89.0	237%	-35%
Other marine fish on growing									
Number of enterprises	11	9	6	6	6	7	7	38%	52%
FTE		128	209	259	167	25	215	73%	-71%
Average wage (thousand €)		15.8	17.1	13.0	19.1	828	50	357%	404%
Labour productivity (thousand €)		-79.6	77.8	18.5	242.8	362	63	70%	-347%
Total sales volume (thousand tonnes)	0.3	1.4	4.4	2.7	2.2	2.8	2.8	6%	-47%
Total income (million €)	2.8	10.0	62.9	17.5	52.7	20.5	24.6	20%	-71%
Total operating costs (million €)		22.2	50.2	16.0	15.3	17.4	20.8	74%	-57%
Gross Value Added (million €)		-10.2	16.3	4.8	40.5	7.6	8.7	-263%	-117%
Net profit (million €)		-16.8	-1.6	-13.5	24.2	-6.5	0.2	-1161%	50%
Total value of assets (million €)		212.5	227.0	218.2	52.2	63.6	65.3	80%	-93%
Net investments (million €)		175.0	3.4	8.3	18.9	7.8	4.0	103%	-88%
Capital productivity (%)		-4.8	7.2	2.2	77.6	17.1	19.9	67%	-446%
Return on Investment (%)		-7.9	1.6	-3.6	56.1	-10.2	-7.4	44%	-2030%
Future Expectation Indicator (%)		80.3	-2.5	-0.5	20.7	21.4	2.7	201%	281%

Source: own elaboration from EU Member States DCF data submission

Figure 4.21.3 Economic performance in € million, indicators for the main Portuguese segments: 2008-2018.



Source: own elaboration from EU Member States DCF data submission

The cost structure of the four main Portuguese segments are presented in Figure 4.7.4.

Segment 1: Clam bottom

The clam bottom culture has a very low level of investments and operational costs are mostly wages and salaries, the companies are mostly small familiar units managed by the owner and their relatives. In 2018, wages and value of unpaid labour is a high cost (59% of the total costs), this values are explained by the difficulty in capture of natural seed for restocking the unit farms, between tides, so it is necessary to resort to temporary labour.

Segment 2: Other marine fish on growing

In this segment the feed costs and the wage and salaries are 44% of the total "operational costs, and the depreciation of capital in 2018, it´s around 11%. Livestock costs is stable over time (15%).

Segment 3: Oyster bottom

In 2018, wages and value of unpaid labour is a high cost (33% of the total costs), because is an activity that needs a lot of manpower to maintain the farm activity.The renewal of equipment but also investments to reduce the hard working conditions are made.

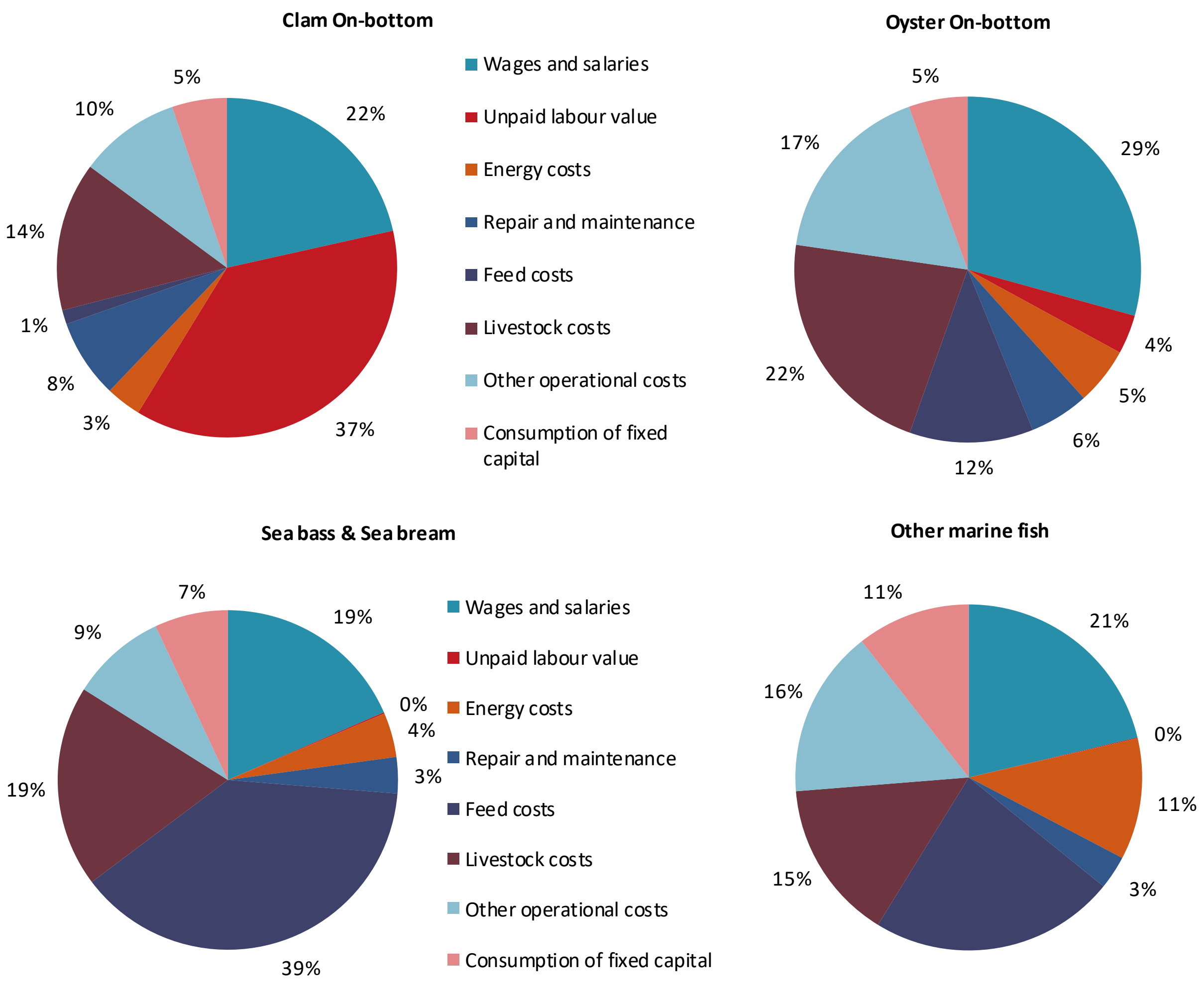
This segment is also characterized by the weight of livestock costs (22%) and then by the weight of other operational costs.

Segment 4: Sea-bass and Sea-bream on growing

In this segment, feed costs are high (39% of the total "operational costs plus depreciation of capital" in 2018). Over the last two years, feed prices have maintained fairly constant prices, on the feed side, there are few companies that have vertical integration.

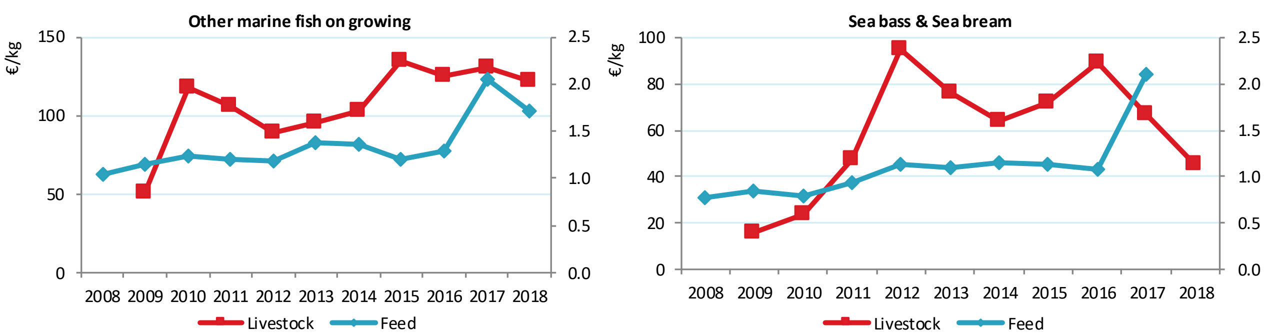
The second operational costs items is wages and salaries (19%), and also livestock costs (19%), because in most the aquaculture farms there is not the integration of hatchery.

Figure 4.21.4 Cost structure of the main segments in Portugal: 2018.



Source: EU Member States DCF data submission

Figure 4.21.5 Feed and livestock average prices €/kg for the main Portuguese segments: 2008-2018.



Source: own elaboration from EU Member States DCF data submission

4.21.5 Outlook

Nowcasts for 2019-20

The data for 2019 is not yet definitive and the data for the year of 2020 only be collected from March until May 31, 2021.

However, in a first approach for 2019, compared to 2018, the production remains stable in value and in volume.

Between 2019 and 2020, beyond the impact of COVID-19, a decrease of shellfish production, may be aggravated by the implementation of contingency plans imposed by other Member States, as well as the shrinking demand for fresh products by consumers at national level.

4.21.6 Trends and triggers

Current production trends and main drivers

The increase in production in 2018 was mainly because of the production of grooved carpet shell, and oyster. Production is expected to grow in the next few years because new projects are under development. These companies will produce sea bream, mussels, oysters and sole.

Portuguese aquaculture is largely confined to open sea, estuary zones and coastal lagoons. Almost 90% of aquaculture facilities are located in public domain areas, based on 10 to 25 year license, renewable for single time by a same period.

Since 2017, in the procedure of Blue Licensing the maximum period of the licence is 25 years, and be renewed until the maximum period of 50 years.

The companies are characterized by a great deal of extensive farming, largely family-based, that don’t have an organized system of accountability.

The subsectors in the Portuguese aquaculture are related to the following production systems:

Extensive: The extensive production develops in areas between tides, called intertidal zones, with the cultivation of bivalve molluscs such as clams and oysters. These production units are included in segments 11.10, 11.11 and 12.11. Most of the unit’s farms are in the Algarve and Centre regions.

Semi-intensive: Included in segment 3.1 and 3.6, the ponds are the main production system for sea bass and sea bream in Portugal. Different farms use various levels of stocking densities and pond sizes, but in general these are semi-intensive systems covering large areas with ponds ranging from one to several hectares and production levels from 0.5 to 6 Kg/m3 (mostly around 2 kg/m3) at the end of the production cycle. Although sea bass and sea bream are traditionally the target species produced in such ponds, there is commonly natural stocking from wild larvae of other fish species, including Senegalese sole. Previous attempts at on growing sole in ponds in a polyculture regime with sea bass and sea bream shows promising growth rates. Species in polyculture regime from different trophic levels have also been considered an efficient and environmentally sound strategy to minimize the impacts of aquaculture systems, because an important fraction of dissolved nutrients and organic matter is recycled within the pond. The difficulties faced by this type of aquaculture are largely related to its high production costs (mainly high labour costs and high land costs) that compromise its economic sustainability due to the low productivity of these systems. There is currently a trend of reconverting the culture practiced on the earth pounds from a fish culture to a mollusc culture, with the consequent decrease in the volume of sea bass and sea bream produced.

Intensive: Corresponding to segments 9.2 and 9.6, the intensive production in Portugal refers to the cultivation of turbot and sole. Since 2012 some new developments happened with the production of sole in recirculation systems (RAS) and in intensive regime as well as the installation of a hatchery of sole. Production costs are high, but the selling price per kg compensates.

Investments in aquaculture are based on spatial planning, seeking not only to minimize possible conflicts with other users with an appetite for the same locations, but also compatible with other uses of the same space, in particular those involved in the conservation of ecosystems, with a view to the sustainable development of aquaculture practices. They will privilege environmental standards in the implementation of the physical structures, but, mainly, in the use of aquaculture production methods compatible with the protection and improvement of the environment. Investments to introduce improvements in management practices of production and marketing, including through the intensification of new information and communication technologies are also encouraged. Structural modernisation is also being promoted within the current fisheries management plan. These objectives are consistent with those established by the EU in the Common Fisheries Policy, and particularly the 2002 Strategy for the Sustainable Development of European Aquaculture, which promotes environmental, economic and social sustainability.

The intervention of the Fund European Maritime Affairs and Fisheries (EMFF), is very important for the investment, innovation and use of new technologies as well as the presentation of new products for new markets.

Production is expected to increase, and the possible of investments supported by the EMFF, namely new offshore units for sea bream and mussels, a new production unit for sole and the increase in production of turbot. The expected production of mussels may in the future introduce a new segment.

Market structure

The Portuguese aquaculture is mostly based on bottom culture units, over 1 300 unit farms, with strictly family labour.

With the publication of the maritime spatial planning situation plan and also soon with the approval of the aquaculture plan in transitional waters, it is expected the emergence of new companies with logistical support or even aiming a restructuring in the national sector.

The emergence in 2009 of a big company, the overall cost structure becomes greatly altered and irregular. The impact of this situation is still making impossible to have a correct cost structure.

The need to differentiate Portuguese products represented a way to the certification of the national production. At this moment, we have two mussel farms with certification, and one macro algae unit, for organic aquaculture.

The objective of national fisheries policy in regard to aquaculture is to increase and diversified production, in the sustainable mode, to improve the sector’s competitiveness.

The processing and marketing of fishery products must respond to changing consumer trends and profiles, seeking to expand and diversify its business, adjusting it to market developments, betting on internationalization and joint control of marketing channels in order to enhance the ability to generate added value. To strengthen this capacity is essential to a strong focus on quality and innovation of processes and products, as well as in the introduction of improvements in the management and organization of companies.

Most aquaculture products are for national consumption; however, the export sales are growing, with an increase of 6% to 33% from 2012 to 2018 in the total of sales. Overall sales figures, when compared to the significant investments in aquaculture in the period 2007-2013 and 2014-2020, seem rather modest. Nevertheless, some investments (notably in a mussels and oyster farms which is about to begin operations) will bring returns in the long term.

Issues of special interest

With the publication of the maritime spatial planning situation plan and also soon with the approval of the aquaculture plan in transitional waters, it is possible to take advantage of new areas.

Spatial planning should cover also offshore aquaculture, IMTA, the restoration of abandoned aquaculture facilities, integrating suitable aquaculture activities into protected areas such as Natura2000 areas (notably those activities offering environmental services), and exploring synergies between different activities and multi-use of space.

Spatial planning should always take into consideration the implementation of EU legislation, including the Water Framework Directive and the River Basin Management Plans. Consideration of special areas for the production of especially sensitive species could also be considered, such as areas for shellfish cultivation.

Many projects were conducted in order to improve new species, methods and technologies which contribute to the increase of the production and to the reduction of environmental impacts of semi-intensive and intensive aquaculture. The proportion of nutrients utilized for fish growth can be maximized, for example by selecting very digestible ingredients that facilitate nutrient assimilation and promote the improvement of FCRs (Feed Conversion Ratios), and at the same time reducing the amount of waste and nutrient output from fish farms (Black 2001, World Bank 2006). Eco-friendly feeds, in which fishmeal protein is replaced by vegetable protein sources, may also contribute to the reduction of aquaculture’s ecological footprint by reducing the pressure on natural fisheries resources).

In intensive aquaculture, we improved to use recirculation systems (RAS), and in semi-intensive and extensive system, we are going to develop the use of multi-trophic system.

The target for the national aquaculture presents a strong growth in the next years, especially concerning the exploitation of open sea areas and, with the support of the European Fund for Fisheries and Maritime Affairs (EMFF.

Portugal has been investing in aquaculture production, in order to response to market needs, attentive to the growing demand for fresh fish for human consumption, both in the market national level, as at European level.

The lack of domestic suppliers with the capacity to meet the consumption needs of fish in Portugal, in particular of sea bream and sea bass, requires to supply from foreign producers much of the needs of these species.

In fact, Portugal is obliged to import the majority of the fish consumption by the Portuguese population, negatively impacting the trade balance of fishery products, with a deficit of €1 022.9 million in 2017, particularly in the derived from the increase in imports of fish, in nominal terms, of 17.4% (DGRM, 2017).

The investments in offshore aquaculture practiced in floating cages is the most common production model, as it is the more efficient production model, and the one that allows a higher level of production compared to the market needs, and therefore the production model used in the production projects, allow for the production of sustainable aquaculture in coastal waters.

In Portugal mainland, Algarve is the area of excellence for aquaculture production, due to the water temperature profile and more favourable sea conditions. Much of the production is currently done on land (ponds), and it has only recently been implemented the first offshore aquaculture unit dedicated to fish production, located in Armona's APA, and another project to install in APA - Monte Gordo, in line with technological advances.

In the Autonomous Region of Madeira, the open sea farming system for fish farming appears as the most suitable for the Region due to limited land space and the environmental conditions of the sea. The average seawater temperature in winter, above 17ºC, allows the growth of cultivated fish and the realization of fattening cycles about 2 to 4 months lower than those of the Atlantic coast of Europe. Marine aquaculture developed from the end of the 1990s, due to the need to close the lack of fish supply in the regional market and as an opportunity to create new forms of business, with an impact on the reduction of fish imports. The sea bream is produced in floating structures in the open sea.

The identification and availability on the Atlantic coast in mainland of new areas of aquaculture production in open sea, the rehabilitation of aquaculture areas of production in areas of estuaries and other wetlands and the betting in systems for intensive production and integrated multi-trophic aquaculture (IMTA), will increase the Portuguese aquaculture.

The development strategy must also be the promotion of integrated multi-trophic aquaculture, in order to increase production capacity and diversify production, reducing impacts on the marine environment. In addition, the cultivation of algae and other low-level trophic autochthonous species should be promoted in order to the development of locally sourced aquaculture products from a value chain perspective, focusing on solutions that focus on the circular economy.

4.21.7 COVID-19 impact

In the category of flat fish, that includes turbot and sole, there is a drop in orders for the foreign market (ES and USA) in the order of 30%, which can mean a reduction in monthly orders in the order of 800 thousand euros/month.

As regards bivalves, there is greater stability to date, but this may be aggravated by the implementation of contingency plans imposed by other Member States, as well as the shrinking demand for fresh products by consumers at national level.

The sector had financial support:

- Access to the Capitalize 2018/Covid-19 credit line was made available to meet the needs of the working and treasury funds.

- A specific credit line has been set up under the €20 million *de minimis* scheme to make more liquidity available to operators in the fisheries sector, in particular for the acquisition of production factors, payment of wages and debt renegotiation;

- Creation of an exceptional and temporary regime, as Wage Compensation to Fishing Professionals prevented from carrying out their activity due to forced stops resulting from the COVID-19 pandemic. This scheme also covers aquacultures.

Support measures under the Mar 2020 programme:

- In order to speed up payments, the following exceptional measures have been adopted:

  (a) where, for reasons not attributable to undertakings and other private entities receiving the programme, it is not possible to validate the payment request within 20 working days from the date of its submission by the beneficiary, the application shall be settled as a down payment;

  (b) payment applications validated in accordance with the preceding subparagraph shall be paid up to a maximum of 70% of the corresponding public support on a weekly basis;

  (c) it is now possible for the beneficiaries of the program to submit payment requests on the basis of invoiced expenditure, but not yet paid by the beneficiary, which is considered for payment as an advance, provided that the sum of advances already made and not justified with expenditure submitted and validated does not exceed 50% of the public expenditure approved for each project;

- The expenses proven to be incurred by beneficiaries in initiatives or actions cancelled or postponed for reasons related to COVID-19, provided for in approved projects, are eligible for reimbursement.

- In addition to the above, projects that, due to the negative impacts resulting from COVID-19, do not reach the approved budget and the full financial implementation provided for in the implementation of actions or targets, and may be terminated as completed as long as they do not call into question the achievement of the objectives for which the operation was approved, are not penalized.

- Where necessary, when the contract defined deadline for the completion of the project is the year 2020, this date is extended to 2021 and within a period compatible with the completion of its physical and financial implementation.

• It is authorized to submit a greater number of payment requests, in addition to the limit established in the flexibility measure already adopted at the end of 2019, which allows the submission of up to 10 payment requests in each project.

4.21.8 Data Coverage and Data Quality

Data quality

The account statistics for 2018 is based on a census on the 846 companies representing 1 515 aquaculture farms. The operation is carried out annually until the end of May.

The Portuguese Directorate General for Natural Resources, Security and Maritime Services (DGRM) has registered the total population of farms and companies engaged in aquaculture production in Portugal. It is mandatory for all aquaculture producers in Portugal to report the production in volume and value each year at the farm level. The operation of data collection was expanded in order to fulfil the needs of DCF and socio-economic data is now collected. The same operation fulfils the administrative needs for information, EUROSTAT and DCF. The data are collected at farm level in production.

While production data is mandatory, economic data are provided voluntarily. The low rate of responses is a tendency in the last years and the administration is enforcing the response with some administrative measures that include sanctions if production is not delivered one year and may include the removal of the license in case of non-response for 2 years.

Due to the low response rates, the variables are estimated to reach the whole population and quality indicators calculated.

Data for the aquaculture sector is published once a year aggregated by type of farm and species. The aquaculture statistics are published on an annual publication, "Estatísticas da Pesca", in collaboration between DGRM and the Portuguese National Statistics Institute (INE) approximately 18 months after the end of the reference year.

Confidentiality

Confidentiality rules are applied when the number of units in a segment is under 3. In this case, units are aggregated, when possible, to a similar segment, under the statistical evidence that both populations are homogeneous. When aggregation is not possible, data provided doesn't include the confidential values and may not include other values if it's possible to achieve that information by subtracting totals to the known segments.

Differences in DCF data compared with other official data sources

The Portuguese data collection uses the same database to provide information to Eurostat, FAO and DCF. Differences in the data results from the aggregation requested by different data calls and the time of the year when data is provided. When data changes (new data are received or re-submission of data by some companies), new sets are compiled and disseminated to the different end users, accordingly to data revision policies. Other than this, differences between sources should not happen.

Other data issues or missing data

Until 2016, economic, social and production, was collected per production unit.

From 2017 since now, the collection data is made by company, for the economic and social data, maintaining the collection of the production per production unit.

Through data for marine overview, we found that some value (Other incomes and Total Value of Assets) affect profitability and productivity indicators in 2017 comparing with 2018. The reason for this situation is related to a company, with an organizational structure different from all the others. As a result of this operation were registered a very sharp break in the enterprise assets and a considerable increase in the “Other Income”. In that way this operation influences the results of all the economic indicators established for the national aquaculture sector. And so, we take the option to remove the company from the sample to avoid extreme thresholds that would jeopardise the analysis of economic indicators established for the national aquaculture sector.

We are implementing validation tools in the data collection, to improve the quality and consistency of the data collected.

4.22 Romania

Overview of Romanian aquaculture

Romania's aquaculture industry in 2018 year registered a quiet increase based on a higher level of sailing prices conducting to a total of €51.8 million, and increased number of enterprises amounting 456 units (mainly small farms). Table 4.7.1 shows a reduction of employee's number amounting 1 965 as total number full time, and corresponding to same amount as FTE, as a result of improvements in production technology leading to an increased total assets value up to €210 million.

Should be observed that despite the fact that Romania is not a landlocked country, freshwater aquaculture represents more than 99% of total production, as volume and value.

Consequently, marine aquaculture is missing from the analyses, due to some legislative aspects related to the access to marine waters, now in solving course, with perspectives to develop this segment starting within 2021 year.

4.22.1 Total Production and sales

In 2018, Romania aquaculture industry totalized a sales volume amounting 13.6 thousand tonnes and €51.8 million as value, all most the same sales volume as in 2017 year, but with an increase of €21.8 million as value. This increase is owned to:

- bigger number of enterprises - medium and small size firms, very important familial Trout farms, especially in mountain area of the country, plus 15 units;
- improvement of technology used and investments in various technical facilities;
- a slight diversification of products – for a higher price level selling - e.g., *Polyodon spathula*, despite the small quantity reported for 2018;
- increased production of trout species - in Romania are produced all 3 main varieties of fresh water trout species - by 394 tonnes;
- and a positive evolution of some species - e.g., Pike perch - having a higher level of selling price in 2018.

4.22.2 Industry structure and total employment

The number of enterprises in 2018 increased from 440 units in 2017 up to 456 in 2018 year. The most important rise is recorded in segment finfish freshwater segment by 15 units, for Trout. Trout farms, Common carps, and other fresh water farms amounts 453 units, marine aquaculture farms (having small quantities and, also small value in past years – all most as experimental activity) totalized only 3 units. Should be revealed the fact that a lot farmers made investments, and as per financial rules, only after finishing the entire constructive process these are registered in logger-books, and finally in balance sheet at the end of the year. So, investment figures increased 140% compared to 2017 is motivated from this point of view, the expenses during construction or modernization in 2-3 or more years are registered in 2018 for an amount of €12.1 million.

Total number of employees decreased from a number of 2 230 in 2017, to 1 964 number in 2018. Despite the total number farms increased, less people have been reported as employed, due, in many cases of less/ceasing activity of farms due to dried weather, especially in summer, but not only, this period of lack of rains includes several months before and after summer season, April - May, September – October. Consequently, the production, approx., is at the same volume level like in 2017 – with not a big increase, have determined an increase on selling prices, especially for valuable species, such as pikeperch and catfish. The farms preferred to paid employees doing safety activities of farm, rather than those for production (useless in these conditions) –

especially in the south and south-east part of the country, where meteorological conditions have been unfavourable, as mentioned. In this area, the most farms are on ponds and some big lakes, on which the aquaculture is licenced, as a second priority for these lakes designed and use mainly, for hydro-activities such as river regularization, producing electricity and irrigation.

From the total employees, 1 947 counts for fresh aquaculture and only 18 for marine aquaculture, as per Table 4.22.1.

Table 4.22.2 Production and sales, industry structure and employment for Romania: 2008-2018.

Variable	2010	2012	2014	2016	2017	2018	Change 2017-18	Develop. 2018/(09-17)
Sales weight (thousand tonnes)	**12.9**	**10.0**	**10.6**	**10.9**	**13.6**	**13.6**	0%	25%
Marine	0.0	0.0	0.0	0.0	0.3	0.0	-93%	-62%
Shellfish	0.0	0.0	0.0	0.0	0.0			
Freshwater	12.8	10.0	10.5	10.8	13.3	13.6	2%	25%
Sales value (million €)	**31.2**	**18.1**	**19.1**	**28.9**	**30.0**	**51.8**	72%	123%
Marine	0.0	0.1	0.1	0.1	4.5	0.5	-89%	-21%
Shellfish	0.0	0.0	0.0	0.0	0.0			
Freshwater	31.1	18.1	19.0	28.8	25.5	51.3	101%	127%
Number of enterprises	**444**	**430**	**430**	**355**	**440**	**456**	4%	4%
Marine	1	2	3	2	1	3	200%	60%
Shellfish	1	1	1	1	1			
Freshwater	442	427	426	352	438	453	3%	4%
Employment	**3,933**	**2,968**	**2,542**	**1,954**	**2,230**	**1,965**	-12%	-29%
Marine	3		4	14	150	18	-88%	-42%
Shellfish	1	1	3	4	-			
Freshwater	3,929	2,967	2,535	1,936	2,080	1,947	-6%	-29%
FTE	**3,933**	**2,523**	**2,001**	**1,495**	**2,230**	**1,965**	-12%	-18%
Marine	3		4	13	150	18	-88%	-42%
Shellfish	1	1	3	4	-			
Freshwater	3,929	2,522	1,994	1,478	2,080	1,947	-6%	-18%

Source: EU Member States DCF data submission

4.22.3 Overall Economic performance

Romanian economic performance of aquaculture has improved between 2008 and 2010, also in the last 3 years. The amount of total income generated by the Romanian aquaculture sector in 2018 was €58.0 million. The total income value in 2018 increased by approx. 48% compared to 2017, and it is 22% higher than the average value for the period 2008-2017. In 2018 the largest part of the income remained from the turnover from sales approx. 89%, followed by subsidies granted by authorities for compensation of excise duty on fuel, used for farms works only, for 10%, and other income – 1%, as a specific second activity, consisting in recreational fishery allowed by authorities in the farms in special regulation. The main farms where it is developed are mainly the medium size farms, between 10-200 ha surface, but also in other farms placed on natural/artificial lakes. The income from subsidies in 2018 decreased compared to 2017. Unlike the turnover for 2018, which was higher than in 2017, the other income decreased by all most 90%.

The total operating costs of the aquaculture industry in 2018 totalized €47.6 million and represented 65% of the total income. The total operating costs in 2018 increased by 82% compared to the level of the year 2017. The largest expenditure item in 2018 was raw material: livestock costs with €19.9 million and feed costs €14.8 million, wages and salaries with €11.4 million, energy costs €1.9 million, repair and maintenance costs with €1.2 million, and other operational costs €0.35 million. Expenditures for other operational costs, raw material: livestock costs and raw material feed costs in 2018 increased by 23%, operational costs 93% and wages and salaries by 9% compared to 2017, respectively.

According to capital cost, consumption of fixed capital is the main cost with the amount of €7.9 million. In 2018, the depreciation of capital decreased by 10% compared to 2017, the financial costs increased by more than 110% and the financial expenditures decreased by 45%. In regards to capital value, the total value of assets and debt amounted €40.7 million and €15.9 million, respectively. The total value of assets in 2018 totalized €210 million comparing €122 million in 2017. The debt decreased in 2018 until €50 million, versus 2017 counting for €62 million.

Table 4.22.2 Economic performance of the Romanian aquaculture sector: 2008-2018.

Variable	2010	2012	2014	2016	2017	2018	Change 2017-18	Develop. 2018/(09-17)
Total income	31.2	28.0	65.1	49.0	39.2	58.0	48%	22%
Total operating costs	29.3	19.0	29.1	29.2	41.0	49.5	21%	64%
Total wages	11.1	5.8	8.6	8.5	11.1	11.4	3%	27%
Gross Value Added	13.0	14.3	43.1	26.6	9.2	13.8	49%	-45%
Depreciation of capital	3.8	2.7	5.2	6.2	8.9	8.0	-10%	59%
Earning before interest and taxes	-1.9	6.4	30.8	13.5	-10.8	0.6	105%	-95%
Financial costs, net	0.8	0.2	0.2	0.4	-51.0	0.8	102%	114%
Net profit	-2.7	6.2	30.5	13.1	40.2	-0.2	-101%	-101%
Total value of assets	381.4	65.9	189.1	252.3	122.0	210.6	73%	15%
Capital productivity (%)	3.4	21.7	22.8	10.5	7.6	6.5	-13%	-58%
Return on Investment (%)	-0.5	9.7	16.3	5.4	-8.8	0.3	103%	-96%

Source: own elaboration from EU Member States DCF data submission

4.22.4 Main species produced and economic performance by segment

As mentioned above fresh water fish is more than 99% in Romanian aquaculture production and then, marine aquaculture is skipped from analyses, totalizing 13.6 tonnes and €51.3 million.

Main species are: Carp 43% (Common carp, Crucian carp, *Carassius spp*., etc.) and other freshwater species combined - segment 1, trout 23 % (Rainbow trout, Brook trout and Sea trout) – segment 2, and Asiatic cyprinids 34% (Bighead carp, Silver carp, mainly) – segment 3, see table 4.7.1.

Figure 4.22.1 Main species in terms of weight and value in Romanian production: 2018.

Source: EU Member States DCF data submission

From the total of 13.6 thousand tonnes, the main group species are: group 1 - (Carp species and other freshwater species) 5.85 thousand tonnes with a value of €10.77 million, group 2 - Asiatic cyprinids 4.62 thousand tonnes with a value of €12.31 million, and group 3 - Trout 3.13 thousand tonnes with a value of €28.22 million. Comparing with the same indicators during the analysed period starting with 2008, 2018 reveal that no major changes are recorded in Romanian aquaculture structure, but increasing in volume and value, the industry is not well diversified, this being the main statement, and, also, the impact of imports fish and fish products as most important component in the domestic fish consumption, as well as the export and import balance of the sector, with net figures in favour of imports. As example, Sturgeons and Polyodon spathula fish species, are present in data collected, but for small quantities, enhancing the actual status of structure production in the country, and fable attempts on the introduction of new valuable species in culture, requested by the market.

The most relevant prices for the species produced in Romania aquaculture variation depends on external and internal factors influencing notably the variation of production evolution on the analysed period. The valuable species, such as sturgeons and Poloydon spathula, including pikeperch, catfish species (last once indigenous species in Romania) vary year to year. Pikeperch is very difficult to be cultured on aquaculture facilities and the quantities produced are varying pending by the cycles of production from year to year, and so the fluctuations on prices are evident, so that the level of prices for 2012-2014 could be evaluated as for a relative stability, followed by an increase in 2015, again declining level, and increasing up to €4 per kg in 2018, from €2.4 per kg in 2017.

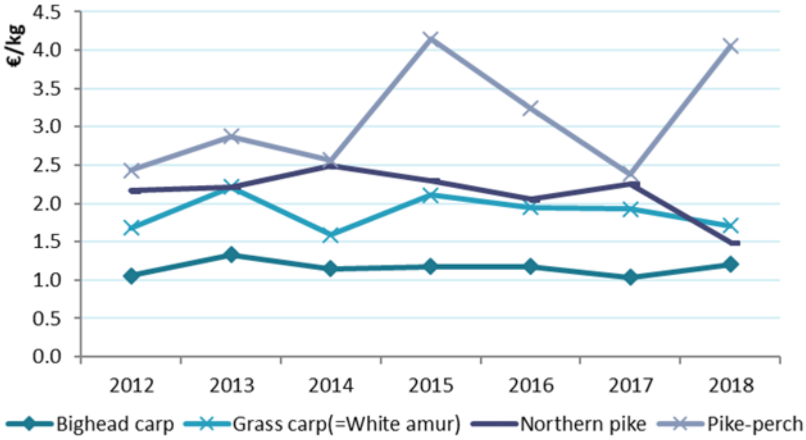
Northern pike species, being more often in wiled environment, is also very difficult for aquaculture culture, that’s why the same characteristics are suitable for analyses as for pikeperch and the similarities on price evolution should be taken into consideration. The price decline from approx. €2.3 per kg in 2017, to around €1.5 per kg in 2018, people preferring that fish from natural environment resulting from professional fishery, mainly in Danube Delta.

For grass carp and bighead carp, prices are pending on production level and total costs inducted for production, as well as the market availabilities related to same captured species from rivers. These species are considered as invasive species on Romanian waters.

Belonging to the same family’s fish species of cyprinids, Asiatic cyprinids, the price evolution is linked to the previous aspect related, and on the concrete quantities produced in farms for both kind species, market reactions conducting to the evolution as in Figure 4.7.2. So, grass carp price declines from €1.9 per kg to €1.6 per kg – a slight decrease between 2017-2018, and bighead carp increased from €1 per kg in 2017 to €1.3 per kg 2018.

It should be underlined that in Romania, considering the price level of domestic products – not so high, due to the varying volume of production, aquaculture industry has to face strong competition on selling process, due to the import of fish and fish products – largely available in supermarket chains, for a high volume-availability, although consumption and domestic demand is constantly growing and diversifying. Consumption per capita, according to the last information from NIS, raised from 6.7 kg per capita in 2018 up to 7.8 kg per capita in 2019.

Figure 4.22.2 Average prices €/kg for the main species produced in Romania: 2012-2018.



Source: own elaboration from EU Member States DCF data submission

The most relevant segments in Romanian aquaculture in 2018, are the following:

Segment 1: Carp ponds

The segment of Carp cages is important, a lot farms, as those with big surface, including lakes, are included here. The analyses reveal the increased levels in 2018, see the number of enterprises evolution as example, due to the transition data collection from DCF to EUMAP and improved allocation by segments of the MS, but not ensuring the compatibility of the figures for the period 2009-2016, with the new one 2017-2018. Must be underlined that in this kind of farms, the technology used is extensive one, and some other species are in culture, but having totally a secondary importance, as for it e.g., Asiatic cyprinids due to the extensive culture method used, an old one. Considering the number of enterprises 218 increased number in 2018, from 94 in 2017, persons employed/FTE 1 371 in 2018 versus 1 340 in 2017, net investments increased up to €3.8 million in 2018, versus €0.6 million in 2017. The segment is important due to the fact that is largely encountered in the country and total value of assets amounting €13 million, versus all most €2.8 million in 2017. Also, the labour productivity increased in 2018 up to €15.6 thousand from €3.9 thousand in 2017. Total operating costs have risen from €1.2 million in 2018, from €0.4 thousand in 2017, due to the increased number of farms allocated to this segment under EUMAP. GVA increased in 2018 to €2.1 million from €0.5 million in 2017, and net profit increased to €1.6 million in 2018, from €0.8 million in 2017.

Segment 2: Carp cages

The segment of Carp cages is important due to the fact is illustrating the evolution of some progress made by MS on data collection and clarification of the last issues on the allocation for the right segment of the units (farms) harmonised with the new EUMAP. The overall explanation is the reduced number of enterprises smaller, 12 as number, in 2018, versus 2017, 101 as number. Also, the number of persons employed decreased from 238 FTE, in 2017 to only 21 FTE, in 2018. It is observed that the total operating costs € 0.3 million in 2018, slightly increased from € 0.27 million in 2017. Due to this evolution, the GVA increased in 2018 up to €0.4 million, from € 0.2 million in 2017. The capital productivity increased up to 16 points in 2018, from 11 points in 2017, as well as the return of investments indicator from almost 1 in 2017 to 11 in 2018, and future expectation indicator indicates an improvement from -3 in 2017 to -1 in 2018.

Both analysed segments are important in the MS aquaculture industry sector due to the fact are delivering all most fresh fish products on the market. Also, the recreational fishery allowed in this facility as very important component in total income, mainly for carp ponds. MS should revise collected data for the period corresponding to DCF for updating, to ensure next analysis for a multiannual data series, target of the actual report.

Table 4.22.3 Economic performance in € million, indicators for the main Romania segments: 2017-2018

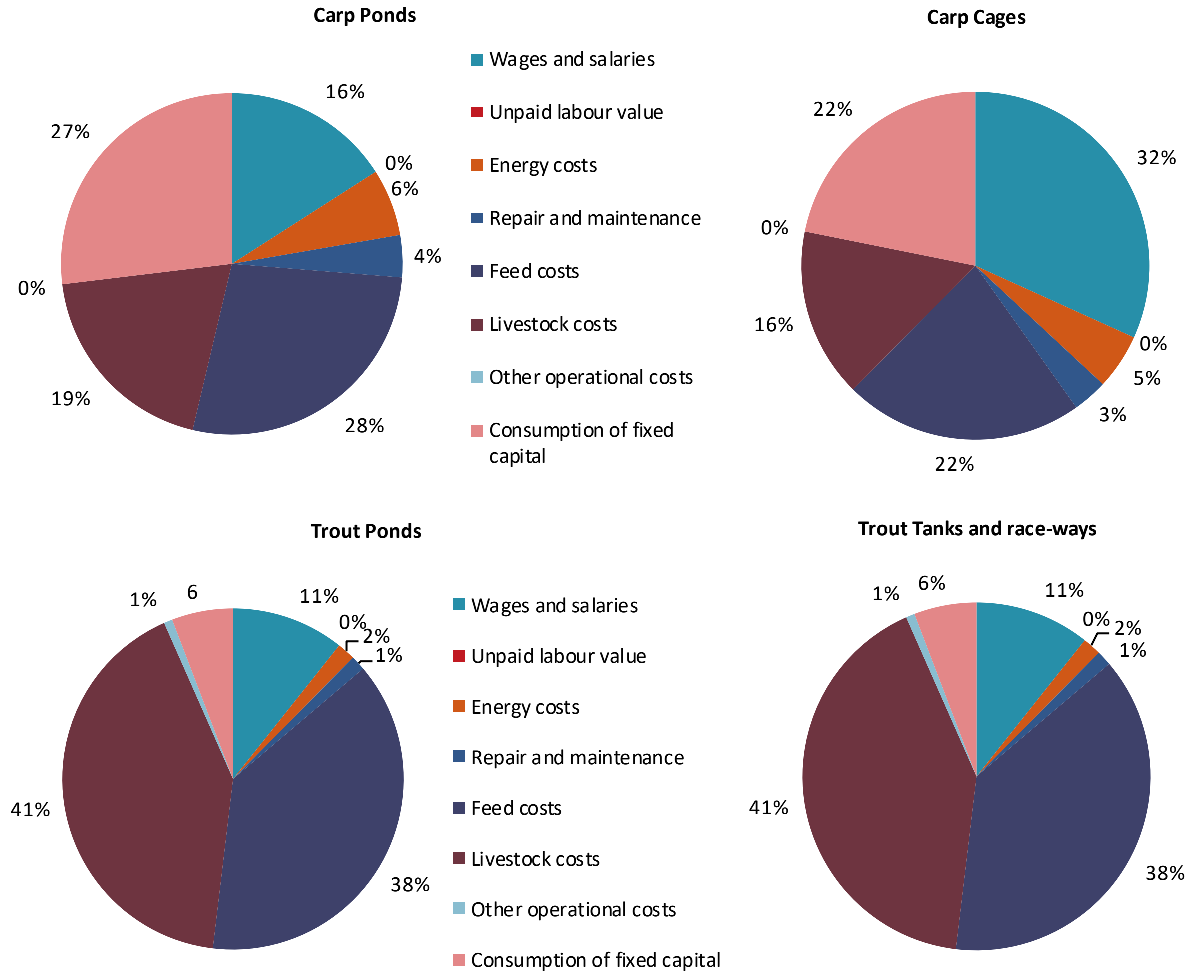
Variable	Carp Ponds 2017	Carp Ponds 2018	Carp Ponds Change 2017-18	Carp Cages 2017	Carp Cages 2018	Carp Cages Change 2017-18	Trout Ponds 2017	Trout Ponds 2018	Trout Ponds Change 2017-18	Trout Tanks and race-ways 2017	Trout Tanks and race-ways 2018	Trout Tanks and race-ways Change 2017-18
Number of enterprises	94	218	132%	101	12	-88%	90	45	-50%	6	88	1367%
FTE	1340	1371	2%	238	21	-91%	151	169	12%	150	231	54%
Average wage (thousand €)	1.1	2.0	82%	3.2	62.6	1882%	16.3	2.8	-83%	11.0	6.7	-40%
Labour productivity (thousand €)	3.9	15.5	303%	7.1	202.0	2753%	23.5	-9.9	-142%	10.6	-23.5	-322%
Total sales volume (thousand tonnes)	7.4	8.5	14%	1.3	1.7	29%	1.7	0.1	-94%	0.0	0.3	1273%
Total income (million €)	8.2	33.4	309%	3.7	7.1	91%	8.1	2.0	-75%	4.0	6.6	66%
Total operating costs (million €)	4.4	12.3	176%	2.8	3.2	17%	7.0	4.2	-41%	4.1	13.6	234%
Gross Value Added (million €)	5.2	21.3	313%	1.7	4.2	152%	3.6	-1.7	-147%	1.6	-5.4	-442%
Net profit (million €)	8.0	16.3	102%	4.0	2.9	-28%	8.2	-2.4	-130%	3.1	-7.9	-354%
Total value of assets (million €)	27.9	130.9	369%	15.3	26.2	72%	29.7	5.7	-81%	1.6	18.4	1035%
Net investments (million €)	0.6	3.8	518%	0.4	0.5	18%	0.9	1.4	56%	0.2	4.6	1868%
Capital productivity (%)	18.5	16.3	-12%	11.0	16.2	47%	12.0	-29.4	-346%	97.7	-29.4	-130%
Return on Investment (%)	9.1	12.7	39%	0.5	11.2	2298%	-1.7	-42.3	-2359%	-62.7	-42.3	32%
Future Expectation Indicator (%)	-2.0	-0.5	74%	-2.8	-1.5	47%	-2.4	20.2	950%	-44.4	20.2	146%

Source: EU Member States DCF data submission

Segment 3: Trout ponds

The segment, trout ponds, is important regarding the limitation of the number of this kind of farms, not always suitable for trout culture. The number of enterprises was reduced from 90 in 2017 to 45 in 2018, 50%, but the number of persons employed slightly increased from 151 in 2017 up to 169 in 2018, and mean wage drastically decreased from €16 thousand in 2017 to almost € 0.3 million in 2018, and by consequence the labour productivity decreased from € 23 thousand in 2017 to €10 thousand in 2018, due to the fact total income also decreased from €0.8 million in 2017 to 0.2 in 2018, but the total operating costs decreased, but not at same level, from €0.7 million in 2017 to €0.4 million in 2018. Consequently, the GVA indicator decreased below 0 in 2018, as well as the net profit indicator, and as consequence the indicators capital productivity and ROI also decreased to negative values, as a result of 50% diminish on overall sector, as described above. Due to positive estimation, after real restructuration of the segment, for 2019 actually, the future expectation indicator shows an unexpected increase that should be carefully evaluated on the next report.

Figure 4.22.4 Cost structure of the main segments in Romania: 2018.



Source: EU Member States DCF data submission

Segment 4 Trout tanks and race-ways

The trout race-ways is still important because of its increase in 2018 versus 2017 year, due to the apparently restructuration on trout allocation of farms to the segments, that should be carefully analysed on the next report, meantime with correct MS data update for at least the last 3-4 years to ensure compatibility between DCF and EUMAP for deep analyses of its.

It is observed that the number of increases from 6 units in 2017 to 88 units in 2018. This evolution is due to the switching activity from trout ponds farms, or to the new reallocation by MS for this segment targeting the compatibility of data of the new EUMAP. The number of persons employed-FTE increased from 150 in 2017 to 231 in 2018, but mean wage decreased by 40% but for the same years. On the occasion of revising data for the next report MS should verify collected data for 2018, especially, due to the fact labour productivity decreased unrealistically in 2018 versus 2017. Total income, total operating costs as well as total value of assets increased by important percentage that impose the verification of transmitted data on the next data calls, by MS. DCF – EUMAP generated reallocation in sight industry by segments and, consequently, data collected should be carefully revised. Is the same recital applied for capital productivity, ROI and future expectation indicators, as well as for GVA and net profit indicators actual levels based on EUMAP data collection of MS.

4.22.5 Outlook

Nowcasts for 2019-20

In Romania aquaculture have a trend of increasing, but very slight, as per analysed data. As per general statement on the openings of the chapter from many years the structure and fish species cultured are all most the same, mainly carp species and Asiatic cyprinids and very important from its value trout species. Some attempts to introduce in production valuable fish species such as: sturgeons and Polyodon spathula with net superior level selling price are not enough to accelerate the increasing production trend. In carp production, the main method is extensive one, but with small yield per ha, despite the opportunities in lakes, tradition on fish consumption. Should be noted that the strong competition of imported fish, mainly marine fish species in super markets creates a lot of restriction on selling local products, as well as the fable organization of the farms in producers associations ensuring a common way and methods providing inputs and outputs on a reasonable and regular bases. The foreseen data on production, now in final stage of validation, indicates the same slight increase, for 2019 of 15%. For 2020, data under final collection and processing, indicates a decrease due to the COVID-19 crisis.

4.22.6 Trends and triggers

Current production trends and main drivers

As mentioned above are three main group species are mostly cultured on Romania industry carp, Asiatic cyprinids and trout, marine aquaculture is still missing, and some other species not for importance in total volume and value production. The sector doesn’t improve the number and variety of species, as well the production methods, as example the farmers are still applying extensive method as a large scale, and not accessing new technology. For this reason, innovation is all most absent and, efforts have to be done in this respect. No significant subsidies are provided, unless in 2019 a small compensation for fuel consumption for works in farms was granted by authorities.

No allocated zones for marine aquaculture are established, only starting within 2021 there are some works on place in this respect, starting with improvements on national legislation being expected.

The trend on increasing the production is observed in the last year but still far to the potential of the total surface available for aquaculture along the country, mainly to the old technology, and a late increase of investments for.

Market structure

The market structure in Romania is still unchanged, we are referring here to the same supermarket chains dominating the market. Only the big farms are able to sign contracts with it, and the small producers facing a lot of difficulties on it, also the huge quantity imported of marine fish and see food, as per changed demand of consumers, are discouraging them. Just the reduced number of processing units are still buying from the internal farmers but not in a constant base. In the attempt to offer other products, just few farms are producing small quantities of sturgeon, and catfish.

4.22.7 COVID-19 impact

The COVID crisis influenced last year the aquaculture Romanian industry and the main impacts were caused by the lockdown, replaced by less strong measures alert situation, but the sales decreased in the first part of the year, mainly, when some popular holidays, not official, reduced the volume of its, due to the restrictions on traveling, so less access to traditional markets was registered. Preliminary estimations indicate a reduction of the sales as a general observation, with signs of recover on the second part of the year.

The preliminary data shows that the sales for 2020 still under estimation, are softly reduced versus 2019. A slight turbulence, variations of prices from a year period to other one, is expected to be define. The authorities didn’t grant any subsidies, which are foreseen for 2021.

A very important issue for developing marine aquaculture is the absence of allocated zones for aquaculture due the juridical environment related to the access to marine waters, but with real expectations to be solved within 2021, because of interest of new investors in this field.

4.22.8 Data Coverage and Data Quality

Data quality and availability

Romania has to improve the methodology used for data collection concerning data quality – still there are CV conducting to up and down level of indicators in the analysed period. The availability of data is respecting the deadlines provided in regulations and recommendations of RCGMed&BS. The EU and national legislation didn't allow to collect data from farms entirely, due to the confidentiality reasons, question raised by them, and MS anytime is addressing this issue to the EU/EC in various occasions. Data for the aquaculture sector is published once a year, approximately 12 months after the end of the reference year, on the web site of national agency for fishery. Availability of data was good/normal for these circumstances above mentioned and the available data doesn't influence the work for NC issuing. Social data no by gender for geo-demographic analyses, and these data were missing. This aspect doesn't influence the quality of the report as a total.

It was remarked that due to the extensive method of production, that's include policulture, combination of species, example given in carp segments are Common carp species and Asiatic cyprinids. MS is advised to deliver details considering this aspect, in order to ensure data series comparison between DCF and EUMAP, allowing a real deep analysis for the purposes of this report.

In 2008, as a general observation is to be done for National Data Collection Program of Romania. First implementing year of the program is 2008, and aquaculture was not mandatory and, starting with 2009 year, after Regional Coordination Meeting 2010, held in Bucharest for Romania and Bulgaria, was decided by the European Commission as special request, both countries to collect data for this sector even it wasn't mandatory by regulation, but due to its importance in the hall fishery national segment.

Other data issues or missing data

Should be noted that social data were transmitted not by gender for geo-demographic, and these data were missing. This aspect didn't influence the quality of the report as a total. The resubmission during the EWG meeting didn't allow to be used in due time.

The current chapter represents a transitional period from the DCF frame to the actually implemented EU-MAP framework, and MS was asked to report either under the DCF or under the EU-MAP. Below the requested variable and segmentations for both programs are listed.

4.23 Slovakia

Overview of Slovakian aquaculture

Slovakia is a landlocked country producing only freshwater aquaculture products. The data collection of freshwater aquaculture is not mandatory. Since Slovakia submitted partial data in the related data call, FAO data were used to complement the submitted data.

Industry structure

Despite the aquaculture sector's relatively small contribution to the national economy, aquaculture has important non-production functions that are instrumental to environmental protection and enhancement. Examples are water management, flood control, landscaping, biodiversity preservation and recreational fishing. There are around 80 Slovak aquaculture enterprises, predominantly small and medium-sized enterprises (SMEs). A particular feature of these enterprises is that aquaculture is not their primary business activity; they engage in fish farming alongside other activities. Aquaculture in Slovakia can be split into two groups: farming of salmonids (e.g. trout and grayling) and of lowland fish species (e.g. carp, pike, tench and catfish). Fish are produced in fish farming facilities (tanks, cages, nurseries, hatcheries and recirculation systems) with a capacity of 140 503 m³ and in 485 fish ponds, covering an area of about 2 000 ha. (Source: Slovakia's operational programme)

Production volume and value

The Slovakian aquaculture production consisted of 2.2 thousand tonnes in 2018, solely from freshwater species. There was a drop of 16% from the year before after continuous increase since 2010. However, the production is 68% higher than the 10 previous year average.

The recovery of production since the lows in 2010 was partially related with the improved economic situation. High correlation is observed with the GDP per capita, when it decreased in 2008-2010 because of economic crises and from 2010 onwards, where it has been increasing (Source: The World Bank).

The same trend for value of production is observed, value significantly dropped from 2008 to 2010 and significantly recovered to the highest values between 2016 and 2018, reaching €5.5 million in 2018.

Table 4.23.1 Production and sales for Slovakia: 2008-2018.

Variable	2008	2010	2012	2014	2016	2017	2018	Change 17-18	Develop. 2018/(08-17)
Production weight (thousand tonnes)	**1.1**	**0.7**	**1.3**	**1.2**	**2.2**	**2.6**	**2.2**	***-16%***	***68%***
Marine	0	0	0	0	0	0	0	0%	0%
Shellfish	0	0	0	0	0	0	0	0%	0%
Freshwater	1.1	0.7	1.3	1.2	2.2	2.6	2.2	-16%	68%
Production value (million €)	**2.8**	**1.9**	**3.3**	**3.3**	**5.0**	**6.1**	**5.5**	***-10%***	***63%***
Marine	0	0	0	0	0	0	0	0%	0%
Shellfish	0	0	0	0	0	0	0	0%	0%
Freshwater	2.8	1.9	3.3	3.3	5.0	6.1	5.5	-10%	63%

SOURCE: FAO (2021)

Main segments

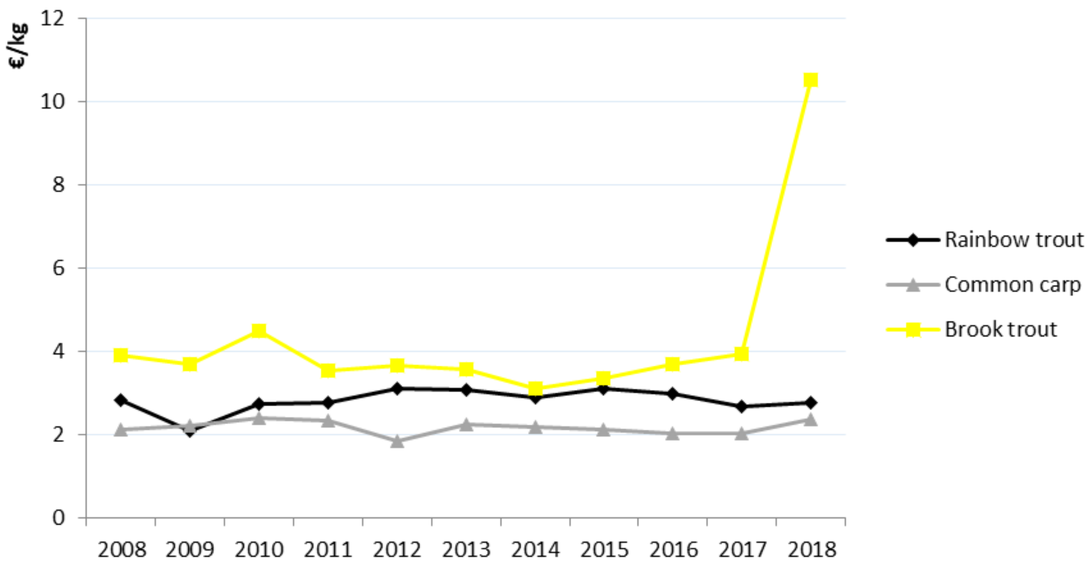
Rainbow trout was the main species produced by the Slovakian aquaculture sector, representing 46% in total weight and 51% of total value of sector production. Second biggest segment is North African catfish with the 37% of the weight and 30% of the production value followed by common carp accounting for 15% in both weight and value of total production.

Figure 4.23.1 Main species in terms of weight and value in Slovakian production: 2018.

Source: FAO (2021)

Average prices have been stable during the period analysed except brook trout that increased significantly in 2018 to €10.5 per kg according to FAO (2021) data, which would need to be further confirmed. Rainbow trout average first-sale prices in Slovakia were €2.8 per kg in 2018, while common carp price was €2.4 per kg.

Figure 4.23.2 Average prices for the main species produced in Slovakia: 2008-2018.



Source: FAO (2021)

Economic performance and employment

The Slovakian aquaculture sector generated €8.6 million of gross value added in 2019, a GVA margin of 18%.

The sector employed about 827 persons in 2019, with and FTE of 256, showing the importance of aquaculture as a part time activity.

Labour productivity amounted to €33.6 thousand in 2019, a 20% higher than the average remuneration, which was at €28.1 thousand

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Table 4.23.2 Economic performance and employment indicators: 2017-2019.

Variable	2017	2018	2019	Change 2018-19
Total income (million €)	46.4	52.7	49.0	-7%
Total operating costs (million €)	39.1	43.9	41.5	-6%
Total wages (million €)	6.2	7.3	7.2	-2%
Gross Value Added (million €)	7.7	10.2	8.6	-16%
Employment (number)	1186	777	827	6%
FTE (number)	308	256	256	0%
Labour productivity (thousand €)	25.1	40.0	33.6	-16%
Average remuneration (thousand €)	20.2	28.5	28.1	-2%

Source: EU Member States DCF data submission

Data Coverage and Data Quality

The data collection of freshwater aquaculture is not mandatory under the DCF and EU-MAP programmes of the EU data collection. So landlocked countries are not obliged to provide economic data for this report. Since Slovakia submitted partial data, the analysis of the Slovakian aquaculture sector is therefore complemented with data extracted from FAO.

Due to some inconsistencies between the FAO's value of production and the reported turnover under the DCF, these numbers should be considered with caution.

4.24 Slovenia

Overview of Slovenian aquaculture

Data on the Slovenian aquaculture were collected only for the marine fish species and shellfish. The data collection of freshwater aquaculture is not mandatory under the DCF and EU-MAP programmes of the EU data collection.

The main segments in the Slovenian marine aquaculture sector are Sea bass & Sea bream cages (seg3.6) and Mussel rafts (seg10.9).

In 2018, the turnover increased by 6% regarding 2017 and amounted €1.35 million. The total sales volume, on the other hand, decrease by 6% from 2017 to 2018 and it was 696 tonnes in 2018.

The amount of GVA, EBIT and Net profit generated by the Slovenian aquaculture sector in 2018 was €0.1 million, €-1.3 million and €-1.3 million respectively. Values of all economic indicators are decreased from 2017, namely due increased value of total operating costs in 2018.

4.24.1 Total Production and sales

In 2018 were six companies in Slovenia dealing with shellfish farming, primarily with mussel farming (Mediterranean mussel). The shellfish are farmed using hanging ropes that are attached to rafts.

In the same year, there was only one company that was engaged in breeding of fish. A main species for breeding is sea bass. Main farming techniques is breeding in cages.

In 2017, the marine aquaculture turnover was €1.27 million, in 2018 the same turnover increased by 6% and amounted €1.35 million. The total sales volume, on the other hand, decrease by 6% from 2017 to 2018 and it was 739 tonnes in 2017 and 696 tonnes in 2018. The main reasons for increased turnover in 2018 are higher sales of sea bass and increased prices of Mediterranean mussel.

The main segments in the Slovenian marine aquaculture sector are Sea bass & Sea bream cages (seg3.6) and Mussel rafts (seg10.9).

4.24.2 Industry structure and total employment

Aquaculture in Slovenia comprises freshwater aquaculture (cold-water fish farming of salmonids and warm-water fish farming of cyprinids) and mariculture (fish and shellfish farming). Warm-water and cold-water fish farming has been practiced since the end of nineteenth century, while mariculture has a shorter history: it started at the end of the twentieth century. The major species contributing most of the production value in freshwater fish farming are rainbow trout (*Oncorhynchus mykiss*) and common carp (*Cyprinus carpio*), whilst in mariculture it is Mediterranean mussel (*Mytilus galloprovincialis*) and European seabass (*Dicentrarchus labrax*).

Mariculture practice is traditional. Fish farming takes place in cages submerged into the sea, while mussel farming takes place in a standard manner in lines of floating buoys linked together, with longline nets hung from them. In 2007, three larger areas were designated for marine aquaculture in Slovenian territorial waters that were subsequently separated into 22 plots, for which concessions were granted for the use of marine water in 2009. It is expected that these plots will not be able to expand, due to the use of Slovenian territorial waters for other purposes. Currently, all the concessions for using marine water for the breeding of marine organisms have been granted, two of them for breeding marine fish and 20 for breeding shellfish. The total area for breeding fish at sea (excluding shellfish farming) in 2018 was 5 663 m2 (two plots). The area of the 20 plots at sea that are used for shellfish farming was 45.1 ha.

Due to natural circumstances, the development of marine fish farming in Slovenia is limited. Mariculture takes place in the Bay of Strunjan, the Bay of Debeli rtič (shellfish farming) and in the Bay of Piran (fish and shellfish farming).

Mariculture shellfish farming is more important than fish farming regarding the total volume of sales. Shellfish farming accounts for 89% of total mariculture production in 2018. The production of European seabass is more important than the production of gilthead seabream. It contributes around 11% to total mariculture production in 2018.

Since the early eighties (1982) the production of the Mediterranean mussel (*Mytilus galloprovincialis*) has been increasing and in 1988 it reached a maximum of 703 tonnes. After that year a significant decline was due to the fact that exports to Italy ceased. In 1995, the production of mussels reached a minimum of 12 tonnes. In recent years, there are increases in production, particularly due to the resolution of the status of shellfish production facilities through the granting of concessions for the use of marine water: first in 2001 and then in 2003, when production reached 135 tonnes, the highest since 1992. There was also a peak in production in 2016, with 648 tonnes of Mediterranean mussels produced. Current production covers mainly the needs of the domestic market. In recent years, especially in 2010, considerable difficulties occurred in the production of shellfish due to the frequent closures of sales because of the occurrence of biotoxins, which prevents shellfish farms to be used to their full production capacity. Damage on shellfish farms caused by wild fish, especially by sea bream, also presents major problems in the last few years. The damage caused by sea bream is estimated at 550 tonnes per year, which represent almost 80% of sales volume in 2018.

In 2011, also with the help of EMFF funds, Slovenian mussel sector commenced with production of Warty Venus. In the year 2012, sales volume of Warty Venus amounted 5.83 tonnes, while in 2018 sales volume increase to 35 tonnes.

From 1991 onwards, intensification was carried out especially with farming European seabass and seabream in the Bay of Piran. A first result of seabass production in 1992 was 5.7 tonnes. In subsequent years, annual variations in production (growth and decline) were noted. In 2001, production reached its maximum with 59 tonnes, and very similar amounts were noted in 2003. Here, there was a peak in production in 2018, with 76 tonnes of seabass.

Table 4.24.1 Production and sales, industry structure and employment for Slovenia: 2008-2018.

Variable	2008	2010	2012	2014	2016	2017	2018	Change 2017-18	Develop. 2018/(08-17)
Sales weight (thousand tonnes)	**0.3**	**0.1**	**0.4**	**0.5**	**0.0**	**0.7**	**0.7**	-6%	109%
Marine	0.1	0.1	0.1	0.1	0.0	0.1	0.1	34%	68%
Shellfish	0.2	0.1	0.3	0.5	0.0	0.7	0.6	-9%	116%
Sales value (million €)	**0.1**	**0.3**	**0.7**	**0.8**	**0.0**	**1.3**	**1.4**	6%	163%
Marine	0.4	0.3	0.4	0.4	0.0	0.3	0.4	34%	38%
Shellfish	0.1	0.0	0.4	0.4	0.0	1.0	1.0	-2%	252%
Number of enterprises	**11**	**13**	**11**	**7**	**7**	**7**	**7**	0%	-25%
Marine	2	2	1	1	1	1	1	0%	-23%
Shellfish	0	11	10	6	6	6	6	0%	-15%
Employment	**29**	**31**	**34**	**20**	**20**	**27**	**29**	7%	3%
Marine	11	15	13	4	9	10	12	20%	10%
Shellfish	18	16	21	16	11	17	17	0%	-1%
FTE	**26**	**28**	**28**	**19**	**20**	**23**	**26**	14%	5%
Marine	10	13	9	4	9	10	12	18%	19%
Shellfish	16	15	18	15	11	13	14	12%	-4%

Source: EU Member States DCF data submission

The first results of seabream production in 1992 were 4 tonnes. In the following years, there was a growth in production, with some variations, until 1997 when production reached a maximum of 61 tonnes. After that year, production declined and reached a minimum of 6 tonnes in 2001. In 2003, production was 16 tonnes. From 2010 to 2018, there was no production of seabream.

Slovenia is a net importer of fish and fish products. In 2018, imports were approximately five times larger than exports. There is a continuous import of fresh farmed species: seabream, seabass and salmon. The majority of the imported fish products come mainly from the European Union and are frozen, dried or processed.

In 2018, Slovenia had five companies with five or less employees, one company with six to ten employees and also one company with more than ten employees. The status in employment reflects the situation in the aquaculture sector whereby the majority of small family farms operates with self-employed people, mostly one employee. Total employment in 2018 was estimated at 29 jobs, corresponding to 26.1 FTEs. The level of employment increased between 2008 and 2018, with total employed increasing by 3% while the numbers of FTEs increase by 5% over the period. Average salary per FTE employees in 2008 was €21.5 thousand. In 2018 average salary per FTE employees decrease for approximately 3% regarding 2008 and amounted €20.9 thousand.

The number of enterprises decreased from 2008 to 2018, but the average number of FTE per enterprise has been rather constant over the period. In the period 2012-2018 Slovenian aquaculture sector underwent major structural changes. Some of the larger companies that are dealing with different types of activities, separated aquaculture from other activities formed new smaller companies, which are exclusively engaged in aquaculture. Consequently, the share of other income in total income has decreased in the period 2012-2018 for 40%. This had impact on lower labour productivity in the period mentioned.

4.24.3 Overall Economic performance

The total amount of income generated by the Slovenian aquaculture sector in 2018 was €2.73 million. This consisted of €1.35 million in turnover and €1.38 million in other income. The total income of the Slovenian aquaculture sector increased by 13% between 2017 and 2018, while turnover increased by 6% in the same period.

Table 4.24.2 Economic performance of the Slovenian aquaculture sector: 2008-2018.

Variable	2008	2010	2012	2014	2016	2017	2018	Change 2017-18	Develop. 2018/(08-17)
Total income	2.8	3.2	4.7	2.2	1.9	2.4	2.7	13%	-12%
Total operating costs	1.1	0.9	1.5	1.1	1.2	2.7	3.2	20%	151%
Total wages	0.6	0.4	0.5	0.3	0.2	0.5	0.5	17%	24%
Gross Value Added	2.3	2.4	2.9	0.7	0.8	0.2	0.1	-58%	-95%
Depreciation of capital	0.1	0.2	0.5	0.9	0.7	1.0	0.8	-16%	59%
Earning before interest and taxes	1.6	2.2	2.6	0.2	-0.1	-1.2	-1.3	-4%	-197%
Financial costs, net	0.1	0.2	0.1	0.1	0.1	0.0	0.0	7%	-63%
Net profit	1.5	2.0	2.5	0.1	-0.1	-1.3	-1.3	-5%	-208%
Total value of assets	3.2	4.6	10.2	8.7	7.6	7.3	6.8	-7%	0%
Capital productivity (%)	71.2	51.3	28.2	7.7	11.0	3.2	1.5	-54%	-96%
Return on Investment (%)	49.9	47.4	25.8	2.1	-1.0	-16.9	-19.1	-13%	-179%

Source: own elaboration from EU Member States DCF data submission

All the firms in Slovenian aquaculture sector are registered to practice aquaculture and aquaculture should be their main source of income, however large part of the income still gain from carrying out other activities, such as scuba diving, underwater work, marketing, etc.

Total operating costs by the Slovenian aquaculture sector in 2018 was €3.2 million. The largest expenditure items were other operational costs (€1.8 million) and Raw material: Feed costs (€0.4 million). The total operating costs increased for 151% from 2008-2018, mainly because of increased other operational costs in that period.

In terms of economic indicators, the amount of GVA, EBIT and Net profit generated by the Slovenian aquaculture sector in 2018 was €0.1 million, €-1.3 million and €-1.3 million respectively. Values of all economic indicators decreased from 2017, namely due increased value of total operating costs in 2018.

4.24.4 Main species produced and economic performance by segment

The most relevant segments in the Slovenian marine aquaculture are:

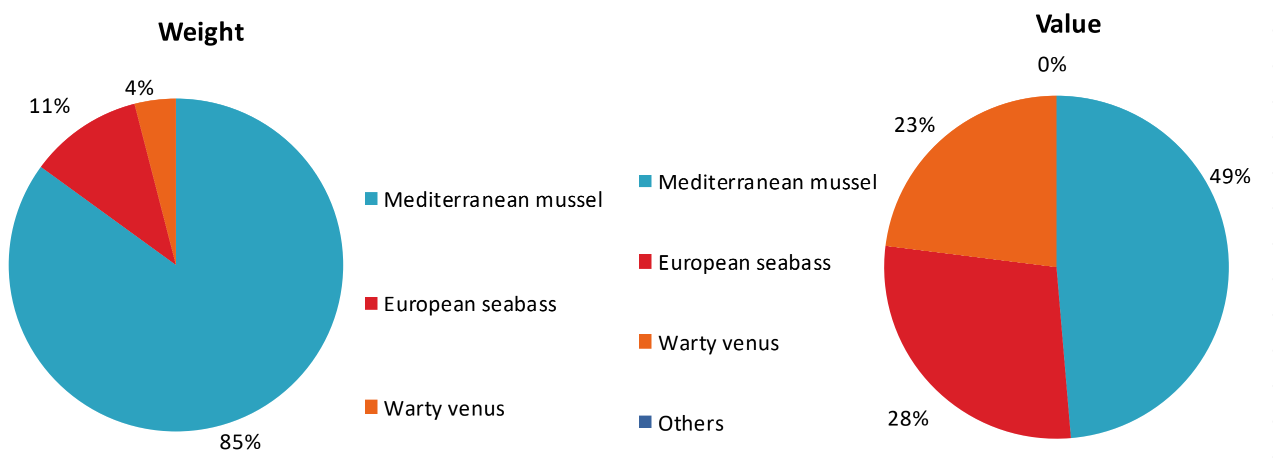
- Segment 1: Sea bass & Sea bream cages (seg3.6);
- Segment 2: Mussel rafts (seg10.9).

They are two main segments in the Slovenian marine aquaculture sector; Sea bass & Sea bream cages (seg3.6) and Mussel rafts (seg10.9). The most important species are Mediterranean mussel and European seabass.

In terms of sales volume mariculture shellfish farming are more important than fish farming. The major cultured shellfish species, Mediterranean mussel, accounts for 85% (592 tonnes) of total sales volume in 2018. The production of European seabass is more important than the production of gilthead seabream. It contributes around 11% (76 tonnes) to total mariculture production in 2018.

In terms of sales volume, sales volume of the Mussel rafts segment represents 89% of the total sales volume of Slovenian aquaculture sector in 2018 (620 tonnes). Turnover from this sector represent 72% of the total turnover in the same year (0.97 millions). In the Mussel rafts sector were 14.3 FTE employees in 2018, which represent 55% of all FTE employees in Slovenian aquaculture sector in the same year.

Figure 4.24.1 Main species in terms of weight and value in Slovenian production: 2018.

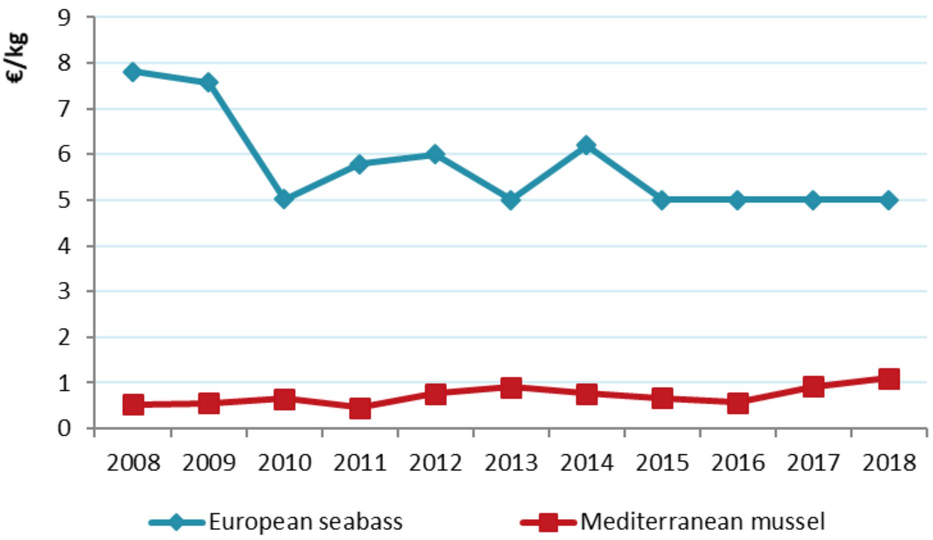


Source: EU Member States DCF data submission

In 2011, also with the help of EMFF funds, Slovenian mussel sector commenced with production of Warty Venus. In the year 2012, sales volume of Warty Venus amounted 5.83 tonnes, while in 2018 sales volume increase to almost 28 tonnes. Income of Warty Venus represent, because of very high first sales price of around €11/kg, more than 30% of all income from Mussels sector in 2018 (0.31 millions). On the other hand, sales volume of Warty Venus represent less than 5% of all sales volume from Mussels sector in the same year (27 tonnes).

The highest average price on the market achieves Warty venus with amount of €11.2/kg. The average price of European seabass was €7.8/kg in 2008. In 2018, average price decrease by 36% regarding 2008 and amounted €5.0/kg. The main reason for decreased price of seabass is increased imports of seabass, mainly from Greece and Croatia, where the first-sales price is lower than in Slovenia. The average price of Mediterranean mussel was €1.1/kg in 2018, an increase of more than 100% regarding 2008. The price increase is mainly due to new sales channels in shellfish sales, where more and more shellfish are being sold to the end customers.

Figure 4.24.2 Average prices €/kg for the main species produced in Slovenia: 2008-2018.



Source: own elaboration from EU Member States DCF data submission

Because of the confidentiality issues, only the economic performance of the Mussel rafts segments is analysed. From the Table 4.7.3 it can be seen that the gross value added is positive in the period from 2008 to 2018, while net profit is negative in the last few years. One of the reasons for negative net profit can be also high values of depreciation costs over a past few years. Slovenian Mussel rafts sector has over the past few years, with the help of EU Funds, invested significantly in the new equipment and production facilities. So this new investments are the main reason for increased value of Depreciation of capital.

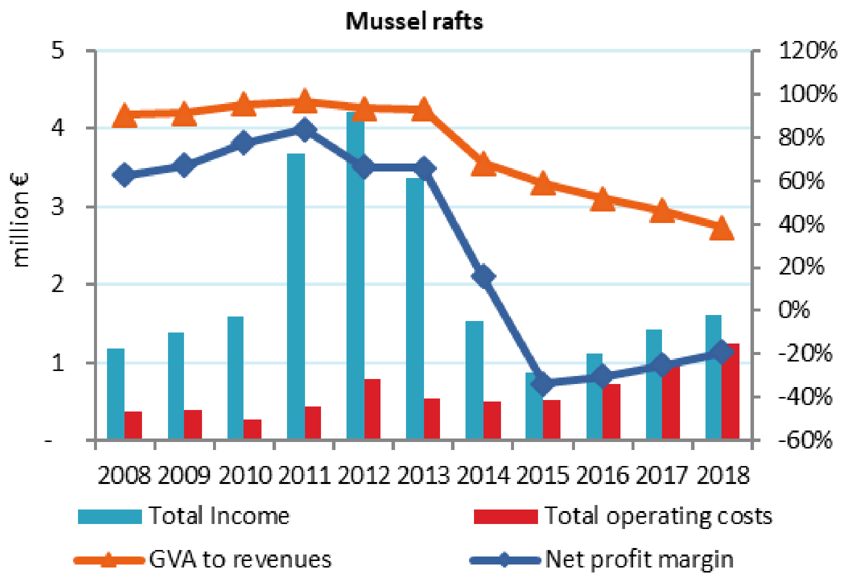
Table 4.24.3 Economic performance of main Slovenian aquaculture segment: 2008-2018.

Variable	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	Change 2017-18	Develop. 2018/(08-17)
Mussel rafts													
Number of enterprises	9	9	11	10	10	7	6	6	6	6	6	0%	-25%
FTE	16	16	15	15	18	19	15	12	11	13	14	12%	-4%
Average wage (thousand €)	16.9	17.1	13.8	21.0	30.7	18.1	14.3	16.8	17.2	16.1	16.5	2%	-10%
Labour productivity (thousand €)	67.1	78.3	97.1	231.1	171.2	129.2	39.9	39.5	54.5	39.0	36.5	-6%	-61%
Total sales volume (thousand tonnes)	0.2	0.3	0.1	0.4	0.3	0.3	0.5	0.6	0.6	0.7	0.6	-9%	51%
Total income (million €)	1.2	1.4	1.6	3.7	4.2	3.4	1.5	0.9	1.1	1.4	1.6	13%	-20%
Total operating costs (million €)	0.4	0.4	0.3	0.4	0.8	0.5	0.5	0.5	0.7	1.0	1.2	26%	123%
Gross Value Added (million €)	1.1	1.3	1.4	3.5	3.1	2.5	0.6	0.5	0.6	0.7	0.6	-6%	-59%
Net profit (million €)	0.7	0.9	1.2	3.1	2.8	2.2	0.2	-0.3	-0.3	-0.4	-0.3	14%	-130%
Total value of assets (million €)	0.8	0.9	1.1	3.4	7.1	5.6	5.1	6.0	5.4	4.7	4.4	-5%	11%
Net investments (million €)	0.1	0.0	0.2	0.9	1.5	2.8	1.0	0.9	0.0	0.0	0.2	5029%	-70%
Capital productivity (%)	128.7	143.1	133.6	101.9	44.4	44.3	11.7	7.8	10.6	14.2	14.0	-1%	-78%
Return on Investment (%)	91.7	107.2	116.1	91.0	40.7	40.6	5.4	-4.5	-5.3	-7.1	-6.5	9%	-114%
Future Expectation Indicator (%)	3.5	-2.3	10.5	22.8	14.1	40.4	5.1	4.6	-12.6	-16.8	-10.2	39%	-248%

Source: own elaboration from EU Member States DCF data submission

In terms of sales volume, sales volume of the Mussel rafts segment represents 89% of the total sales volume of Slovenian aquaculture sector in 2018. Turnover from this sector represent 72% of the total turnover in the same year. In terms of other economic indicators, the amount of GVA and Net profit generated by the Slovenian Mussel rafts sector in 2018 was €0.6 million and €-0.3 million respectively. Despite increased productions of Mediterranean mussel as the most important species in this segment. the values of all economic indicators in Mussel rafts sector are decreased substantially from 2008. Main reason for decreasing of economic indicators is decreased in other income due major structural changes in the sector. In terms of sales volume and value, Mediterranean mussel represents 85% and 49% of the total sales volume and value of the Mussel rafts segment.

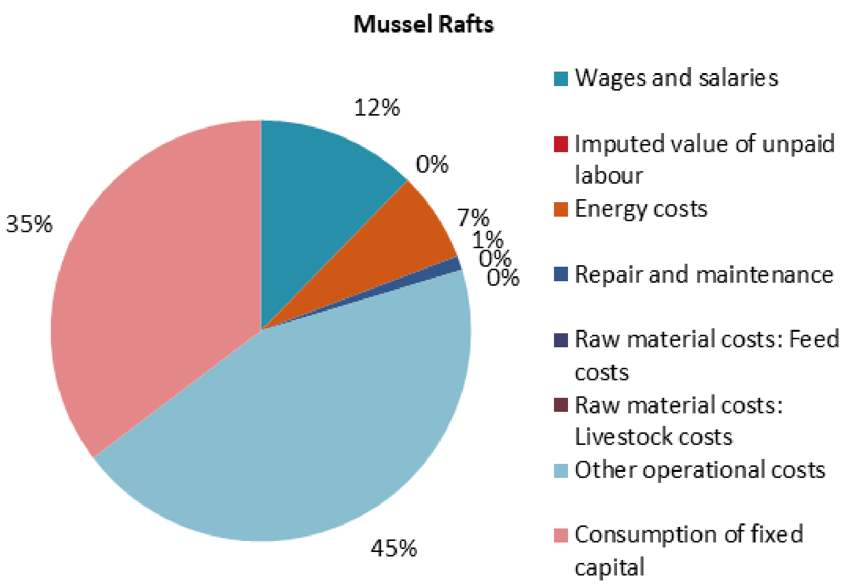
Figure 4.24.3 Economic performance in € million, indicators for the main Slovenian segment: 2008-2018.



Source: own elaboration from EU Member States DCF data submission

The largest cost item of Mussel rafts sector in 2018 were other operation costs, accounted for 45% of the total operational costs. Depreciation of the capital made up 35% of all operational costs. In 2018, Depreciation of the capital increases by more than 500% regarding 2008. Slovenian Mussel rafts sector has over the past few years, with the help of EU Funds, invested significantly in the new equipment and production facilities. So this new investments are the main reason for increased value of Depreciation of capital.

Figure 4.24.4 Cost structure of the main segment in Slovenia: 2018.



Source: EU Member States DCF data submission

4.24.5 Outlook

Nowcasts for 2019-20

The preliminary data for 2019 shows an increase of 30% in terms of production volume and just a slight increase (+1%) regarding turnover. The increase in production is mainly due to the increase in shellfish production in 2019 (+35% in volume, while the value of sales remains relatively stable comparing 2018). In 2019, employee growth is also expected to increase by 7%.

In 2020, due to the Covid-19 crisis, we can expect a significant drop in production, both in terms of volume and value. According to current information, production (volume and value) could fall by more than 40%.

4.24.6 Trends and triggers

Market structure

Slovenian market for marine products is fragmented and disorganized. A large number of producers and dealers are unorganized and acting individually. For all these reasons, they achieve a lower first sales price and higher operating costs and are therefore non-competitive with foreign suppliers.

The Slovenian seafood trade balance is relatively stable over the years and it presents a negative balance. Slovenia is a net importer of fish and fish products. In 2018, imports were approximately five times larger than export and amounted to 18 608 tonnes (€99 million) of fish and other fish product. On the other hand, exports amounted to 5 361 tonnes (€31 million) in the same year. The majority of the imported fish and fish products come mainly from EU. The largest Slovenian seafood import partners are Italy, Spain and Croatia. Concerning exports, the largest partners are Austria, Croatia and Bosnia and Herzegovina.

There is a continuous import of fresh farmed species: seabream, seabass and salmon. The majority of the imported fish products come mainly from the European Union and are frozen, dried or processed.

Issues of special interest

The Ministry of Agriculture, Forestry and Food (MAFF) is responsible for fisheries and aquaculture in Slovenia. Fisheries comprise capture fisheries, aquaculture of fish and other water animals and trade in fisheries products. Inland fisheries, fish farming and fish health are managed by three main Acts: the Freshwater Fishery Act, the Livestock-breeding Act (ZŽiv) and the Veterinary Service Act (Zvet) and their regulations, ordinance, etc. Marine fisheries, fish and mussel farming are regulated by Marine Fisheries Act (ZMR-2). In fisheries and aquaculture it is necessary to take into consideration the Environment Protection Act (ZVO), the Nature Conservation Act (ZON), and the Water Act (ZV).

The main leading government agency in fisheries and aquaculture is the Directorate of Forestry, Hunting and Fisheries within the Ministry of Agriculture Forestry and Food. The main task of the Directorate is to provide overall administrative control of aquaculture and fisheries, to ensure an adequate legislative framework for aquaculture and fisheries, and to carry out related legislative tasks. The Directorate is directly involved in controlling the operation of fish farms, licensing procedure of alien species or hybrids and is also responsible for the maintenance of fish stocks in natural waters. The concessions for the use of water, which are the prerequisite for setting up a fish farm in Slovenia, are, however, granted by the Ministry of Environment and Spatial Planning. The Directorate manages that part of the state budget which is designed for fisheries and aquaculture. The funds are used for a variety of purposes, including the financing of the setting up and the management of fisheries information systems; financing of performing public service in fisheries by the Fisheries research institute of Slovenia; for the protection of natural resources Development in the Republic of Slovenia 2007-2013; as well as for the collection of data in and monitoring in fisheries. Ecological, biological research and the breeding of some indigenous species (Danube salmon, grayling, nase) are conducted in the Fisheries Research Institute of Slovenia. The Marine Biology Station of the National Institute for Biology deals with interdisciplinary research of the sea.

There has been a dynamic change in the fish production sector due to economic changes in the period from the independence of Slovenia to its accession to the European Union and after the accession. In the future, it would be reasonable to support research projects such as: analysis of potential possibilities in fish farming development in Slovenia with regards to spatial and hydrological circumstances and research into the possibility of economic farming of new species. It would also be reasonable to continue with investment in the modernization of older fish farms, especially the improvement of hygienic conditions and the construction of new fish farms which comply with EU legislation technologically and ecologically. It would also be necessary to adopt all outstanding fisheries legislation and encourage the establishment of aquaculture producer organisations with a view to the development of fish farming in terms of small and medium sized family fish husbandry. These measures would facilitate the more competitive position of Slovenian fish farming. Natural circumstances and conservation requirements in Slovenia do not allow the development of large industrial farms. The establishment of producer organisations would make it easier to obtain knowledge, new technology and reduce market costs.

Typical Slovenian maritime enterprise is small family fish/shell farm with self-employed persons, mostly one employee and some unpaid assistance from family workers. Regarding techniques and species all Slovenian marine segments are very homogeneous. Marine fish farming practice is normally intensive and takes place in floating platforms where the cages are submerged into the sea. They produced mostly European seabass. Shellfish farming practice is extensive and takes place in lines of floating buoys linked together, where longlines with mussels are suspended. The major and the only cultured shellfish species is Mediterranean mussel.

Outlook for future production trends

In the Slovenian Operational Programme for 2014-2020 the emphasis is primarily on freshwater aquaculture. The main objectives in marine aquaculture are to increase the production of shellfish to 1000 tonnes and production of marine fish to 120 tonnes. Future development of Slovenian marine aquaculture is strongly conditioned by the small size of the Slovenian Sea. In 2007, three larger areas were designated for marine aquaculture in Slovenian territorial waters that were subsequently separated into 22 plots, for which concessions were granted for the use of marine water in 2009. It is expected that these plots will not be able to expand, due to the use of Slovenian territorial waters for other purposes. All Slovenian maritime fish and shellfish farms are currently operating at about 60% of their capacity. In the future we can expect increasing production to maximum capacity and then stagnation of Slovenian marine aquaculture. The production volume of marine fish and shellfish in 2018 was 76 tonnes and 620 tonnes respectively, so it can be assumed that the objectives of Slovenian OP are realistically achievable.

On the other hand, because of the good quality and quantity of inland water, Slovenia has a good chance to increase freshwater aquaculture, particularly salmonid rearing such as rainbow trout, Huchen (*Hucho hucho*) and brown trout. Today is in Slovenia about 60 trout farms, with a total production of only about 800 tonnes per year.

Fish farming is a sector that promises growth, in particular through an intelligent approach to quality and value adding that is integrated with environmental protection. Main aim of Slovenian OP are Technological development, innovation and knowledge transfer, competitiveness and viability of aquaculture small and medium-sized enterprises (SMEs) including improvement of safety or working conditions, protecting and restoring aquatic biodiversity, enhancing aquaculture-related ecosystems, promoting resource-efficient aquaculture, providing professional training and lifelong learning.

Key objective of Slovenian OP for fresh water aquaculture;

- Increase volume, value and net profit of aquaculture production; in cold water volume to a 1 000 tonnes per year, warm water volume 300 tonnes per year, increased GVA per employee to a €25 000 per year, total value of production to a €1.8 million per year and net profit to a €180 000;

- Increase organic aquaculture and recirculation systems; five fish farms with capacity more than 10 tonnes per year, total production of 500 tonnes per year;
- Support environmental services;
- Create and maintain employment; increase number of total employees to 180.

Slovenia collecting the economic and social data just for the marine aquaculture so in the future will not be able fully assess whether the objectives have been achieved or not.

4.24.7 COVID-19 impact

Covid-19 had a very large negative impact on the Slovenian aquaculture sector. According to initial estimates, the sales volume and value will decrease for more than 40% regarding previous year. The main reason for negative impact on the Slovenian aquaculture sector are loss of domestic market, mainly due to closure in touristic sector and loss of international markets. According to initial estimates, the number of employees is not expected to decrease.

Due to the coronavirus outbreak, Slovenia implemented various measures to help businesses face these challenging times. The public support took the form of direct grants, wage subsidies, exemption from paying social security contributions, reduction of certain taxes and water fees, bank guarantees, deferred payment of certain credits and compensatory payments. The basic condition for measures mentioned was a 30% decrease in turnover / production in the sector compared to the same period in 2019.

4.24.8 Data Coverage and Data Quality

Data were collected only for the marine fish species.

Regards to the data base "The central register of aquaculture and commercial ponds" from MAFF, in 2018, there were six operators in Slovenia dealing with shellfish farming and one subject that was engaged in breeding of fish. The data for the operators mentioned were collected from multiple sources (The Agency of the Republic of Slovenia for Public Legal Records and Related Services (AJPES), questionnaire, MAFF)), allowing for cross checking. The accounting data, which are collected by the AJPES public agency, are already checked and verified. The data were collected for all seven subjects.

In June 2019 the questionnaires for 2018 were sent to all operators and all of them also returned the questionnaire. Therefore, the response was 100%.

Economic data on the aquaculture sector were collected from accounting records – AJPES and through questionnaires. The national program for collection of economic data for the aquaculture sector combines information from three main resources:

1. Questionnaire information returned from the aquaculture sector on a voluntary basis,
2. Data base: 'The central register of aquaculture and commercial ponds' from MAFF,
3. The annual accounts of business enterprises.

The data collected from all sources are combined in such a way that a complete set of accounting items is compared for each business enterprise.

In cases where a questionnaire, as the only source, was used the response rate was 100%. In cases where the data from annual accounts of business enterprises was used the response rate was also 100%, because we have economic reports for all investigated companies.

The economic variables were collected on the basis of Council Regulation (EC) No 199/2008 and the Appendix X to the Commission Decision (EC) 949/2008. Slovenia has uploaded the complete set of requested data to the JRC server before the deadline.

While due to confidentiality issues because of the low number of marine fish farms, we are only presenting Mussel rafts segment in the chapter; ''Main species produced and economic performance by segment''.

In case of Slovenian data, there are differences between Eurostat and DCF data. The difference is because the Eurostat data also contain data from freshwater aquaculture and also because of better coverage of DCF data for marine sector.

List of acronyms and abbreviations;

AJPES - The Agency of the Republic of Slovenia for Public Legal Records and Related Services.

MAFF - The Ministry of Agriculture, Forestry and Food of the Republic of Slovenia.

VARS - Veterinary Administration of the Republic of Slovenia.

4.25 Spain

Overview of Spanish aquaculture

The Spanish aquaculture sector produced 329.7 thousand tonnes in 2018 generating a turnover of €719 million. The number of enterprises remains stable around 2 900 and employment slightly increase to 6 730 FTE. Despite the stability in production, operating costs have grown proportionally more than value, which has had a negative impact on economic performance indicators. Net profit decreased from 21.3 million in 2017 to €1.9 million in 2018.

4.25.1 Total Production and sales

In Spain, the production of aquatic products from aquaculture continued the positive trend started in 2013. Despite the slight reduction in the quantities produced in 2018 compared to 2017, the value of production continued to grow.

The production in the aquaculture sector in 2018 was 329 730 tonnes, which means a 18% increase compared to the previous years. These results suggest the consolidation of the recovery of the industry started in 2014, especially in marine and shellfish productions.

The production in 2018 corresponds mainly to marine aquaculture (fish and shellfish), which together represent more than 94% of the quantities produced, while only 6% is freshwater aquaculture. Besides, marine aquaculture is represented by shellfish and around 19% of the total production is marine fish. Shellfish production relevance on total production has remained stable around 75% along the period considered. Marine finfish production has followed a positive trend since 2012, mainly due to the recovery of seabream and seabass industry, but also due to the increase in other productions such as Atlantic Bluefin tuna, meagre and sole.

Table 4.25.1 Production and sales, industry structure and employment for Spain: 2008-2018.

Variable	2008	2010	2012	2014	2016	2017	2018	Change 2017-18	Develop. 2018/(08-17)
Sales weight (thousand tonnes)	**260.6**	**259.7**	**271.3**	**288.2**	**295.2**	**331.1**	**329.7**	0%	18%
Marine	46.8	45.0	44.7	49.1	57.0	65.3	63.2	-3%	24%
Shellfish	188	194	208	223	220	247	249	1%	19%
Freshwater	26.2	20.8	18.9	16.5	18.4	19.1	18.0	-6%	-7%
Sales value (million €)	**462.6**	**469.6**	**482.3**	**545.7**	**626.7**	**637.3**	**719.3**	13%	37%
Marine	265.0	297.3	335.4	352.6	481.7	398.6	478.8	20%	39%
Shellfish	124	111	90	143	82	167.4	169.8	1%	47%
Freshwater	73.4	61.1	56.5	50.4	62.5	71.2	70.7	-1%	8%
Number of enterprises	**3,101**	**3,066**	**3,032**	**3,035**	**2,990**	**2,953**	**2,895**	-2%	-5%
Marine	117	97	95	88	79	56	53	-5%	-42%
Shellfish	2,818	2,797	2,777	2,774	2,717	2,721	2,701	-1%	-3%
Freshwater	166	172	160	173	194	176	141	-20%	-18%
Employment	**26,322**	**27,907**	**19,891**	**19,914**	**17,811**	**16,147**	**18,586**	15%	-16%
Marine	2,721	2,303	2,147	2,433	2,379	2,454	2,772	13%	17%
Shellfish	22,538	24,775	16,858	16,613	14,465	12,729	14,905	17%	-21%
Freshwater	1,063	829	886	868	967	964	909	-6%	1%
FTE	**6,612**	**6,377**	**5,740**	**5,946**	**6,534**	**6,301**	**6,730**	7%	7%
Marine	2,083	1,763	1,759	1,862	1,958	1,921	1,926	0%	2%
Shellfish	3,717	3,917	3,356	3,450	3,851	3,679	4,125	12%	11%
Freshwater	812	697	625	634	724	701	679	-3%	0%

Source: EU Member States DCF data submission

In the case of freshwater, despite the stability in the quantities produced between 2016 and 2018, its value continued the positive evolution and consolidated a trend towards lower production with a higher average value.

By far the largest activity in Spanish aquaculture in terms of production is culture of mussel (*Mytilus galloprovincialis*). The 244 019 tonnes obtained in 2018 represented 74% of the total Spanish aquaculture production. In 2018, mussel production increased 13% compared to 2016. The main species in marine fish production were seabass, seabream and turbot, with 23 476 tonnes, 19 406 tonnes[15] and 8 058 tonnes, respectively. In freshwater production the main species is rainbow trout with 17 027 tonnes produced in 2018, which is more than 95% of this segment output.

The value of the Spanish aquaculture industry has grown continuously since 2012 until a turnover of €719 million in 2018, which was 37% higher compared to the average during the 2008-2017 period, reaching the highest value of the data set since 2008. In recent years, although all the groups have increased the value of their productions, freshwater production has consolidated its loss of importance in the aquaculture industry in Spain.

In shellfish production, Mediterranean mussel production generated €134.5 million turnover in 2018, 13% higher compared to 2016. Among the shellfish, apart from the commented importance of mussels, there are other species cultivated as oysters and clams. The main species cultivated in 2018 were Japanese carpet shell (€8.9 million), common edible cockle (€1.1 million) and pullet carpet shell (€2.7 million).

Regarding oyster production, Pacific cupped oyster (€2.3 million) and European flat oyster (€1.7 million) are the main species cultivated. With the exception of the Mediterranean mussel, the rest of shellfish species decreased the value of their productions compared to 2016.

Similarly, the increase in the industry turnover was led by the improvement in marine fish production. The main marine finfish species are seabass and seabream. While the production and value of seabream declined in recent years, the production and value of seabass have grown significantly, in what could be considered a substitution process in the industry, because the same companies usually produce these two species. Turbot production and value have remained stable until 2018. In 2018, the quantities produced increased 9% until 8 058 tonnes, but the turnover decreased 9.8% to €56.1 million.

Although Atlantic Bluefin tuna is the sixth species in terms of quantities, due to its greater value, it is ranked as the second most important species in marine fish culture, with a production value €137.8 million in 2018. Following the trend started in 2010, tuna production value increased significantly in 2018, 73% compared to 2016. The increase in Atlantic Bluefin tuna captures has increased the supply of this product and, as a consequence of the higher demand, prices have also increased 20% compared to 2016. The management of the fishing quota, together with the development of the fattening of tunas bred in captivity at industrial scale will be the determining factors of the development of this industry. The increase in the value of this group in 2016 has also been caused in part by the rise of other species less representative in terms of weight but more important in terms of value and in terms of diversification, such as meagre (€23.3 million).

Despite the decline in its importance in Spanish aquaculture, the production of the main Spanish freshwater species has followed a positive trend during 2017 and 2018, in terms of both quantities and value. Rainbow trout is the main freshwater species in Spanish aquaculture with a production of 17 027 tonnes in 2018, valued €64.5 million, which were 4% lower but 1.2% higher respectively compared to the previous year. The results for 2017 and 2018 seem to confirm a change in trend after a period of high volatility in prices and falls in production. Other much less relevant productions are the European eel and sturgeon. The sturgeon has been one of the best for diversification in freshwater, due to the problems of competitiveness experienced by the trout, but in the last years, the production has stagnated.

[15] In 2018, seabream production was 13 810 tonnes and 13 662 tonnes according to FAO and MAPAMA statistics, respectively.

4.25.2 Industry structure and total employment

The Spanish aquaculture industry accounted for 2 895 enterprises in 2018, representing a decrease of 2%, with regard to the previous year, and a decrease of 5% from the average of the 2008-2017 period. Although it is a small decrease, it breaks the flat trend observed in the previous years, which described a somehow stable evolution in the size of the industry in terms of number of operating enterprises.

The total number of employees in the Spanish aquaculture industry was 18 586 in 2018. The figure shows a 15% increase with regard to 2017, but a 16% decrease when considering the last 10 observed years. The long-term decrease in employment is higher than in the number of enterprises. This evolution suggests that the withdrawing companies are more labour intensive and inefficient than the remaining. The evolution of employment in terms of overall FTE shows a 7% increase compared to 2016, and 7% increase in relation to the previous 10-year period, probably suggesting a trend towards stabilization of employment.

Despite this improvement, the quotient between total employment and FTE was 2.7 in 2018. Although it continues decreasing along the observed years, it is still suggesting high levels of labour rotation and occupational instability.

4.25.3 Overall Economic performance

The economic performance of the aquaculture sector in Spain has been improving since 2012. The results during 2017 and 2018 confirms the positive evolution of the value of production and total income. Total income has increased proportionally more than the quantities produced, indicating a higher average value of the products.

Despite the increase in incomes, the increase in operating costs during 2017 and 2018 has been proportionally greater than that of revenues. Although the sector still shows positive economic performance indicators as a whole, these have fallen significantly during the last two years analysed. Gross value added decreased 6% in 2018 compared to 2016, while the reduction has been especially significant in the case of EBIT, from €74 million to €6.5 million, mainly due to an increase in total wages of caused by the rise in the imputed value of unpaid labour. The main source of this cost is mussel production, with a structure of small family businesses. The increase in total employees but not FTE in shellfish segment can be explained by a rise in part time and family business employment in the Galician mussel industry.

Table 4.25.2 Economic performance of the **Error! Reference source not found.** aquaculture sector: 2008-2018.

Variable	2008	2010	2012	2014	2016	2017	2018	Change 2017-18	Develop. 2018/(08-17)
Total income	495.8	526.4	517.1	589.5	650.4	659.9	748.4	13%	33%
Total operating costs	548.9	459.2	513.8	514.4	547.8	602.4	713.1	18%	37%
Total wages	165.3	133.0	129.2	134.1	146.3	190.4	198.4	4%	42%
Gross Value Added	100.8	179.7	112.8	195.6	238.9	231.7	224.0	-3%	36%
Depreciation of capital	12.7	40.9	34.1	31.9	28.6	27.0	28.9	7%	-6%
Earning before interest and taxes	-65.7	26.2	-30.8	43.2	74.0	30.5	6.5	-79%	-34%
Financial costs, net	-23.7	-16.8	-16.6	-11.7	13.5	9.2	4.6	-50%	144%
Net profit	-42.0	43.0	-14.2	54.9	60.5	21.3	1.9	-91%	-91%
Total value of assets	958.5	854.6	907.0	798.5	688.4	871.4	937.2	8%	14%
Capital productivity (%)	10.5	21.0	12.4	24.5	34.7	26.6	23.9	-10%	16%
Return on Investment (%)	-6.9	3.1	-3.4	5.4	10.8	3.5	0.7	-80%	-54%

Source: own elaboration from EU Member States DCF data submission

Operational costs show particular structures across species, but at the aggregated level, four factors represent the 94% of the total operational expenditures in 2018; feed cost (32%), total wages (28%), other operational cost (21%), and livestock cost (14%).

The depreciation of capital has increased in 2018 in line with the increase in the total value of assets, confirming a positive trend in new investments in assets started in 2016. Net financial costs[16] decreased significantly, during 2017 and 2018. This may be caused mainly by two reasons, on the one hand, the context of low interest rates and on the other, a reduction in 2018 of more than 10% in the level of debt for the sector as a whole.

The net profit of the industry, despite being positive, has been the most affected indicator, reducing more than 90%, from €60 million in 2016 to less than €2 million in 2018. When considering a relative measurement as is the Return on Investment ratio, and different from the evolution between 2014 and 2016, it is confirmed a reduction of the economic performance from 10.8% in 2016 to 0.7% in 2018. That means than although in average during 2018 the economic performance of the assets of the Spanish companies hs been positive, for each €100 of investment made in the companies, were obtained €3.5 in 2017 and €0.7 in 2018. Considering this, and regardless of how the activity was funded and what was the financial cost, the activities developed by the Spanish aquaculture industry still were profitable, but less than in previous years.

After a few years of improvement in the economic performance indicators of the Spanish aquaculture sector, and despite the fact that during 2017 and 2018 production and its value have continued to increase, the increase in costs has once again reduced economic returns.

The 2019 and 2020 data will allow to analyse how the increase in costs, extreme climatic events, and diseases, as well as the effect of the COVID crisis on the markets, may impact on firms cost structures and profitability indicators. The most recent data about aquaculture sector in Spain suggest that, in general, firms do not have much room to assume further reductions in margins and profitability, without returning to negative returns as experienced between 2008 and 2012.

4.25.4 Main species produced and economic performance by segment

The four main species in Spanish aquaculture in terms of value (European seabass, Atlantic Bluefin Tuna, Mediterranean mussel, and Gilthead seabream) represented 89% and 74% of the total industry quantities and value in 2018, respectively.

By far Mediterranean mussel is the main harvested species in Spain, with a production in 2018 of 244 019 tonnes, which represents nearly three of each four kilograms of total production in Spain. This species is mainly produced in Galicia in mussel rafts, but it is also cultivated in Catalonia, and in a smaller proportion in Valencia and the Balearic Islands in rafts, and in Andalusia in longlines. However, the value of mussel production represented 19% of the aquaculture industry in the country. Mussel is a species whose production depends on the changes of environmental conditions, suffering big fluctuations into different years in the past. However, since 2014 the value generated by the mussel industry has been increasing due to both, an increase in the quantities (in particular in 2017 and 2018) and the rise of prices (€0.63/kg).

When talking about marine fish, seabass is the main harvested species in Spain, with 23 476 tonnes in 2018, with a total value of €170 382 million. Seabream is the second marine fish cultivated in Spain, with 19 406 tonnes in 2018, valued €88 017 million. These two species represented more than 36% of the total aquaculture production value in 2018. Seabream and

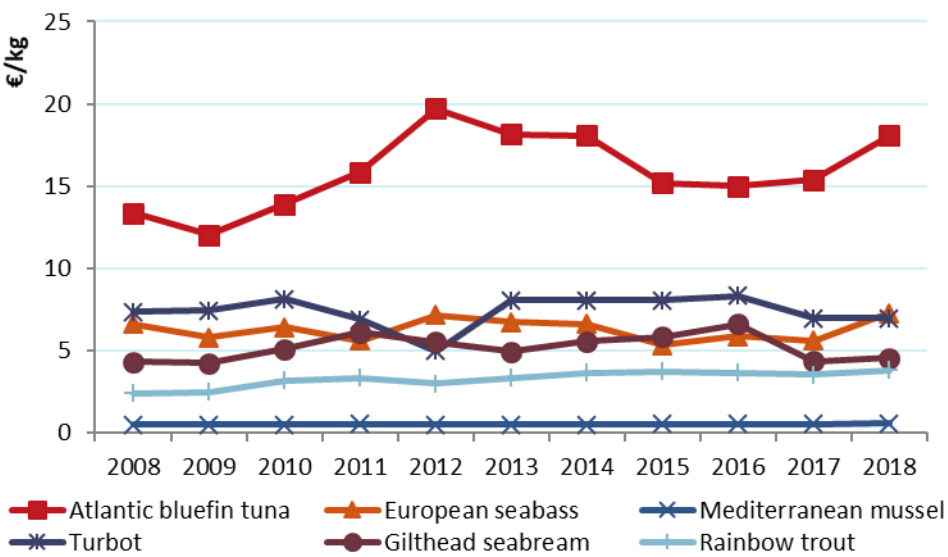
[16] Note that “Financial cost net” should be calculated as costs, coming from financial activity of the enterprise, minus the financial income. In the case of the Spanish chapter, the negative value of this indicator during the period 2008-2015 seems to be caused not by a greater amount of financial income than financial cost in the industry, but by a different calculation. This seems to have been corrected in 2016. However, this limitation affects the result of the calculation of "net profit" between 2008 and 2017, and the analysis of the evolution of net profit in 2018 with respect to previous periods. This circumstance has been taken into account in the analysis carried out.

seabass production is concentrated in Mediterranean coast, but these species are also produced in the Canary Islands and in the Atlantic coast of Andalusia. The third important species is turbot produced, in the North Atlantic coast, with a total production in 2018 of 8 058 tonnes, valued €56.1 million. The Atlantic Bluefin tuna, with only nearly 7 636 tonnes (less than 2% of the total industry production volume), but it means an increased 67% production compared to 2016, valued €137.8 million, which was equivalent to 19% of total production value. The rainbow trout is the main freshwater species in Spain. Its production takes place inland around mostly all the regions of the country. Total production achieved 17 027 tonnes in 2018 with a value of €64 594 thousand. In the group of molluscs in Spain there are also traditional ways of aquaculture, like the clams cultivated in the intertidal areas. Their production is dominated by *Ruditapes philippinarum*. These are a kind of aquaculture with a high social value in the areas in which it is concentrated, in particular in Galicia.

Figure 4.25.1 Main species in terms of weight and value in **Error! Reference source not found.** production: 2018.

Source: EU Member States DCF data submission

Figure 4.25.2 Average prices €/kg for the main species produced in Spain: 2008-2018.



Source: own elaboration from EU Member States DCF data submission

Analysis of evolution of the average prices for the main species in Spanish aquaculture indicates different evolutions according to the diversity of species. Seabream changed the positive trend started in 2014 with a decrease of the average price until €4.50 per kg in 2018. In the case of seabass, average prices in 2018 consolidated the increasing trend of prices until €7.30 per kg., the highest record in the last 10 years. Trout prices have followed a growing trend since 2013. The average price in 2018 was 2.7% higher than 2016, which is the highest price record in the last 10-years period. In the case of the mussel, prices have increased in 2018 until €0.6/kg, the highest observed price since 2008. The most significant aspect in the evolution of prices is the increase experienced by the price of Atlantic Bluefin tuna.

The most relevant segments in the Spanish aquaculture are presented below.

- Segment 1: Seabass and seabream cages
- Segment 2: Tuna cages
- Segment 3: Mussel rafts
- Segment 4: Trout tanks and race-ways

The Spanish aquaculture segments show no significant differences between EUMAP and DCF data collection frameworks. Tuna ranching, previously included into "other marine fish" increased in importance and in the new system deserves a singular segment replacing the previous one.

Segment 1: Seabass and Seabream cages

Seabass (*Dicentrarchus labrax*) and seabream (*Sparus aurata*) are the most important species in finfish aquaculture in Spain in volume of production and together are the most important species in whole industry in terms of value. Seabass production has followed a positive trend in recent years, both in terms of quantities and value. In 2018, seabass production achieved 23 476 tonnes with a value of €170 million. Traditionally, seabream use to be the most important of the two species, but the positive evolution of seabass has ranked this species as the most valuable species of the Spanish aquaculture industry. Meanwhile, seabream production in 2018 was 19 406 tonnes valued €88 million.

These species are cultivated in warm waters, in the Mediterranean Sea, but also in the Spanish Atlantic coast and Canary Islands. There are productions in Andalusia, Canary Islands, Valencia, Murcia, Balearic Islands and Catalonia. In spite of the hatcheries located in Spain, there are not enough juveniles for domestic production so, they must be imported from other countries.

Although a part from some production developed in brackish waters in southern Spain, the majority of the domestic seabass and seabream production is grown in cages. The production in cages generated 30 510 tonnes, valued almost €187 million in 2018. These results represented the 82% of the total seabream and seabass production volume and value. Apart from production in cages, there are other systems such as brackish waters (11% of the turnover) and hatcheries and nurseries (9% of the turnover).

The value of the production decreased while the operational cost remained stable. This situation negatively affected the economic performance indicators, both GVA and Net profit, but particularly ROI, due to the increase in the value of the assets. In general, this segment follows the general trend of the industry in which profitability worsens, but it is still positive.

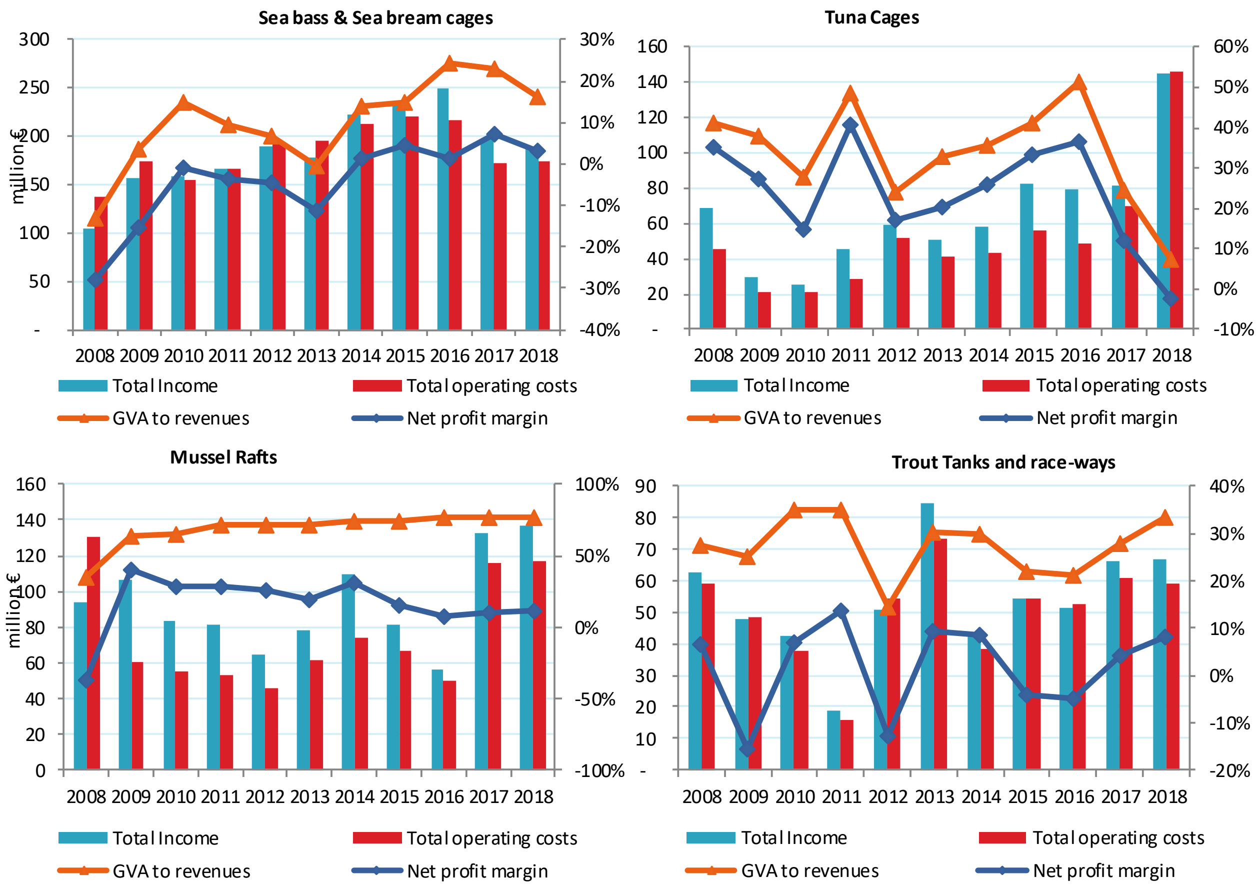
In the structure of operating expenses is the feed that remains a highest percentage. Feed price has fluctuated between 2016 and 2018, and increased again in the last period. The feed cost in the seabass and seabream cage segment in Spain decreased from 50% of the total operating cost in 2015 to 40% of the total in 2016, and increased again to 45% in 2018. Livestock purchases together with feed represented in 2018 almost 64% of total operational cost. The second most relevant cost is other operational cost that remained stable in recent years. The relevance of this type of cost is more significant in cage segment, since larger companies normally develop more activities related with external services, consultancy, marketing, etc.

Table 4.25.3 Economic performance of main **Error! Reference source not found.** aquaculture segments: 2008-2018.

Variable	2008	2010	2012	2014	2016	2017	2018	Change 2017-18	Develop. 2018/(08-17)
Sea bass & Sea bream cages									
Number of enterprises	59	40	33	30	26	25	24	-4%	-34%
FTE	896	669	594	706	747	845	633	-25%	-14%
Average wage (thousand €)	25.7	35.6	35.2	37.7	39.4	31.7	30.8	-3%	-6%
Labour productivity (thousand €)	-14.8	34.7	20.5	43.2	80.5	35.3	31.5	-11%	15%
Total sales volume (thousand tonnes)	29.7	29.8	29.4	33.0	32.9	32.4	30.5	-6%	-4%
Total income (million €)	105.4	159.1	188.9	221.7	249.9	198.0	187.3	-5%	1%
Total operating costs (million €)	137.4	155.5	192.5	213.8	215.9	173.1	174.3	1%	-6%
Gross Value Added (million €)	-13.2	23.2	12.2	30.5	60.2	43.6	30.2	-31%	43%
Net profit (million €)	-29.6	-1.5	-8.4	2.9	3.4	14.0	6.3	-55%	207%
Total value of assets (million €)	161.9	167.1	199.6	154.3	302.3	229.9	242.8	6%	21%
Net investments (million €)	5.7	0.3	2.1	6.4	17.8	6.5	10.0	55%	30%
Capital productivity (%)	-8.2	13.9	6.1	19.8	19.9	19.0	12.4	-34%	25%
Return on Investment (%)	-22.0	-4.5	-7.1	-0.6	8.7	7.7	2.9	-63%	152%
Future Expectation Indicator (%)	1.3	-6.5	-4.2	-1.6	3.3	-0.2	1.7	777%	316%
Tuna Cages									
Number of enterprises	6	4	3	5	4	4	4	0%	0%
FTE	98	64	69	139	187	184	307	67%	163%
Average wage (thousand €)	48.9	48.1	95.4	45.7	51.6	46.3	38.5	-17%	-31%
Labour productivity (thousand €)	288.8	109.6	208.1	147.6	215.5	97.0	32.7	-66%	-83%
Total sales volume (thousand tonnes)	3.8	1.8	3.0	3.1	6.2	5.1	8.0	56%	113%
Total income (million €)	68.6	25.3	59.5	57.9	79.4	81.5	145.4	78%	151%
Total operating costs (million €)	45.1	21.4	51.7	43.6	48.2	69.9	145.9	109%	243%
Gross Value Added (million €)	28.3	7.0	14.4	20.5	40.4	20.1	10.7	-46%	-50%
Net profit (million €)	24.2	3.7	10.2	15.1	28.9	9.6	-3.6	-138%	-123%
Total value of assets (million €)	67.5	18.7	37.8	47.5	63.7	49.5	122.0	146%	163%
Net investments (million €)	14.0	0.5	0.8	1.7	1.3	2.0	2.3	13%	-13%
Capital productivity (%)	42.0	37.6	38.0	43.1	63.3	40.5	8.8	-78%	-83%
Return on Investment (%)	32.7	15.6	16.6	26.7	44.3	19.3	-3.1	-116%	-109%
Future Expectation Indicator (%)	18.6	-2.9	-1.8	0.3	-2.6	0.0	-0.8	-2597%	-183%
Mussel Rafts									
Number of enterprises	2054	2045	2038	2027	1957	1950	1959	0%	-3%
FTE	2350	2283	2221	2493	2610	2641	3099	17%	28%
Average wage (thousand €)	29.4	12.0	12.7	18.4	14.0	19.1	16.5	-14%	1%
Labour productivity (thousand €)	13.8	22.9	20.4	32.5	16.4	13.8	13.3	-4%	-40%
Total sales volume (thousand tonnes)	180.6	188.4	202.1	219.6	214.0	240.7	242.4	1%	19%
Total income (million €)	94.0	83.2	64.6	110.1	56.3	132.7	137.2	3%	54%
Total operating costs (million €)	130.1	55.3	46.0	73.9	49.9	115.4	116.9	1%	64%
Gross Value Added (million €)	32.4	52.3	45.4	81.0	42.8	100.4	104.4	4%	76%
Net profit (million €)	-34.2	23.7	16.7	34.7	4.5	14.4	15.8	10%	2%
Total value of assets (million €)	85.3	122.5	147.0	192.0	0.0	50.7	46.8	-8%	-55%
Net investments (million €)	7.2	9.5	0.1	1.7	0.0	6.1	6.2	0%	65%
Capital productivity (%)	37.9	42.7	30.9	42.2		197.8	222.8	13%	138%
Return on Investment (%)	-43.5	17.3	11.5	17.9		29.2	34.7	19%	72%
Future Expectation Indicator (%)	7.3	2.3	-1.1	-0.1		7.3	4.5	-39%	1135%
Trout Tanks and race-ways									
Number of enterprises	60	7	76	73	75	83	79	-5%	50%
FTE	371	204	494	495	556	565	563	0%	51%
Average wage (thousand €)	26.5	2.9	23.1	16.9	18.9	23.0	25.0	9%	40%
Labour productivity (thousand €)	33.9	4.3	14.6	25.9	19.5	25.9	31.1	20%	36%
Total sales volume (thousand tonnes)	12.9	5.1	17.7	15.6	16.7	18.3	17.4	-5%	50%
Total income (million €)	38.7	3.2	50.6	42.9	44.7	66.0	67.0	2%	78%
Total operating costs (million €)	35.8	2.9	54.1	38.3	44.2	60.8	58.9	-3%	67%
Gross Value Added (million €)	12.6	0.9	7.2	12.8	10.9	18.4	22.2	21%	122%
Net profit (million €)	3.3	0.2	-6.6	3.7	-0.9	2.7	5.5	102%	404%
Total value of assets (million €)	39.5	3.6	92.2	8.7	39.8	90.2	81.8	-9%	100%
Net investments (million €)	1.3	0.0	0.8	0.5	1.1	2.1	3.8	76%	426%
Capital productivity (%)	31.8	24.4	7.8	148.0	27.3	20.4	27.2	33%	-33%
Return on Investment (%)	6.7	3.5	-7.5	39.0	-3.2	3.5	7.0	100%	-5%
Future Expectation Indicator (%)	2.5	-4.5	-2.9	-8.1	-1.7	0.1	1.7	2050%	157%

Source: own elaboration from EU Member States DCF data submission

Figure 4.25.3 Economic performance in € million, indicators for the main **Error! Reference source not found.** segments: 2008-2018.



Source: own elaboration from EU Member States DCF data submission

Segment 2: Tuna cages

As a capture based activity, the economic performance of tuna aquaculture is strongly dependent on the availability of livestock from the wild fishery. Thus, any change in the quotas for bluefin tuna catches in the Mediterranean will be transferred to most of the performance indicators of the Spanish tuna ranching companies. The corresponding TAC's were significantly decreased by ICCAT in 2010, matching the figures of the scientific advice. Such a decision reduced the supply of juveniles and causing the subsequent increase in the prices of the final product. Since demand, especially in Japan, is quite inelastic, the increase in the price favoured the profitability of the industry (Fernández Polanco & Llorente, 2016[17]). In 2014, the TAC was raised by 20% and in 2017 a progressive increase on the TAC was recommended.

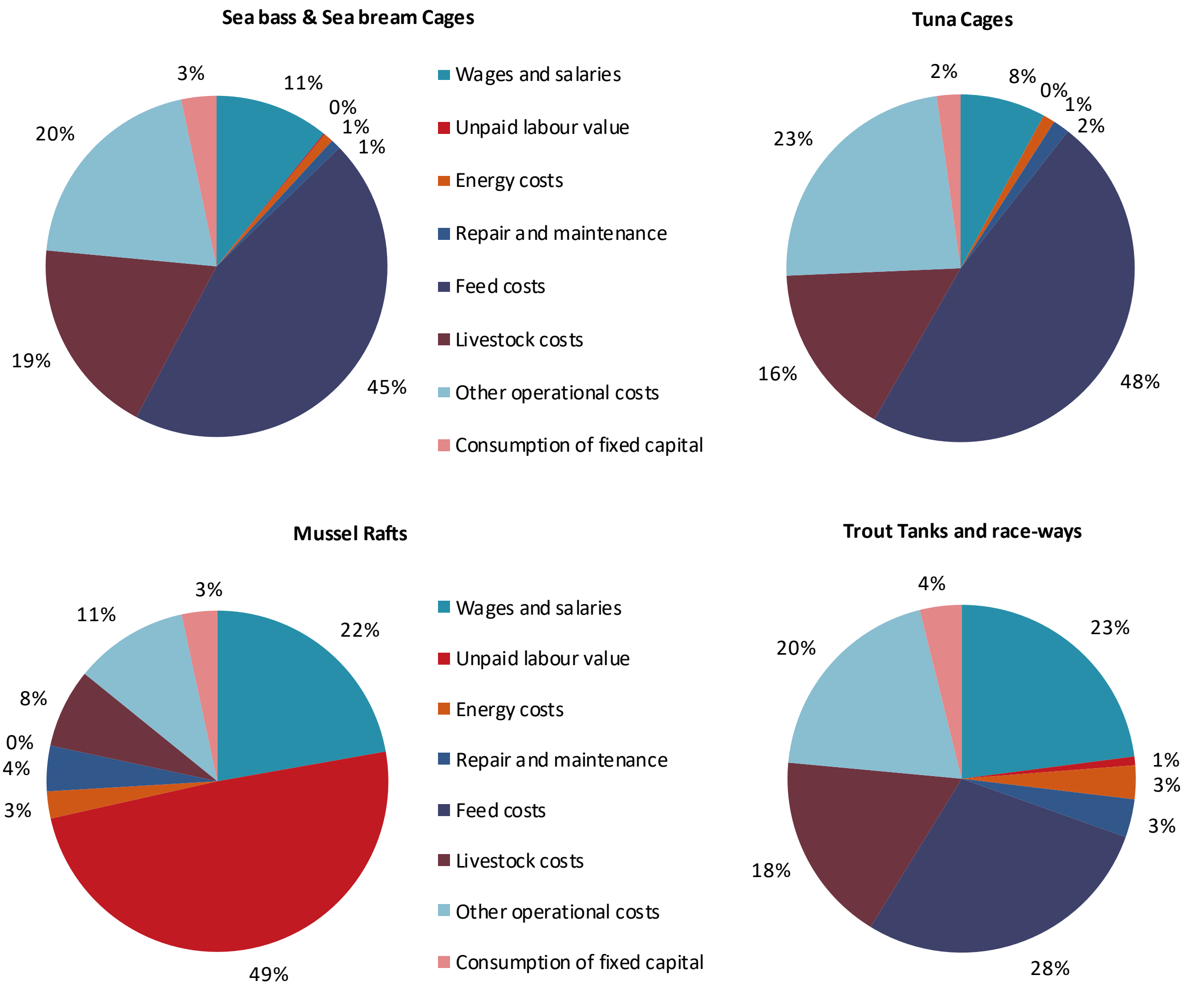
The progressive increase in catches resulted in a shift in the supply of juveniles, raising the volumes of production but also decreasing the final price. The data in table 4.7.3 show an increase in sales and income in the last two years. However, operating costs have also increased as a result of the growth in activity. The volume of investments increased in the two last years, reverting in a higher value of assets in the last year of the series. The result is, however, a decrease in the return of investments and net profit, becoming both negative in 2018.

These trends can be clearly seen in figure 4.7.3. Total Income and net profit were declining until 2010, when the increase in the quota caused an abrupt change in the trend as the prices were still high. This first shock is corrected in the following years as production grown. The increasing

[17] Fernandez-Polanco, J., & Llorente, I. (2016). Tuna economics and markets. *In Advances in Tuna Aquaculture* (pp. 333-350). Academic Press.

trend in income and net profit persisted until 2016 but with a less pronounced slope. On the other hand, operating costs also rose with the increase of activity since 2010, affecting and shifting net profit into a descending slope in the last two observed years.

Figure 4.25.4 Cost structure of the main segments in Spain: 2018.



Source: EU Member States DCF data submission

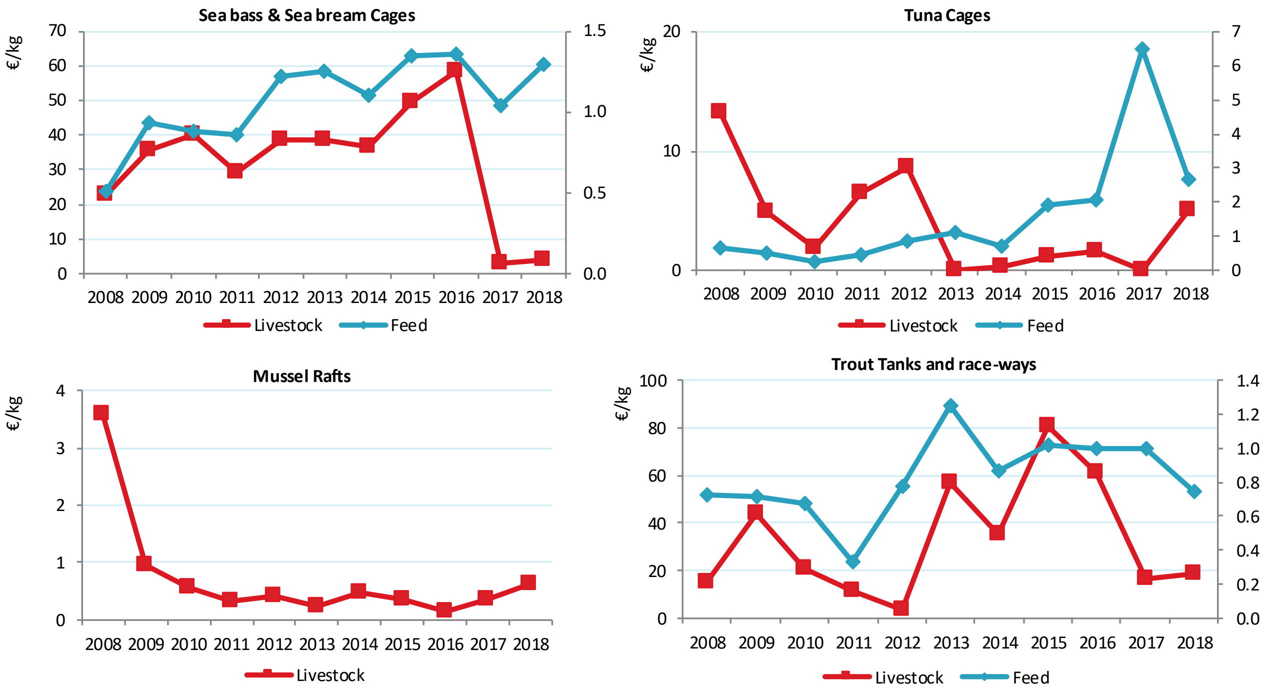
Tunas are mainly fed with fresh small pelagics as feeds based on fish meal are not feasible for fattening them. For this reason, feed is the main item in the cost structure of tuna ranching, accounting for 48% of total cost. Other important raw material is livestock which is purchased from the fishing companies. The cost of juveniles accounts for 16% of total costs. Other operational costs, accounting for 23% of total costs, involve an important consumption from farming technology and equipment. Labour cost is the fourth main cost item but accounts only for 8% of total costs (Figure 4.7.4).

The evolution of the raw material costs is shown in figure 4.7.5. Livestock costs raised sharply between 2010 and 2012 with the increase in activity. The evolution of feed costs in the same period, even increasing, remained more stable. In 2013, livestock costs decreased and remained at similar levels until 2017. In the following year, feed costs start increasing until reaching a peak in 2017, the same year in which feed costs significantly raised. This shift in raw material costs are in part behind the decreases in profits observed in the last two years.

Segment 3: Mussel rafts

The mussel industry in Spain, most of it concentrated in Galicia, represented 74% of the total Spanish aquaculture production in terms of quantities and the 18.6% of the value in 2018, considering that the average price of this product is significantly lower than the main fish cultivated in Spain. Being a species, which strongly depends on natural conditions, its annual production might reflect high fluctuations over time; in 2018 it experienced an increase of 13% respect to 2016 until 244 thousand tonnes. This total production was the third highest peak in the period considered. The evolution during 2015 and 2016 illustrates how dependent is the mussel production to the environmental conditions in the Galician estuaries, where red tides can close the production areas for long periods of time. The production value of this segment was €134 million in 2018, the highest production value during the whole 10-year period analysed; which represents an increase of 13.9% compared to 2016. This increase is mainly explained due to the growth of prices in 2018 (€0.6/kg), the highest observed price since 2008.

Figure 4.25.5 Feed and livestock average prices €/kg for the main **Error! Reference source not found.** segments: 2008-2018.



Source: own elaboration from EU Member States DCF data submission

This is the biggest segment in terms of employment, with 3 099 FTE in 2018, which was 18% higher than in 2016; and it also the highest number of people employed in the segment during the period. Traditionally it is a sector where there are a lot of people working a part of the year; most of them are self-employed workers; so the small familiar units are the base of this segment. In this context, and as in 2016, the mussel industry was the most profitable of the three segments analysed during 2018.

The mussel industry GVA was positive in all the years analysed and the EBIT and net profit have been positive since 2009. Although all the economic indicators have a positive value it is necessary to highlight the break in the negative evolution of the indicators between 2011 and 2013 and the positive evolution in all of them in 2018. Key economic indicators of this segment show an increase of the value of production (13.5%) in 2018 compared to 2016, instead of an increase of prices (from €0.43 per kg. in 2015 compared to €0.46 per kg in 2018)[18].

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[18] Xunta de Galicia (2019) Aquaculture Yearbook. Available online at https://www.pescadegalicia.gal/Publicaciones/AnuarioAcuicultura2019/index.htm

The operational cost structure of this extensive aquaculture activity really differs from the observed in the other segment analysed. Unlike fish farming where feed is the main cost and labour cost is under 27% of the total cost, in the case of the mussel industry there is no feed cost, but as a low investment capital activity, labour cost is the most relevant operational cost. The relevance of labour cost is confirmed in the Figure 4.7.4 in which can be observed that the wages and salaries represented the 22% of the operational cost, but what is more relevant, the imputed value of unpaid labour was the 49% of the total operational cost.

Segment 4: Trout tanks and race-ways

The trout segment seems to be consolidating the recovery trend in production and sales of the previous years, after a long decline since the end of the last Century. Although the number of companies decreased employment remained stable. Total sales increased with regard 2016, as well as net profits, benefited by better prices and a lower increase in operating costs (Table 4.7.3).

The evolution of Income and profit in the last ten years (Figure 4.7.3) shows a sharp decline in 2012 which is recovered in the following year and returns to increase in 2016. In the last two years observed, income and costs have risen, but the raise of operational costs is smaller than the increase in income, resulting in a consequent raise in profits.

Feed cost is the main item within the raw materials, reaching 46% of the total cost structure when adding the cost of livestock. Labour costs account for 23% of the cost structure and is the second most important item when raw material costs are considered detached in feed and livestock. Finally, other operational costs, 20% of the total, are the fourth most important cost item gathering other varied costs related with the functioning of production and marketing (Figure 4.7.4).

Raw material costs evolved in a similar way since 2008, with a sharp increase in 2012 both in feed and livestock. Feed costs remained stable until they slightly decreased in 2018, but livestock costs started a descending trend in 2015, which contributed to a positive impact on the profits of the enterprises since then (Figure 4.7.5)

4.25.5 Outlook

Nowcasts for 2019-20

Aquaculture production in Spain in 2019 decreased by 3% to 308 033 tonnes, with a value of almost €637 million. Freshwater production, led by rainbow trout, grew by 4% up to 17 485 tonnes valued €60 million. Marine production decreased by 3% and 2% in quantity and value respectively to 290 thousand tonnes with a value close to €577 million. Fish production grew by 5% to a yearly record of 59 803 tonnes, but decreased its value by 1% to €438 million due to the context of lower prices. Meanwhile, the production of crustaceans, mainly mussels, fell by 6% to 260 thousand tonnes.

The production of gilthead seabream continues its downward trend in favour of the seabass, which grew and now is consolidated as the main species in finfish marine aquaculture in Spain, both in quantity and value. Bluefin tuna continues its growing trend and is already the second most important species in value, which in 2019 achieved €124 million.

Employment (FTE) and the number of aquaculture facilities remains stable in both marine and freshwater aquaculture. In 2019, there is a 20% reduction in the number of people employed in marine aquaculture, mainly in Galicia, where mussel production is concentrated.

4.25.6 Trends and triggers

The Covid-19 outbreak added much uncertainty to the future evolution of the Spanish aquaculture industries and expected trends could change depending on the persistence of the pandemic and the final real impacts in the National and global economy. Besides this great issue, some other events and facts in 2019 and 2020 will also have their impact on the future evolution of the National aquaculture industry.

The production of marine fish suffered in late 2019 and early 2020 serious losses caused by climatic and epidemiological episodes. The storm "Gloria" directly impacted the Mediterranean marine farms, damaging facilities and causing farm escapes. Consequently, a decrease in production close to 30% is expected in 2020. There has also been a reduction in fingerling production during 2019 and it is expected to continue in 2020 (APROMAR, 2020[19]).

Furthermore, in 2020, in a context of continuous reduction in household's seafood consumption in Spain during the last 8 years, we must add the economic effects generated by the Covid-19 crisis. The Spanish economy is highly impacted by the stop of the tourism and the reduction in the demand in the HORECA channel. The most direct effects for aquaculture companies have been the decrease in the incomes due to the drop in sales and prices, and the increase in operating costs, mainly feed. In the medium term, producers are also concerned about a potential drop in prices, once the markets will open, and all producers market the accumulated stocks (APROMAR, 2020).

In Galicia (Spain), although the mussel sector made huge efforts to continue extracting mussels from rafts and developing the activity during the COVID-19 pandemic, it appears to be difficult to recover the level of production before the pandemic. The demand of fresh mussels certified by the Galician Protected Designation of Origin (PDO) has been reduced due to the lower demand from European markets (France and Italy) and the closure of traditional channels such as restaurants and hotels. However, the demand of mussels from consumers of transformed and canned mussels continued stable during the confinement. The sector suffered, again, the occurrence of red tides in the Ria de Pontevedra, and partially in other Rias (Ares-Betanzo, Muros-Noia), which obligated to prohibit the extraction of mussels from April to June. The sector also suffered considerable delays in collecting sales payments, attributed to organizational difficulties that may arise from the state of alarm in the country. Another fact which influenced the development of the Galician mussel market is the increasing imports of mussels from Italy, which seems to have increased during the lockdown.

4.25.7 COVID-19 impact

Spanish aquaculture, like all the seafood industry in the country, suffered the consequences of the pandemic outbreaks and the mitigation measures implemented since the beginning of the crisis in March. The lockdown of the Horeca during the fall caused oversupply in the domestic markets and prices at first sale collapsed initially for recovering at the beginning of the summer, but lower levels than before the outbreak. The decline of tourism in the summer season did not help recovering and several farms could not manage to sell all their stocks, with an impact in the form of increasing operating costs. Farms and industries selling to processors and retailers managed to maintain their levels of activity, despite the decrease in the prices. Other industries and species more dependent on Horeca have been shocked more seriously compromising their ability for recover. In general, cash flow is shrinking due to the falls in sales and prices, and in some cases solvency may be in serious risk.

The mussel aquaculture industry in Galicia (Spain) suffered the initial shock due to the lockdown during March and April. This led to an initial reduction of sales, turnover and income. However, this situation has been improved after the lockdown, namely because of the high demand of mussel from the canned industry. The sector also suffered new red tides which obligated to close mussel farms in some inlets.

[19] Aquaculture in Spain 2020. APROMAR. http://www.apromar.es/content/informes-anuales

4.25.8 Data Coverage and Data Quality

Minor data mistakes were found and amended.

4.26 Sweden

Overview of Swedish aquaculture

In 2018, the Swedish aquaculture sector produced 13.8 thousand tonnes of aquaculture products valued at €63.5 million. The majority of production is carried out in freshwater and the main specie produced is rainbow trout. The industry consists of 93 enterprises employing 412 people. The sales value of production is growing continually and saw an increase of €0.4 million for 2018 compared to the previous year.

4.26.1 Total Production and sales

Over the years 2008 to 2018 production levels have increased from 6 300 tonnes in 2008 to 13 800 tonnes in 2018 and the value of total production have increased from €14.5 million in 2008 to €63.5 million in 2018. The change in production levels between 2017 and 2018 is a decrease of 12%, however the sales value as a whole increased by 1% (Table 4.7.1).

4.26.2 Industry structure and total employment

In 2018, the total number of aquaculture sites was 130, distributed on 93 enterprises. The Swedish aquaculture sector is dominated by small enterprises, and in 2018, 82% of the Swedish enterprises had less than 5 employees.

Table 4.26.1 Production and sales, industry structure and employment for Sweden: 2008-2018.

Variable	2008	2010	2012	2014	2015	2016	2017	2018	Change 2017-18	Develop. 2018/(08-17)
Sales weight (thousand tonnes)	**6.3**	**11.7**	**14.8**	**14.0**	**13.4**	**16.6**	**15.8**	**13.8**	-12%	5%
Shellfish		1.4	1.3	1.8	1.5	2.3	2.0	2.0	-1%	14%
Freshwater	6.3	10.3	13.5	12.3	11.8	14.3	13.8	11.8	-14%	2%
Sales value (million €)	**27.2**	**41.2**	**49.8**	**56.9**	**53.3**	**59.7**	**63.1**	**63.5**	1%	33%
Shellfish		0.8	1.0	1.3	1.1	1.6	1.3	0.6	-55%	-50%
Freshwater	27.2	40.4	48.7	55.6	52.2	58.2	61.8	62.9	2%	34%
Number of enterprises	**67**	**175**	**147**	**142**	**126**	**136**	**105**	**93**	-11%	-33%
Marine			7	10						
Shellfish		37	28	30	31	27	18	14	-22%	-55%
Freshwater	67	138	112	102	95	109	87	79	-9%	-27%
Employment	**232**	**399**	**370**	**411**	**411**	**489**	**431**	**412**	-4%	4%
Shellfish		58	50	52	67	68	42	37	-12%	-38%
Freshwater	232	341	320	359	344	421	389	375	-4%	9%
FTE	**141**	**230**	**263**	**278**	**268**	**295**	**510**	**284**	-44%	3%
Shellfish		17	24	24	22	19	26	21	-17%	-3%
Freshwater	141	213	239	254	247	276	485	263	-46%	2%

Source: EU Member States DCF data submission

4.26.3 Overall Economic performance

The Swedish aquaculture sector has performed fairly well during the 2008-2018 period. Total income has been rising while operating costs have fallen. During 2010, the sector had very negative results however the sector has since recovered and is showing continual growth (Table 4.7.2).

Table 4.26.2 Economic performance of the **Error! Reference source not found.** aquaculture sector: 2008-2018.

Variable	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	Change 2017-18	Develop. 2018/(08-17)
Total income	37.4	32.3	42.1	54.8	52.1	52.9	59.8	57.2	61.8	64.3	58.9	-8%	14%
Total operating costs	32.9	27.7	83.8	46.7	48.0	43.6	53.2	48.9	49.7	56.1	33.8	-40%	-31%
Total wages	6.5	5.4	6.6	8.4	8.8	10.0	12.4	9.2	9.0	10.6	9.6	-10%	10%
Gross Value Added	10.9	8.7	-35.8	15.3	12.0	18.8	18.2	16.1	21.2	18.8	34.7	85%	233%
Depreciation of capital	1.8	1.8	1.8	2.2	2.6	2.3	2.8	3.0	2.8	3.6	3.5	-3%	42%
Earning before interest and taxes	2.7	2.8	-43.6	5.8	1.6	7.0	3.8	5.4	9.3	4.5	21.5	377%	30307%
Financial costs, net	0.7	0.6	0.4	0.8	-0.8	0.8	1.0	0.6	0.3	0.9	0.4	-53%	-25%
Net profit	2.0	2.2	-44.0	5.0	2.4	6.2	2.8	4.8	9.0	3.6	21.1	479%	3594%
Total value of assets	46.5	34.9	48.6	61.5	63.3	64.8	65.6	65.7	64.0	76.3	74.6	-2%	26%
Capital productivity (%)	23.5	25.0	-73.8	24.8	18.9	29.0	27.8	24.5	33.0	24.6	46.4	89%	195%
Return on Investment (%)	5.7	8.1	-89.7	9.4	2.5	10.8	5.8	8.2	14.5	5.9	28.8	388%	1638%

Source: own elaboration from EU Member States DCF data submission

4.26.4 Main species produced and economic performance by segment

Since 2016 the Swedish aquaculture industry is divided into seven segments according to EUMAP

1. Other freshwater fish – Cages
2. Other freshwater fish – Tanks and race-ways
3. Other freshwater fish – Ponds
4. Other freshwater fish – Recirculation systems
5. Other freshwater fish – Hatcheries and nurseries
6. Crustaceans – Other
7. Mussel – Other

However, to be able to follow the development over time the production in Sweden is aggregated into three main segments.

1. Other freshwater fish – Cages, same as EUMAP
2. Other freshwater fish – On growing, includes EUMAP 2, 3 and 4 as well as previous DCF segmentation *Trout On growing*
3. Other shellfish – Other, same as EUMAP 6 and 7

The largest segment in Swedish aquaculture, in terms of both value and volume of production, is freshwater fish grown in cages. The second most important segment is freshwater fish on growing. The third segment consists of shellfish (blue mussels and oysters). There are five main species produced in Sweden, rainbow trout, blue mussel, arctic char, Atlantic salmon and European eel as well as a group of other freshwater fish (Figure 4.7.1).

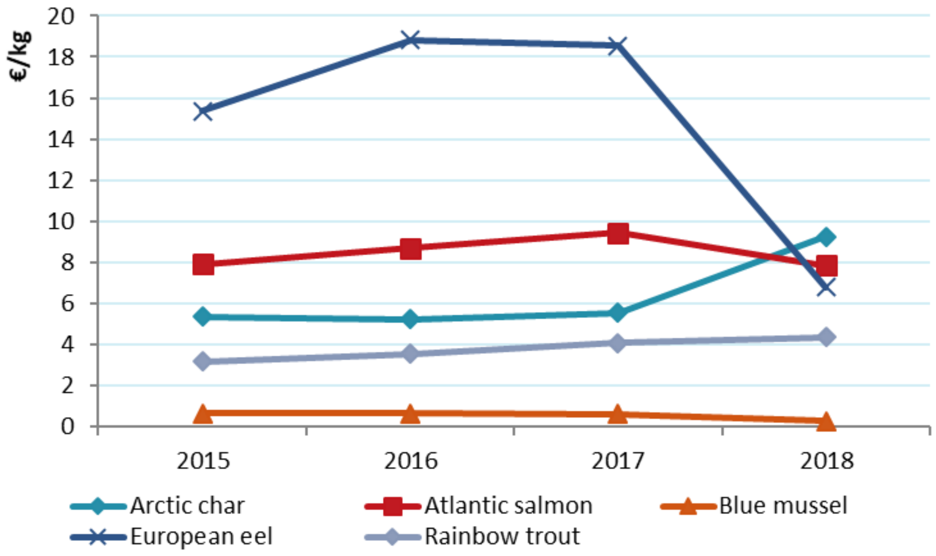
Figure 4.26.1 Main species in terms of weight and value in **Error! Reference source not found.** production: 2018.

Source: EU Member States DCF data submission

Aquaculture cages in freshwater dominate in Sweden – both in production and value. Other methods for aquaculture in Sweden are ponds, tanks and raceways. Rarer are recirculating aquaculture systems but more and more are being established. Rainbow trout is the most important specie in Sweden and is produced in most geographical regions.

In 2018, Swedish aquaculture yielded 13 800 tonnes, out of which 11 839 tonnes were fish (in fresh weight). The amount of fish that was produced for human consumption was 11 108 tonnes. The dominating species was Rainbow trout, with 81% of the total production and 93% of the value. The production of Blue mussel yielded the second highest value as well as the second highest production volume. The total value of aquaculture production amounted to €63.5 million, an increase by €0.4 million compared to 2017.

Figure 4.26.2 Average prices €/kg for the main species produced in Sweden: 2015-2018.



Source: own elaboration from EU Member States DCF data submission

Rainbow trout is the most important specie both in terms of weight and value. European eel yielded the highest value per weight in Sweden prior to 2018 however, the production of European eel is less than 1% of the total aquaculture production. Atlantic salmon production in Sweden is almost exclusively for stocking purposes hence the high value per kilo (Figure 4.7.2).

The prices of the main species produced by Swedish aquaculture have been fairly stable during the period of 2015 to 2018 for most species. The price of European eel saw a drastic decrease in 2018 while the price of arctic char increased, the cause for these price fluctuations is however unknown. (Figure 4.7.2).

Table 4.26.3 Economic performance of main **Error! Reference source not found.** aquaculture segments: 2008-2018.

Variable	2008	2010	2012	2014	2016	2017	2018	Change 2017-18	Develop. 2018/(08-17)
Other freshwater fish cages									
Number of enterprises	65	63	55	49	49	37	36	-3%	-32%
FTE	96	121	143	118	162	192	178	-7%	29%
Average wage (thousand €)	36.9	37.9	44.2	71.5	39.3	37.5	43.9	17%	2%
Labour productivity (thousand €)	60.6	69.0	54.4	79.4	124.5	69.1	138.4	100%	90%
Total sales volume (thousand tonnes)	5.8	9.4	12.6	10.3	13.7	13.0	11.1	-14%	5%
Total income (million €)	23.1	31.1	39.2	43.7	53.7	55.8	55.5	-1%	40%
Total operating costs (million €)	20.8	27.4	37.7	42.7	30.5	47.3	28.5	-40%	-16%
Gross Value Added (million €)	5.8	8.4	7.8	9.4	29.9	15.9	34.9	120%	202%
Net profit (million €)	1.1	2.2	0.2	-1.6	20.7	5.3	24.0	357%	586%
Total value of assets (million €)	26.6	34.5	50.8	47.3	53.8	62.5	65.6	5%	45%
Net investments (million €)	1.1	3.9	0.7	0.2	1.0	0.9	2.2	139%	51%
Capital productivity (%)	21.8	24.2	15.3	19.8	55.5	25.4	53.2	109%	113%
Return on Investment (%)	5.1	7.2	-0.9	-2.2	39.1	9.8	37.2	278%	371%
Future Expectation Indicator (%)	0.6	7.7	-2.5	-3.8	-2.2	-2.2	-0.6	71%	-558%
Other freshwater fish Ponds									
Number of enterprises					24	15	18	20%	-8%
FTE					23	17	17	-3%	-17%
Average wage (thousand €)					19.3	24.8	20.2	-19%	-8%
Labour productivity (thousand €)					21.7	31.6	25.6	-19%	-4%
Total sales volume (thousand tonnes)					0.2	0.2	0.2	-23%	-28%
Total income (million €)					1.7	1.4	1.6	10%	0%
Total operating costs (million €)					1.2	0.9	1.1	30%	9%
Gross Value Added (million €)					1.0	1.0	0.8	-24%	-22%
Net profit (million €)					0.4	0.5	0.4	-7%	4%
Total value of assets (million €)					3.0	2.2	2.2	0%	-16%
Net investments (million €)					0.1	0.0	0.0	-86%	-95%
Capital productivity (%)					32.9	47.4	36.1	-24%	-10%
Return on Investment (%)					13.7	22.1	16.2	-27%	-10%
Future Expectation Indicator (%)					1.6	-2.5	-4.3	-72%	-802%
Other freshwater fish Tanks and race-ways									
Number of enterprises					17	21	17	-19%	-11%
FTE					52	71	68	-5%	11%
Average wage (thousand €)					20.3	20.2	28.9	43%	42%
Labour productivity (thousand €)					0.7	12.5	19.7	58%	200%
Total sales volume (thousand tonnes)					0.3	0.5	0.5	18%	35%
Total income (million €)					4.2	4.8	3.7	-23%	-18%
Total operating costs (million €)					5.4	5.5	3.9	-29%	-28%
Gross Value Added (million €)					0.0	1.0	1.7	74%	233%
Net profit (million €)					-1.2	-0.8	-0.8	-4%	18%
Total value of assets (million €)					3.8	5.0	5.2	6%	20%
Net investments (million €)					0.2	0.1	1.5	1492%	1048%
Capital productivity (%)					1.2	19.7	32.4	64%	210%
Return on Investment (%)					-34.5	-17.8	-15.1	15%	42%
Future Expectation Indicator (%)					2.3	-0.4	19.3	4634%	1933%

Source: own elaboration from EU Member States DCF data submission

The most relevant segments in the Swedish aquaculture are analysed below.

Segment 1: Other freshwater fish cages

The segment *Other freshwater fish cages* corresponds to the same segment in the new EUMAP as previously reported.

The value and volume of production of segment 1 has grown between 2008 and 2018 and the figures indicated that the segment was experiencing progress in the economic indicators. However, the positive trend observed between 2008 and 2012 was changed to a negative trend in 2013 and 2014. This decline was broken in 2015 and production increased further in 2016 only to decline again in 2017 and 2018. The segment produced 80% of aquaculture production in the three segments in 2018 and the total income accounted for 90% (€55.5 million) of total income. Total sales volume in segment has increased with 48% during 2008-2018 from 5.8 to 11.1 thousand tonnes and gross value added increased from €5.8 to €34.9 million.

Segment 2: Other shellfish other

The second segment *Other shellfish other* consists of enterprises producing mussels and oysters. Previously (until 2015), enterprises producing freshwater crayfish was also included. This segment represents 5% (700 tonnes) of Sweden's total aquaculture production in terms of weight but only 2% (€0.8 million) in terms of gross value added. The income and production has been relatively stable for this sector during the 2008-2018 period.

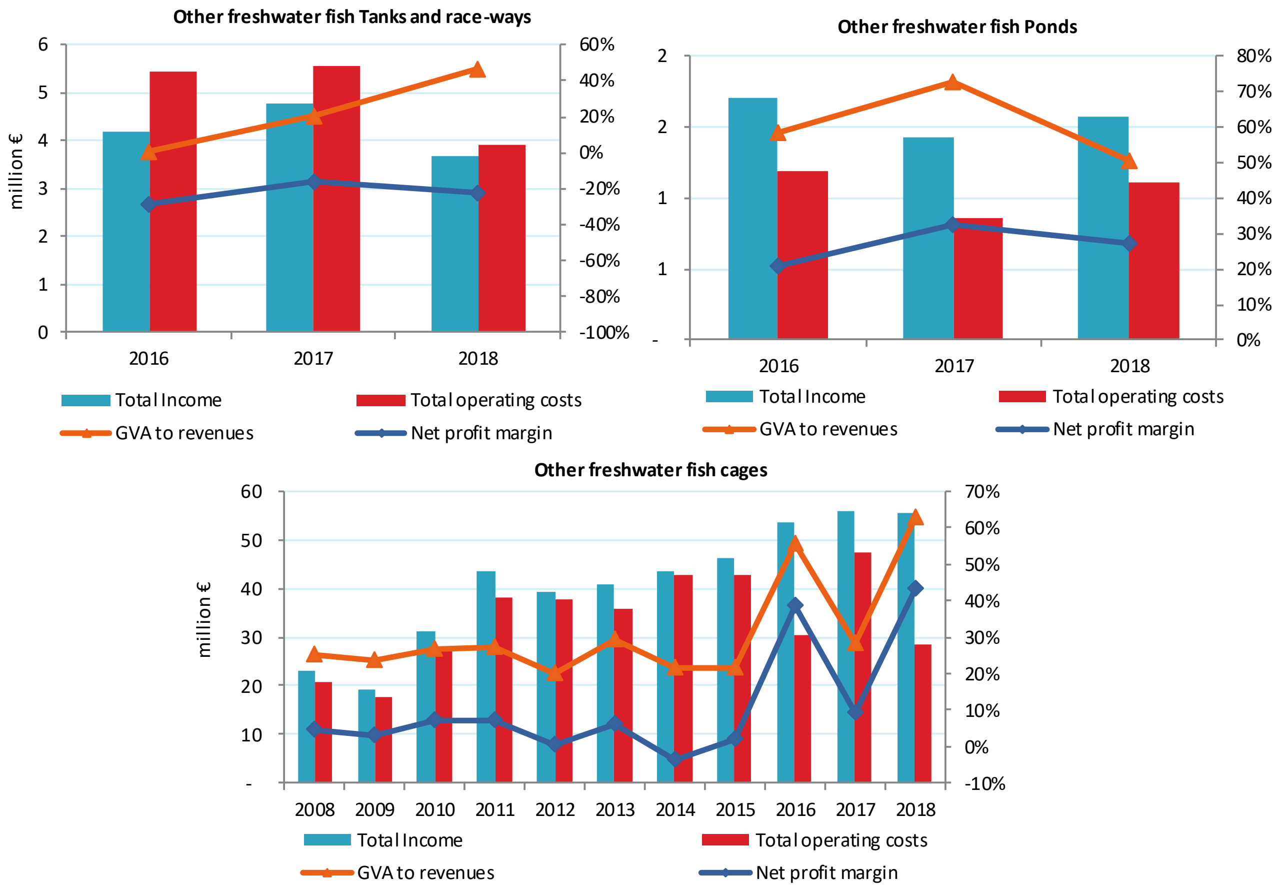
Segment 3: Other freshwater fish on growing

The third segment *Other freshwater fish on growing* is aggregated to be able to study development over time. The segment includes the previous segment *Trout on growing* as well as new EUMAP segments *Other freshwater fish tanks and raceways*, *Other freshwater fish ponds* and *Other freshwater fish RAS*. This segment contains all species of freshwater fish and aquaculture production both for stocking as well as consumption.

This is the second largest segment in terms of gross value added. In 2018, the segment produced 5% (700 tonnes) of total production and the total income accounted for 9% (€5.7 million). The production volume has varied over time with a peak at 2.0 thousand tonnes in 2014. However the production in 2018 was only 0.7 thousand tonnes. The low production is also reflected in a lower income (€5.7 million), gross value added (€3 million) and a negative profit (€-0.2 million). The low performance of this segment can have several causes. One of the causes may, to some extent, be correlated to the increase in segment 1. It can also be an effect of the change in segmentation where the farmers choose which segment represents the enterprise best. Some of the bigger enterprises tends to go towards combined systems where they have the whole chain from roe to fish for consumption, since the cage production is their largest production they will classify themselves as *Other freshwater fish cages*.

In 2018, the GVA to revenue showed an increase in segment 1 (Other freshwater fish cages) with a higher percentage than all previous years. Similarly, segment 2 (Other freshwater fish tanks and raceways) showed an increase in 2018 with a percentage higher than previous years. Segment 3 (Other freshwater fish ponds) has been relatively steady for the last three years. The net profit follows the same trend as GVA to revenues for segment 1 and 3 but for segment 2 it fluctuates over the years with a minor increase in 2017. Operating costs have been stable for segment 3 but total income peaked in 2016. Also, in segment 1 there are similar reports with higher income compared to operating costs and the opposite was observed in segment 2 (Figure 4.7.3).

Figure 4.26.3 Economic performance in € million, indicators for the main **Error! Reference source not found.** segments: 2008-2018.



Source: own elaboration from EU Member States DCF data submission

The operational cost structures for the main Swedish freshwater fish segments are presented in Figure 4.7.4 using EUMAP segmentation. Due to low number of enterprises and response rate, the segment *Other freshwater fish Recirculation systems* cannot be presented.

Segment: Other freshwater fish Cages

In 2017, the feed costs were the main cost component with 34% of total operating costs in this segment. Other operational costs amounted for 15% of the total costs in 2018 and wages and salaries amounted 25%. The energy costs are of minor importance, 2% of total operational costs are due to energy costs.

Segment: Other freshwater fish on growing

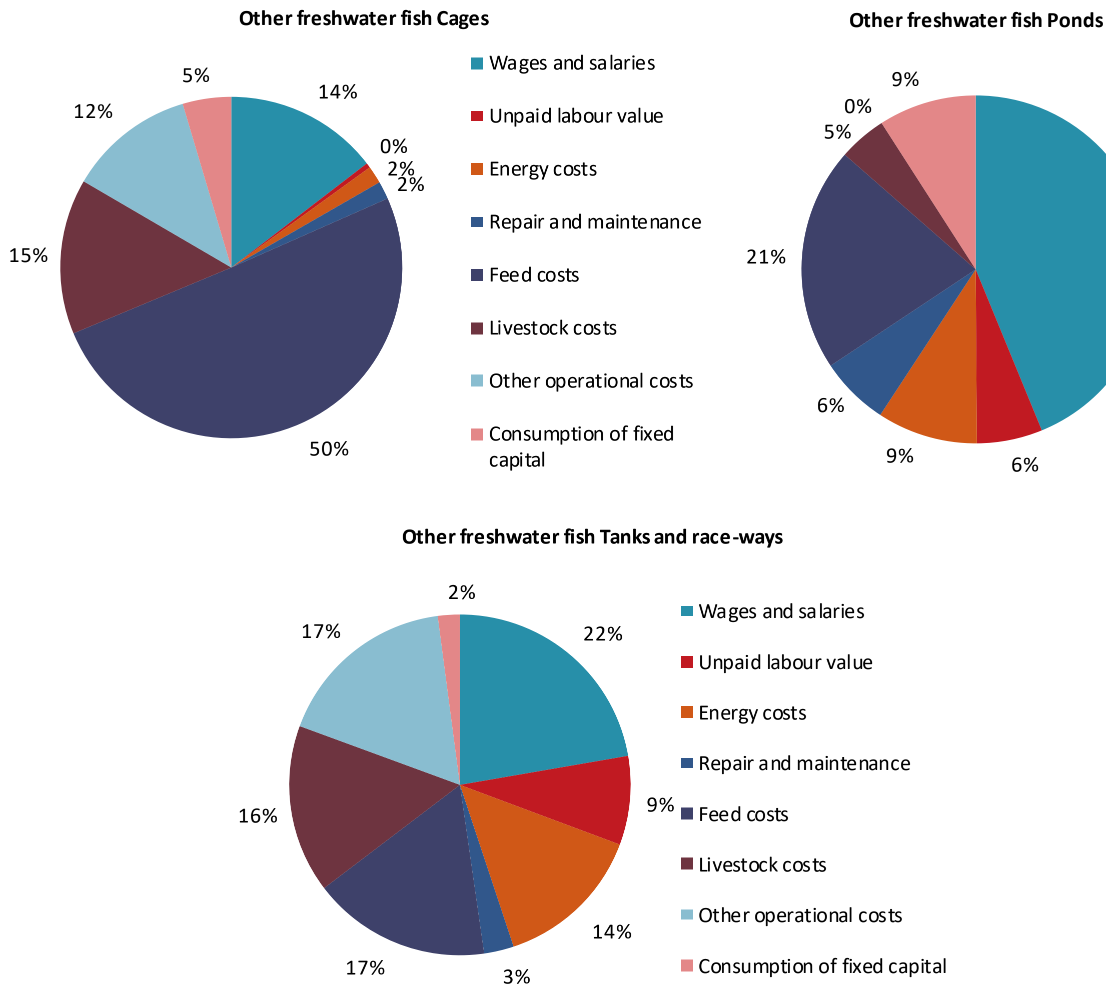
In this segment, the cost of salaries dominated with 24% of the total costs. The other main costs associated with this segment were feed, livestock, energy and other operational costs making up 62% of the total costs.

Segment: Other freshwater fish ponds

The segment Other freshwater fish ponds reported a cost of wages and salaries that presented near half (44%) of the total costs. Another major cost in this segment was feed costs (21%)

whereas unpaid labour, energy, repair and maintenance and other operational costs only represented a minor part of the costs.

Figure 4.26.4 Cost structure of the main segments in Sweden: 2017.



Source: EU Member States DCF data submission

4.26.5 Outlook

Nowcasts for 2019-20

In 2019 and 2020, the Swedish aquaculture sector is predicted to keep developing at a rate somewhat similar to previous years. The Swedish government has made it clear that there is a desire for the sector to have greater growth. Actions to facilitate that development are being taken in the form of additional funds to facilitate development as well as conducting an analysis on how to adapt regulations and simplify the administration of the aquaculture sector. The Covid-19 pandemic has a potential to affect the growth of the Swedish aquaculture sector in a negative way.

4.26.6 Trends and triggers

Market structure, current production trends and main drivers

The Swedish aquaculture sector has experienced an increase in volume of production. Over the last decades production levels have increased from 6 300 tonnes (2008) to 13 825 tonnes (2018). One explanation for the observed growth in production is likely related to structural changes in the aquaculture sector, where enterprises merge into larger units to benefit from economies of scale. Data since 2008 show that the number of enterprises have decreased, at the same time average production volumes has steadily been increasing.

Between 2013 and 2015, the increase in production stalled and a minor decrease was seen these years. However, in 2016 the production recovered and was higher than any previously reported year, this recovery was followed by a minor downturn in production for the following years 2017 and 2018. The downturn in 2017 and 2018 is most likely the result of permits expiring for a few enterprises coupled with disease outbreaks that had a negative impact on production. Most of the Swedish aquaculture production comes from a few large enterprises, there are however many small enterprises with a limited production.

Issues of special interest

There have also been incentives at national level to increase knowledge about the needs for sustainable aquaculture production and ways to promote it. According to regulations of the European Maritime and Fisheries Fund 2014-2020 (EMFF), member states are obliged to develop a national aquaculture strategy in order to increase the state of knowledge about aquaculture and address future needs in order to achieve sustainable production and more efficient policies. The Swedish Board of Agriculture, managing authority of the EMFF, developed a national strategy document (Svenskt vattenbruk - en grön näring på blå åkrar, in Swedish) with the objective to identify how the Swedish aquaculture sector can grow in the direction of economic and environmental sustainability to 2020, with the main challenge of combining economic, ecologic and social cohesion. Among other things, the strategy identified the importance of cooperation among different actors in the industry and the need of spatial planning and development of new production techniques. The national strategy for Swedish aquaculture constituted the main foundation for constructing a national action plan for sustainable development of Swedish aquaculture. The national strategy document is being revised during 2021 with the goal of creating a common strategy for the fishery and aquaculture sectors. As part of the revision, the action plan for Swedish aquaculture will be evaluated and updated to better suit the future needs of the sector.

Outlook for 2019 and 2020

Sweden's net imports of fish, crustaceans and molluscs were considerably higher than the production in 2018. Swedish aquaculture could gain a larger share of the domestic market, where demand for cultivated fish products is high.

There is an increasing demand for sustainably produced seafood from the public in Sweden. There are also political initiatives that aims at developing and increasing the Swedish aquaculture production. In 2017, the Government put forward an action plan stemming from "A National Food Strategy for Sweden – more jobs and sustainable growth throughout the country. 2016/17:104". The strategy lifts the potential of future aquaculture and concludes that "seafood and marine resources have the potential to meet increased demands. Areas of water should be made available for sustainable aquaculture, such as fish, shellfish, oyster and mussel farms, so as to strengthen the Swedish aquaculture industry". Aquaculture is included in the action plan and funds that will contribute to a sustainable development has been allocated. Funds have not been granted to enterprise investments but to projects that will help the whole industry to develop.

The Swedish aquaculture industry has received some major setbacks in 2017 and 2018 that will likely affect the future production in Sweden. Several farms has been denied new or increased environmental licenses due to new interpretations of the environmental legislation. Some were given the opportunity to change techniques to more environmentally friendly techniques but others are forced to close down. Due to these new verdicts in the Land and Environmental Court of Appeal, the largest production segment in Sweden (freshwater fish in cages) needs to change to more environmentally friendly techniques. This will require large investments and in the European Maritime and Fisheries Fund (EMFF) funds have been allocated to support environmental investments for aquaculture.

The Swedish aquaculture sector also face difficulties related to regulations and implementing new production techniques at a commercial scale. There is an ambition to increase aquaculture production using new sustainable production techniques, however, most of this work is still on project levels and has not reached commercial scales. The production of marine shellfish products is currently small in relation to freshwater production, although Sweden has significant production of organic mussels (KRAV).

An analysis of the impact of administrative burdens and governance has been conducted, as the results show a high burden for enterprises. Also, an investigation on how to adapt regulations and simplify administration was conducted during 2019 and the results were published in late 2020. The investigation identified multiple areas of improvement and the work is set to continue in 2021.

The sector is also facing potentially major setbacks to its development in 2020 and beyond due to the Covid-19 pandemic.

4.26.7 COVID-19 impact

The outbreak of Covid-19 resulted in the supply chains being exposed to great strain both nationally and internationally. In both Sweden and the EU, the Hotel Restaurant and Catering (Horeca) segment largely closed down at the beginning of the year. This also happened during late 2020 into early 2021. This has meant that industries with large exposure to Horeca have been affected very negatively, this includes the Swedish aquaculture sector.

For Swedish aquaculture, the closure meant a reduction in sales that varied in intensity during the year. During the spring, the decrease was about 30%, but improved gradually to a decrease of 15–25%. Then came the second wave of infection, which again generated a decrease. Since the impact of Covid-19 is global, the decrease in sales has also affected other countries. This has meant an increased supply of seafood products from abroad to the Swedish market. Increased supply has put pressure on prices and affected companies negatively. Despite low prices and an increase of seafood in general, both farmed and wild-caught, the loss within Horeca is not covered by increased retail sales, i.e., sales to retail companies have not increased in the corresponding volume that has decreased to Horeca. The problem of oversupply and the consequent lower prices risks remaining for a longer period even if the pandemic were to end as the recovery in demand from HoReCa can be expected to take time. Sweden also has no significant production of fish feed, which makes the industry vulnerable to restrictions concerning imports. Internationally, Swedish aquaculture companies state that they are still competitive in terms of both quality and production costs.

4.26.8 Data Coverage and Data Quality

Since 2011, the Swedish Board of Agriculture is responsible for compiling and reporting statistics on the aquaculture sector for the reported period together with the Swedish Agency for Marine Water Management. The Swedish Board of Agriculture in cooperation with Statistics Sweden conducted two questionnaires and a tax declaration survey for each year. Data was collected from both income tax declarations, administrative records and two questionnaires (Q1 and Q2), sent to all aquaculture farmers (Q1) and all aquaculture firms that have aquaculture as their main activity (Q2). In order to identify the segments, companies using more than one farming technique or growing more than one species, all production, incomes and costs were transferred to the main technique and main species based on turnover.

The questionnaire (Q1) is sent out to all aquaculture farm units and farm units are clustered into enterprises. For each enterprise, the value of sales from Q1 is compared to income as reported in the income tax declarations. Enterprises that have aquaculture as their main activity more than 50% (income from tax declarations/sales value from Q1) are considered to have their primary activity in aquaculture. These enterprises represent the population for questionnaire Q2 (the cost allocation key survey), derived from income tax declarations combined with Q2, for all aquaculture activity in Sweden.

The second questionnaire (Q2) is used to create a cost allocation key for costs that are not specified in income tax declarations, since production year 2016 (collected in 2018), it also includes social variables according to EUMAP. The response rate for Q2 was low, in order to increase response rate and data quality while lessening the administrative burden for enterprises the questionnaires were combined into one during 2019. The combined questionnaire is distributed yearly to all enterprises.

Data quality and availability

Data for the aquaculture sector is published once a year, in August the same year as the census.

Confidentiality

To avoid problems with confidentiality, segments should in general include more than 10 enterprises. Due to confidentiality problems the segment Other freshwater fish Recirculation systems is not reported in total since the response rate was too low

Differences in DCF data compared with other official data sources

Since data on aquaculture production is reported from the Statistics Sweden to Eurostat, there should be minor deviations in the production volumes as reported by Eurostat. Furthermore, since FAO, EUROSTAT data and DCF report data on production based on first sales the definition should not be an issue. Disparities may also arise due to updates in the data mainly due to changes in the number of active enterprises.

5 ESTIMATING THE IMPACT OF COVID-19 ON THE PERFORMANCE OF THE EU AQUACULTURE SECTOR

Beyond the public health consequences, pandemics have affected societies in many ways along the history, disrupting the social, political, and economic spheres (Garret, 2009; Duncan-Jones, 2018; Munro, 2004). Economic impacts may differ across countries and industries due to previous differences in terms of efficiency and resilience. However, the disruptions in the overall economy alter the market conditions causing shifts in the relations among quantities and prices, which finally reach the different economic activities in one way or another. Trade is then disrupted due to failures at different levels of the supply chains (Coibon et al., 2020). Financial markets are also seriously shocked because of the effects of a decrease in productivity on companies' revenues and the rapid growth in uncertainty. Concerning business performance, pandemics usually affect both labour and capital costs due to the combination of limited labour supply and the underuse of capital goods. In general, return on assets decreased while and after pandemic episodes (Jorda et al., 2020). The consequence of this decline is an increase in the propensity to save at the cost of investments. In this scenario companies suffer liquidity stress and limited access to credit due to the disruption in financial markets while decreased income compromises solvency (Baret et al., 2020).

Lockdown measures, put in play worldwide, have forced several companies to temporarily shut down (Nicola et al., 2020; Brodeur, 2020), with special impact on industries with large shares of temporary and self-employee workers like in many small-scale activities in the seafood industry. Fish production is considered an essential activity not subjected to lockdown, but a significant share of customer industries, especially in the hospitality services, had to, causing dramatic contractions in demand. Demand of food products initially rose, but preferences shift to preserved products and declining in perishable (Nicola et al., 2020). Fresh fish had faced the issues of delayed transports during lockdown having to release large amounts of production into the closest available market at whatever price (Love et al., 2020). Initially, the price at first sales of many fish products has fallen. Companies trading with frozen and preserved seafood and those with consolidated relations with retailers are better positioned for avoiding contractions in production (Love et al., 2020). However, small and medium scale aquaculture farms may have to decrease their activity for avoiding financial risks in a scenario of increasing costs.

After the initial shock of the COVID-19 in Europe, farmers who have been unable to sell their harvest have had to maintain large quantities of live fish, increasing their expenditure in feed. Other farmers have not been able to complete all necessary seasonal tasks such as fish breeding. This ultimately has increased costs and risks, especially when the supply of inputs has also been disrupted, and it is also likely to delay restocking and subsequent harvests. Species grown for export have been severely affected by the disruption of international logistics (FAO, 2020). Similar disruptions with serious impact on economic performance are also reported in the US aquaculture (van Senten et al., 2020).

Covid-19 effects on the aquaculture industry considerably differ across species and companies and thus, producing an accurate estimation of the current economic impacts becomes extremely difficult. Moreover, the pandemics and the associated uncertainty is still ongoing, and the evolution is still unpredictable. Secondary and qualitative sources have been used here for estimating the expected impact on the main performance indicators used in this report. Contacts based on questionnaires and interviews with stakeholders and experts provided the basis for understanding the specific cases affecting the various segments of the EU aquaculture and expected changes in the values and trends of the indicators of interest. This information conforms the basis of the findings and conclusions presented in the following sections.

5.1 Sources of information

Quantitative sources like surveys with statistically representative samples and systematic data collection are not yet available and producing such kind of study lies outside of the goals of this special chapter. Accurate estimations of the economic impacts of this pandemic will take time to be obtained with econometric modelling and may not be expected to be available until some years after the pandemic will be over. However, industry and policymakers require, at least, a picture of the situation to proceed with decision making under the less possible uncertainty. Despite limitations in statistical representativity, secondary and qualitative information sources provide fast access to the key data and issues and allow providing estimations of the main figures and trends. Secondary sources used in this chapter consist in reports, media releases and few statistical data, which were reviewed to identify the main issues of interest and trends.

Qualitative sources were used in the form of questionnaire-based interviews with selected stakeholders and experts voluntarily recruited. Two groups of interviews were undertaken with enterprises and representatives of Producers' Organizations on one side, and the national experts participating in the STECF working group of Aquaculture Economics. The first group consisted in 58 participants representing enterprises (65%) and producers associations (35%) who contributed replying to the questionnaire in 17 Member States (Belgium, Cyprus, Czech Republic, Estonia, Finland, France, Germany, Greece, Italy, Latvia, Lithuania, Netherlands, Poland, Portugal, Slovenia, Spain, and Sweden). The species covered in this group included carp, mussels, oyster, salmon, seabass, sea bream, and trout. The second group consisted of 20 experts covering other 17 EU countries. The expert's group was requested to provide a brief description of the observed impacts on their national aquaculture industries and participated in a Delphi survey in two waves for estimating the impact ranges in the same key performance indicators analysed with the producers' group.

<u>Results</u>

Total 58 respondents representing aquaculture enterprises (65%) and producers associations (35%) participated in the first group, contacted for the interview between January 1st to 31st 2021. Participants had to fulfil an online questionnaire including several questions about impacts on economic performance and main causes of impacts, plus other general questions about business characteristics and market position. Performance indicators varied in similar ways depending on whether they account for costs or incomes. Sales volumes, prices, turnover and total income show decreases while all cost items are pointed to have increased (Table 5.1). The same estimators were requested to the experts' group, resulting in the same expected trends.

Table 5.1. Variation estimates in the performance indicators obtained in the participating groups.

	PO's	Business	Experts	Average
Sales volume	-20.00	-15.71	-14.17	-16.63
Prices	-15.00	-3.89	-6.19	-8.36
Total income	-19.38	-20.50	-13.26	-17.71
Turnover	-21.25	-11.50	-11.61	-14.79
Total costs	8.75	5.79	6.56	7.03
Wages and Salaries	0.00	6.84	1.43	2.76
Raw materials	5.33	4.21	5.67	5.07
Energy costs	8.13	2.63	4.63	5.13
Repair and Maintenance	4.38	6.32	5.41	5.37
Employment	-5.71	5.26	0.91	0.15

Sales volumes show the large decreases in all groups, with an average 16.7% decrease. Representatives of the producer's organizations (PO's) resulted in the maximum decrease estimate, reduced about 5 percentage points in the group of enterprises and experts. Greater differences can be seen in the case of decreases in prices and turnover, where the estimate provided by the producer's representatives respectively accounts for triple and double the figures provided by enterprises and experts. Total income and turnover result in the largest average decrease as a consequence of the corresponding decreases in sales and prices. In this case, the biggest estimate corresponds to the enterprises, 20.5%, while experts provided a smaller 13.2% decrease. Costs are estimated to have increased but to a lower extent than the decrease in the income sources. The main average variations are found in the costs of raw materials, energy costs and repair and maintenance, with increases around 5% in all the three cases. The results regarding variations in employment are contradictory, probably resulting from a multiplicity of different situations in different methods of production across countries.

The experts' panel was requested to provide also additional estimates for the main aquaculture segments (table 5.2).

Table 5.2. Variation estimates in the performance indicators by main aquaculture segments

	Marine	Shellfish	Freshwater	Average
Sales volume	-3.40	-19.05	-10.34	-10.93
Prices	-3.84	-3.81	-5.55	-4.40
Total income	-8.66	-14.50	-12.30	-11.82
Turnover	-6.48	-13.66	-10.29	-10.14
Total costs	5.52	2.78	7.88	5.39
Wages and Salaries	1.20	0.69	2.15	1.35
Raw materials	2.49	2.72	6.39	3.86
Energy costs	1.60	2.12	4.88	2.87
Repair and Maintenance	3.76	3.93	3.85	3.85
Employment	-0.25	2.55	0.13	0.81

Shellfish appears to be the segment with the stronger negative impacts on the income sources, but costs, in contrast, show the lower increases. The decline in the demand of fresh shellfish due to lockdown may have contributed to enhance the negative impacts on sales and prices. On the other hand, not having dependency on feed offers an advantage in raw material costs. However, this segment combines species well differentiated in terms of production and markets, and these figures may significantly change when moving across species and production systems. Marine aquaculture, on the other side, shows the smaller decreases of the three segments, being turnover and income the main negative indicators. The magnitude of the impacts on freshwater aquaculture are in the middle of the other two segments. The drop in prices appears bigger than in shellfish and marine aquaculture. The increase in total costs is also the largest of the three segments, with raw materials and energy costs as the most affected item

The five most important reasons reported by producer's organizations and enterprises to explain the economic impacts of the COVID-19 were, in this order, the lower sales at markets due to the lower demand from hotels and restaurants, the loss of key customers such as school or traditional markets, the loss of markets due to the absence of tourists, the loss of international markets and the loss of buyers (middlemen), all of them affected by the disruption of the lockdown and the close of commercialization channels.

5.2 Specific issues and cases

The specific impacts reported by the national experts' panel show significant differences across species and regions. At species level, consistently with the estimates obtained with the participating groups, shellfish, marine and freshwater farming differ in the magnitude of the impacts. However, there are also important differences within these segments. Some of these come from the intrinsic product attributes, the different markets targeted, and the dominant supply chains of every species. Producers selling to processors and retail outlets were less affected than those with large shares of restaurants and other hospitality business in their customer's portfolios. Large scale farmers with alliances and long-term contracts with retail chains have stand much better than small scale farms with stronger dependency on local markets and restaurants. However, in general, the small raise in household demand does not cover the losses in sales from the inactivity of the hospitality industry causing cash flow constrains and putting in risk the solvency of many companies. Beside these factors, alternative production systems, national and regional specific conditions, and the heterogeneous implementation of the mitigation measures, show different levels of impacts within the same species. However, a few common issues and trends across Member States can be identified.

Al segments suffered the consequences of the lockdown of the hospitality industry in more or less extent. Southern European Member States have also seen the touristic season lost, with a direct impact on seafood sales and consumption. Besides the contraction in local demand seafood trade suffered disruptions and prices in the international market went down due to an excess of supply, increasing competition from imported products, adding pressure to domestic producers. Salmon and trout farmers in Denmark, Sweden and, Finland have seen their sales and prices affected by competition from Norwegian salmon, which have also experienced an important contraction in global demand. With the prices falling, the costs of finfish farmers, whether marine or freshwater, increased since many farmers have been forced to stock their livestock for longer periods due to the contraction in domestic demand. Same issues affected the Greek seabass and seabream industry, with an excess of supply in the domestic market, increasing price competition with Turkey in the international market and constrains in their exports by air. The implementation of new safety rules in the processing plants also affected trade by reducing labour efficiency. Reduced demand from international customers also affected the Portuguese exports of flatfish.

Lockdown consequences differed across shellfish species. Mussels demand in Spain were affected by the lockdown and farmers increased their sales to the processing industry, partially recovering the decrease in the demand for fresh mussels. However, increased competition from Chilean imports negatively affected the price. In Ireland, Bottom mussel sector was relatively unaffected and rope mussel fresh sales recovered after summer. On the other hand, oysters in France suffered the consequences of the lockdown in the autumn of 2020, but sales at supermarkets remained stable. However, winter season resulted in a decrease of consumption by about 20% due to the limitations in the number of allowed participants in meetings. Similar fall was suffered in the same period in the Netherlands due to the second lockdown.

Augmented export constrains and disruptions prevented carp trade across countries in Central and Eastern Europe. These limitations on trade resulted in oversupply at domestic markets in Poland, the Czech Republic, and Bulgaria, with significant decreases in the prices, but prevented German producers from competition allowing them sustaining a premium price. However, even in this scenario of limited competition the German freshwater farming industry, including salmonids, suffered a significant decrease in sales of around 20%.

5.3 Summary

The Covid-19 outbreak has shocked the economic activities and aquaculture is not an exception. The results from the different studies with the selected groups point to a decrease in all income sources and an increase in all cost items. The most affected segment appears to be shellfish, at least in the decrease of incomes, as costs have not increased as much as in the other segments. Freshwater aquaculture follows in the rank of impacted segments and marine farming stands as the less affected industries. Although the important differences across species, industries and countries, the combination of decreased incomes and increased costs always puts profitability at risk. In experts' opinion, the situation will be overpassed when the pandemic will be finally under control. However, this perception may change if the pandemic and the mitigation measures persist longer in time.

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6 NOWCAST ESTIMATION OF A SELECTION OF INDICATORS TO 2019 AND 2020

6.1 Background

For the first time in the report on the economics of aquaculture in Europe, a nowcast exercise is to be conducted. Carrying out the nowcast for aquaculture is a considerable challenge, considering that the availability of official statistics on aquaculture at the European level and in other supranational organizations and global databases is lower than in other activities such as fisheries or fish processing.

However, on this occasion, the results of the estimates for 2019 and 2020, despite their limitations, will be especially useful, considering the economic situation caused by COVID-19 during 2020. This methodology is applied to make a preliminary attempt of the nowcasting exercise, which could be improved in upcoming reports.

6.2 Scope

The scope of the nowcast for this first attempt is limited to estimate the production in volume (Total weight of sales), the production in value (Gross sales), and the employment (both persons employed and persons employed FTE) at national level for EU aggregate series.

This exercise is inspired in what has already been done for the report on fleet economics, and follows the recommendations and principles for estimation of the main variables for EU aggregates approved by the STECF plenary in 2019. In addition, as far as possible, we try to apply the same estimation principles defined for imputation on missing data.

6.3 Nowcast relations in economic indicators

The exercise of defining a nowcasting methodology to analyse the economic activity of aquaculture in the EU has started with the search for possible variables for the estimation in 2019 and 2020.

- First of all, it has been confirmed that the explanatory variables used in the imputation methodology only have information available until 2018.
- Secondly, the variables to be nowcasted (production in quantity and value and employment) have been searched in alternative sources, or a proxy (closely connected) of them, without positive results.
- The third step has been the identification of variables whose evolution may be a proxy for the evolution of aquaculture activity, with data available for 2019 and 2020. Among others:
    - The production of juveniles and eggs have been considered (Eurostat) to estimate the production of sea and fresh water aquaculture (Eurostat) at country level with one year and two years lags.
    - The evolution of nominal GDP (Eurostat) has been considered to estimate the turnover of aquaculture at country level (DCF).
    - The evolution of the number of employees in fishing and aquaculture (NACE Rev 2: Code A03) and in agriculture, fishing and aquaculture (NACE rev 2. Section A. Codes: 01, 02 and 03) have been considered to estimate the evolution of employment in aquaculture (DCF) at national level.

  For these variables, a preliminary descriptive analysis of the estimation errors has been carried out. The application of these estimators to the 2008-2016 period has shown significant differences between the estimated values at the country level, and the real data provided by MS through the DCF. This preliminary analysis suggests a low nowcasting accuracy.

This first stage has highlighted the challenge posed by nowcasting in aquaculture. Availability of the variables under analysis for 2019 and 2020 in alternative sources has not been identified, except some figures for production volume and value in 2019 in Eurostat. Neither alternative variables whose evolution can approximate the evolution of the nowcasted variables have been located.

In the case of aquaculture, the number of aquaculture farms is not available in an official register updated to 2019 and 2020. Even if such a registry existed, it would not be as effective alternative variable as in the case of the number of vessels in fishing, given the differences in terms of number of productions units, size, production scale, production technology, etc., which may exist between companies within the same aquaculture segment, even within the same company.

In this context, estimates for 2019 and 2020 are based on the evolution of EUMAP, Eurostat, national public bodies' data and estimates, and the results of the survey Impacts of Covid-19 on the aquaculture activity. The estimations are qualified by experts attending the EWG meeting. The nowcasting is completed with qualitative information from different secondary sources (industry reports, producer organizations, etc.) provided by experts and from experts' own experience. This qualitative information is especially useful for the nowcasting in 2020, for which there is still very little final or estimated official information available, and to understand what is the evolution of the situation at segment and species levels.

The methodology developed for the nowcast is described in Annex II

6.4 Nowcast output and coverage

The information obtained during the EWG has allowed a quantitative nowcast at national level in 2019, based on data from EUMAP, Eurostat and final and estimated data from national public bodies provided by the experts. In the case of the weight of sales and gross value we have been able to estimate all the countries with the exception of Hungary, Slovakia and Sweden. This means that the nowcasting coverage for 2019 is equivalent to 97% and 98% of the production volume and value in 2018, respectively. In the case of employment, the availability of data has been lower and the nowcast coverage decreases to 81% and 65% in the case of employees and FTE, respectively.

In the case of 2020, the data obtained are mainly estimates, and for a very small number of countries, which does not allow for a quantitative nowcast like the one carried out in 2019. In this case, the qualitative information provided by the experts, and the results of the survey on the economic impact of covid-19 on aquaculture, are essential for the nowcast.

6.5 Nowcast results

The results of the nowcast for national totals in 2019 are included and analysed in the EU overview chapter. The results of the nowcast for 2020 are analysed in the special chapter on Covid-19 and in the corresponding section about nowcast in each national chapter produced by the experts.

Below are the quantitative results of the estimates made for 2019 and 2020, as well as the sources of information used to determine the imputation factors.

The tables below present the results of the nowcasting for the total weight of sales in 2019 and 2020 and the information sources used to calculate the estimation factors in 2019 and 2020. Cells shaded in blue and red indicate final and estimated data, respectively.

Country	2018	2019	2020
AUT	3.991	4.153	Nonowcast
BEL	111	86	Nonowcast
BGR	11.361	12.828	9.644
HRV	19.680	20.443	Nonowcast
CYP	7.437	8.179	Nonowcast
CZE	21.751	20.990	Nonowcast
DNK	55.902	62.291	56.062
EST	505	568	Nonowcast
FIN	11.862	12.650	Nonowcast
FRA	222.447	244.449	Nonowcast
DEU	30.875	35.370	Nonowcast
GRC	130.782	127.143	Nonowcast
HUN	15.119	Nonowcast	Nonowcast
IRL	37.201	38.204	38.716
ITA	150.299	156.612	Nonowcast
LVA	1.025	689	Nonowcast
LTU	3.750	4.197	4.106
MLT	19.291	13.823	Nonowcast
NLD	58.884	40.628	Nonowcast
POL	39.293	42.415	Nonowcast
PRT	11.768	11.475	Nonowcast
ROU	13.626	14.233	Nonowcast
SVK	2.224	Nonowcast	Nonowcast
SVN	1.951	2.153	Nonowcast
ESP	329.730	318.452	Nonowcast
SWE	13.825	Nonowcast	Nonowcast

Country	2018	2019	2020
AUT	Eurostat	Eurostat	Nonowcast
BEL	Eurostat	Eurostat	Nonowcast
BGR	EU-MAP	EU-MAP	EU-MAP
HRV	EU-MAP	EU-MAP	Nonowcast
CYP	Eurostat	Eurostat	Nonowcast
CZE	Eurostat	Eurostat	Nonowcast
DNK	EU-MAP	National Data	National Data
EST	Eurostat	National Data	Nonowcast
FIN	EU-MAP	EU-MAP	Nonowcast
FRA	National DaTa	National DaTa	Nonowcast
DEU	Eurostat	Eurostat	Nonowcast
GRC	National Data	National Data	Nonowcast
HUN		Nonowcast	Nonowcast
IRL	National Data	National Data	National Data
ITA		Nonowcast	Nonowcast
LVA	National Data	National Data	Nonowcast
LTU	National Data	National Data	National Data
MLT	Eurostat	Eurostat	Nonowcast
NLD	DCF	DCF	Nonowcast
POL	Eurostat	National Data	Nonowcast
PRT	EU-MAP	Eurostat	Nonowcast
ROU	DCF	DCF	Nonowcast
SVK		Nonowcast	Nonowcast
SVN	Eurostat	Eurostat	Nonowcast
ESP	National Data	National Data	Nonowcast
SWE		Nonowcast	Nonowcast

The following tables below present the results of the nowcasting for the gross sales in 2019 and 2020 and the information sources used to calculate the estimation factors in 2019 and 2020. Cells shaded in blue and red indicate final and estimated data, respectively.

Country	2018	2019	2020
AUT	26.411.558	30.639.539	Nonowcast
BEL	841.346	538.207	Nonowcast
BGR	30.491.416	35.632.273	26.928.683
HRV	120.046.793	120.760.937	Nonowcast
CYP	45.325.566	50.847.992	Nonowcast
CZE	45.180.711	38.339.474	Nonowcast
DNK	205.946.841	227.910.887	205.199.798
EST	2.028.354	1.789.966	Nonowcast
FIN	78.890.018	76.459.669	Nonowcast
FRA	886.495.281	927.257.581	Nonowcast
DEU	102.114.179	115.088.914	Nonowcast
GRC	556.290.755	527.320.541	Nonowcast
HUN	31.258.421	Nonowcast	Nonowcast
IRL	179.455.531	174.974.333	173.687.964
ITA	380.259.459	407.638.140	Nonowcast
LVA	4.412.257	4.372.039	Nonowcast
LTU	12.476.037	13.436.711	13.020.747
MLT	242.684.445	161.912.201	Nonowcast
NLD	99.962.691	72.587.919	Nonowcast
POL	112.472.183	1.119.349.432	Nonowcast
PRT	96.805.539	90.327.873	Nonowcast
ROU	51.784.811	51.951.322	Nonowcast
SVK	5.485.893	Nonowcast	Nonowcast
SVN	6.540.674	6.698.710	Nonowcast
ESP	719.315.463	701.859.075	Nonowcast
SWE	63.461.469	Nonowcast	Nonowcast

Country	2018	2019	2020
AUT	Eurostat	Eurostat	Nonowcast
BEL	Eurostat	Eurostat	Nonowcast
BGR	EU-MAP	EU-MAP	EU-MAP
HRV	EU-MAP	EU-MAP	Nonowcast
CYP	Eurostat	Eurostat	Nonowcast
CZE	Eurostat	Eurostat	Nonowcast
DNK	EU-MAP	National Data	National Data
EST	Eurostat	Eurostat	Nonowcast
FIN	EU-MAP	EU-MAP	Nonowcast
FRA	National DATa	National DATa	Nonowcast
DEU	Eurostat	Eurostat	Nonowcast
GRC	National Data	National Data	Nonowcast
HUN		Nonowcast	Nonowcast
IRL	National Data	National Data	National Data
ITA		Nonowcast	Nonowcast
LVA	National Data	National Data	Nonowcast
LTU	National Data	National Data	National Data
MLT	Eurostat	Eurostat	Nonowcast
NLD	DCF	DCF	Nonowcast
POL	Eurostat	National Data	Nonowcast
PRT	EU-MAP	Eurostat	Nonowcast
ROU	DCF	DCF	Nonowcast
SVK		Nonowcast	Nonowcast
SVN	Eurostat	Eurostat	Nonowcast
ESP	National Data	National Data	Nonowcast
SWE		Nonowcast	Nonowcast

The following tables below present the results of the nowcasting for the persons employed in 2019 and 2020 and the information sources used to calculate the estimation factors in 2019 and 2020. Cells shaded in blue and red indicate final and estimated data, respectively.

Country	2018	2019	2020
AUT	408	Nonowcast	Nonowcast
BEL	13	Nonowcast	Nonowcast
BGR	1.082	Nonowcast	Nonowcast
HRV	1.289	1.360	Nonowcast
CYP	454	Nonowcast	Nonowcast
CZE	1.500	Nonowcast	Nonowcast
DNK	568	568	568
EST	41	Nonowcast	Nonowcast
FIN	453	472	Nonowcast
FRA	15.416	17.523	Nonowcast
DEU	1.824	1.814	1828
GRC	3.584	3.498	Nonowcast
HUN	2.260	Nonowcast	Nonowcast
IRL	1.952	1.961	1981
ITA	4.761	Nonowcast	Nonowcast
LVA	235	323	Nonowcast
LTU	408	424	419
MLT	320	Nonowcast	Nonowcast
NLD	307	Nonowcast	Nonowcast
POL	8.731	8.613	Nonowcast
PRT	1.652	Nonowcast	Nonowcast
ROU	1.965	2.191	Nonowcast
SVK	615	Nonowcast	Nonowcast
SVN	187	187	Nonowcast
ESP	18.586	15.133	Nonowcast
SWE	412	Nonowcast	Nonowcast

Country	2018	2019	2020
AUT			Nonowcast
BEL			Nonowcast
BGR			Nonowcast
HRV	EU-MAP	EU-MAP	Nonowcast
CYP			Nonowcast
CZE			Nonowcast
DNK	EU-MAP	National Data	National Data
EST			Nonowcast
FIN	EU-MAP	EU-MAP	Nonowcast
FRA	National Data	National Data	Nonowcast
DEU	EU-MAP	National Data	National Data
GRC	EU-MAP	EU-MAP	Nonowcast
HUN			Nonowcast
IRL	National Data	National Data	National Data
ITA			Nonowcast
LVA	National Data	National Data	Nonowcast
LTU	National Data	National Data	National Data
MLT			Nonowcast
NLD	DCF		Nonowcast
POL	National Data	National Data	Nonowcast
PRT	EU-MAP		Nonowcast
ROU	DCF	DCF	Nonowcast
SVK			Nonowcast
SVN	EU-MAP	EU-MAP	Nonowcast
ESP	National Data	National Data	Nonowcast
SWE			Nonowcast

The following tables below present the results of the nowcasting for the persons employed in 2019 and 2020 and the information sources used to calculate the estimation factors in 2019 and 2020. Cells shaded in blue and red indicate final and estimated data, respectively.

Country	2018	2019	2020
AUT	245	Nonowcast	Nonowcast
BEL	8	Nonowcast	Nonowcast
BGR	892	Nonowcast	Nonowcast
HRV	1.085	1.138	Nonowcast
CYP	405	Nonowcast	Nonowcast
CZE	900	Nonowcast	Nonowcast
DNK	399	399	399
EST	34	Nonowcast	Nonowcast
FIN	320	320	Nonowcast
FRA	9.883	9.413	Nonowcast
DEU	1.424	Nonowcast	Nonowcast
GRC	3.338	3.278	Nonowcast
HUN	1.362	Nonowcast	Nonowcast
IRL	1.086	1.082	1.040
ITA	1.609	Nonowcast	Nonowcast
LVA	182	175	Nonowcast
LTU	245	255	252
MLT	258	Nonowcast	Nonowcast
NLD	277	Nonowcast	Nonowcast
POL	5.238	Nonowcast	Nonowcast
PRT	796	Nonowcast	Nonowcast
ROU	1.965	1.967	Nonowcast
SVK	369	Nonowcast	Nonowcast
SVN	121	Nonowcast	Nonowcast
ESP	6.730	6.720	Nonowcast
SWE	284	Nonowcast	Nonowcast

Country	2018	2019	2020
AUT			Nonowcast
BEL			Nonowcast
BGR			Nonowcast
HRV	EU-MAP	EU-MAP	Nonowcast
CYP			Nonowcast
CZE			Nonowcast
DNK	EU-MAP	National Data	National Data
EST			Nonowcast
FIN	EU-MAP	EU-MAP	Nonowcast
FRA	National Data	National Data	Nonowcast
DEU	EU-MAP		Nonowcast
GRC	EU-MAP	EU-MAP	Nonowcast
HUN			Nonowcast
IRL	National Data	National Data	National Data
ITA			Nonowcast
LVA	National Data	National Data	Nonowcast
LTU	National Data	National Data	National Data
MLT			Nonowcast
NLD	DCF		Nonowcast
POL			Nonowcast
PRT	EU-MAP		Nonowcast
ROU	DCF	DCF	Nonowcast
SVK			Nonowcast
SVN	EU-MAP		Nonowcast
ESP	National Data	National Data	Nonowcast
SWE			Nonowcast

6.6 Nowcast methodology development for Aquaculture economic indicators

In the case of aquaculture, although this first approach to a nowcast methodology is limited both in the number of indicators addressed and in the estimation methodology, the results show the usefulness of this exercise to increase the information provided to policy makers and the rest of the end users of the report.

The work to carry out the first nowcast has highlighted the importance of experts work to obtain quantitative information for the nowcast at t+1, and the difficulty of making a quantitative nowcast based on secondary sources for the period t+2.

In order to provide information for the management of aquaculture in the EU, future reports should improve the nowcasting methodology and information collection to support the nowcast analysis.

In future EWGs, the results of the nowcast would improve if the nowcast had a preparatory work, in line with the work carried out this time for data collection for the special chapter on COVID-19. This preparatory work would allow to obtain from experts final and estimated quantitative and qualitative data for t+1 and t+2.

7 SOCIO-DEMOGRAPHICS OF THE EU AQUACULTURE SECTOR

The social variables that should be collected for the aquaculture enterprises are listed in table 6 - Social variables for the fishing and aquaculture sectors from the COMMISSION DELEGATED DECISION (EU) 2019/910, establishing the multiannual Union programme for the collection and management of biological, environmental, technical and socioeconomic data in the fisheries and aquaculture sectors.

According to Art. 6 (b) from the COMMISSION DELEGATED DECISION (EU) 2019/910 Social data shall be collected every three years starting in 2018 by collecting data for 2017. In order not to leave space for interpretation which should be the first year for collection of data, PGECON 2019 agreed that social data should be collected every three years starting in 2018 when the first data was collected covering year 2017 until further experience has been gained from both end users and experts.

Member states have provided social data for 2017 and part of the MS reported data also for 2018, which was not obligatory. This is the first year of reporting social data. Thus, this report presents a snapshot in time and cannot examine trends, which may be possible in future reports.

The social variables collected are: Employment by gender, FTE by gender, Unpaid labour by gender, Employment by age, Employment by education level, Employment by nationality, Employment by employment status and FTE National. Furthermore, under the economic data collection the following employment variables are collected, which is listed in table 7 - Economic variables for the aquaculture sector in the regulation: Number of persons employed, Unpaid labour and Number of hours worked by employees and unpaid workers.

The Commission Decision does not require stratified data or combined variables, however PGECON recognised that reporting social variables at more disaggregated levels rather than at national totals and the reporting combined variables would add value to the social analysis. PGECON workshop reports from Vilnius (2017) and Athens (2018) provide recommendations on how the social data could be reported at a more disaggregated level.

The following categories for social variables were recommended:

- Age categories: <=14, 15-24, 25-39, 40-64, >=65, unknown.
- Education categories: High, Low, Medium, unknown.
- Gender categories: Female, Male, unknown.
- Nationality categories: national, EEA, EU, non-EU/EEA, unknown.
- Employment status: Employee (which can be disaggregated into Employee full time, Employee part time), Owner, unknown.

PGECON recommended that social data should be reported for the total population and that the sampling strategy and sampling size should be reported.

The analysis for 2017* includes data provided by 17 countries under the 2020 EU-MAP data call – Bulgaria, Croatia, Germany, Greece, United Kingdom, Denmark, Finland, France, Ireland, Latvia, Malta, Netherlands, Portugal, Romania, Slovenia, Spain and Sweden.

*France provided social data only for 2018, but due to the stability of the social data, the EWG 20-12 agreed to impute the social data provided by France despite the different year.

Member states collected social data at different levels. Some member states collected data at enterprise level and they were able to report the total numbers for each variable, others at employee level, which led to the possibility to report combined variables. Similar to the economic data collection under DCF, member states used different sampling strategies (e.g. census, probability sample survey, non-probability sample survey or combination between the strategies).

Table 7.0 MS providing social data for 2017 aquaculture enterprises during 2020 data call.

Country	Gender	Age	Education	Nationality	Employment status
BGR	Y	Y	Y	Y	Y
DEU	Y	Y	Y	Y	Y
DNK	Y	Y	Y	Y	Y
ESP	Y	Y	Y	Y	Y
FIN	Y	Y	Y	Y	Y
FRA*	Y	Y	Y	Y	Y
GBR	Y	Y	Y	Y	Y
GRC	Y	Y	Y	Y	
HRV	Y	Y	Y	Y	Y
IRL	Y	Y**	Y	Y	Y
LVA	Y	Y	Y	Y	Y
MLT	Y	Y	Y	Y	Y
NDL	Y	Y	Y	Y	Y
PRT	Y	Y	Y	Y	Y
ROU	Y**	Y**	Y**	Y**	Y**
SVN	Y	Y	Y	Y	Y
SWE	Y	Y	Y	Y	Y

Source: MS data submissions under the 2020 Aquaculture data call and elaboration by the EWG.

The table contains data from the countries delivering data before the deadline[20].

*Data refers to 2018,

**Data was in different format and was excluded from EU overview.

EWG 20-12 noticed the following discrepancies:

Romania reported the social data, but all the variables were in a format which was not comparable with the rest of the MS. The data was excluded from the EU overview and MS comparison.

Ireland provided the data by age in different categories than the agreed during PGECON and the data was excluded from the EU overview and MS comparison.

Portugal and Romania provided revised social data after the EWG meeting.

[20] Italy submitted social data after the deadline, and therefore it could not be analysed by the working group. A preliminary inspection of the Italian social data shows that data were disaggregated by main segments (i.e., Sea bass & Sea bream in Cages, Sea bass & Sea bream in Tanks and race-ways, Trout in Tanks and race-ways, clam On-bottom, and mussel Longline). Overall, it shows that 98% are Italian nationals and from other EU countries, 1% from EEA countries and 1% from non EU/EEA countries. The majority of the workers are also owners (70%). The majority of the workers are male, with about 90% in terms of FTE. The age group 40-64 years is predominant with 56%, followed by 25-39 years with 32%, both 15-24 years and over 64 end with 6% each. The low education level is predominant with 70%, followed by medium 27% and high 23%.

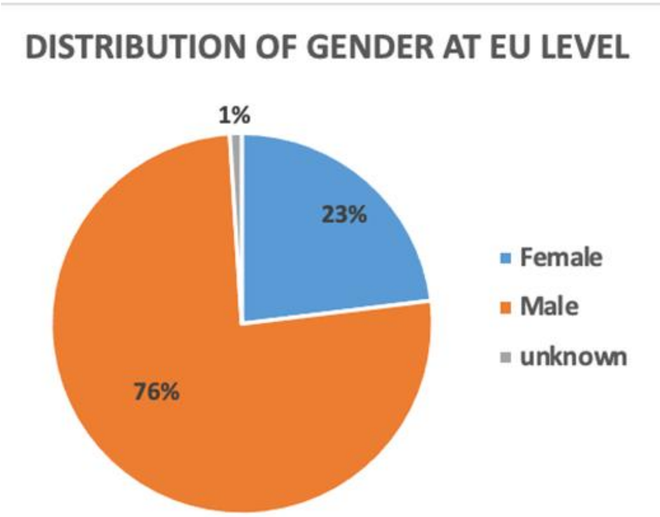
Different MSs have different understanding of the variables employment status, so comparison between all MSs was not possible. Denmark, Spain and Malta reported the employment status as employee, owner and unknown; Finland, France, United Kingdom and Netherlands provided data disaggregated by employee and owner; Bulgaria and Ireland provided data for full time and part time employment; Croatia reported data for employee, employee full time, employee part time and owner; Latvia provided data as employee full, employee part, owner and unknown; Portugal and Slovenia reported the variable as employee full, employee part and owner; Sweden divided data into owner and unknown and Germany reported data as full time employee, part time employee, apprentice and employee (including unpaid (family) labour).

In the following, the social data from the data call is analysed and commented. However, it should be born in mind that this is the first time where these data are systematically collected and analysed. Furthermore, the experts at this meeting are economists and therefore data is analysed from that perspective and not from other social science perspectives, which may change the interpretation for some of the variables.

7.1 Gender

The proportion of male in the aquaculture enterprises was 76%, while the female proportion was 23% and only 1% of the employees were reported as unknown.

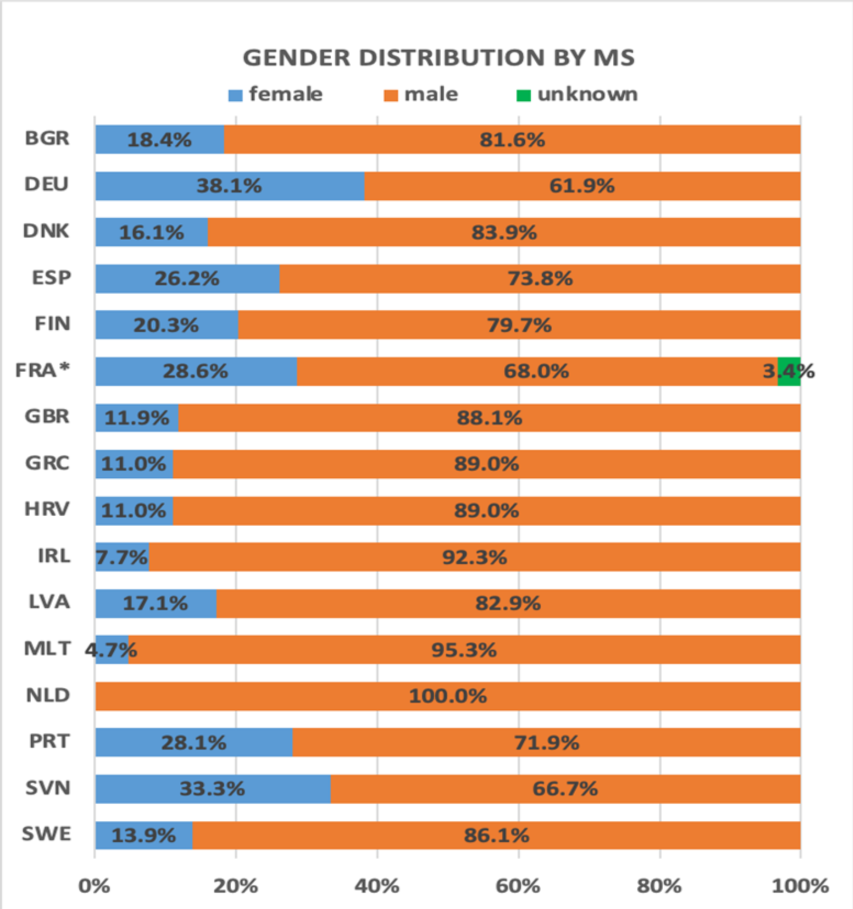
Figure 7.1.1: Gender distribution in EU, 2017



Source: MS data submissions under the 2020 aquaculture data call and elaboration by the EWG.

Seventeen countries provided data for the gender variable. The percentage of female employees in the different MSs varied between 0% in the Netherlands and up to 38% in Germany. Only France used the option ‘unknown’, however the overall percentage is minor (3.4%).

Figure 7.1.2: Gender distribution by MS, 2017



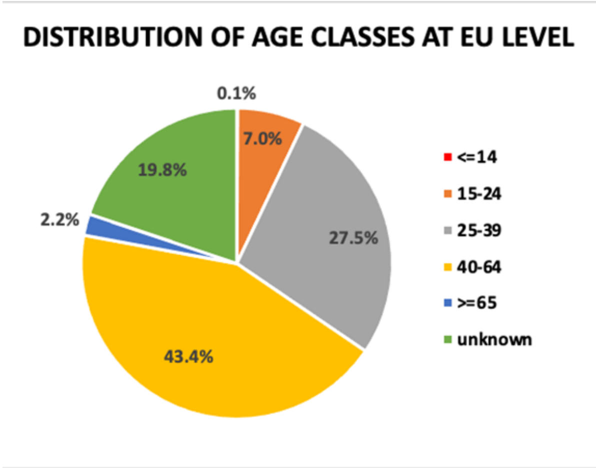
Source: MS data submissions under the 2020 aquaculture data call and elaboration by the EWG.

*Data refers to 2018.

7.2 Age

Most member states collected age-data based on the proposed age categories provided by PGECON. However, some member states used their own age categories and a few member states collected actual ages of individuals and assigned employees to one of the age groups or used their own categories. As example, Ireland provided the data distribution on age classes, but some of the classes did not correspond to the PGECON recommendation.

Figure 7.2.1: Age distribution in EU, 2017

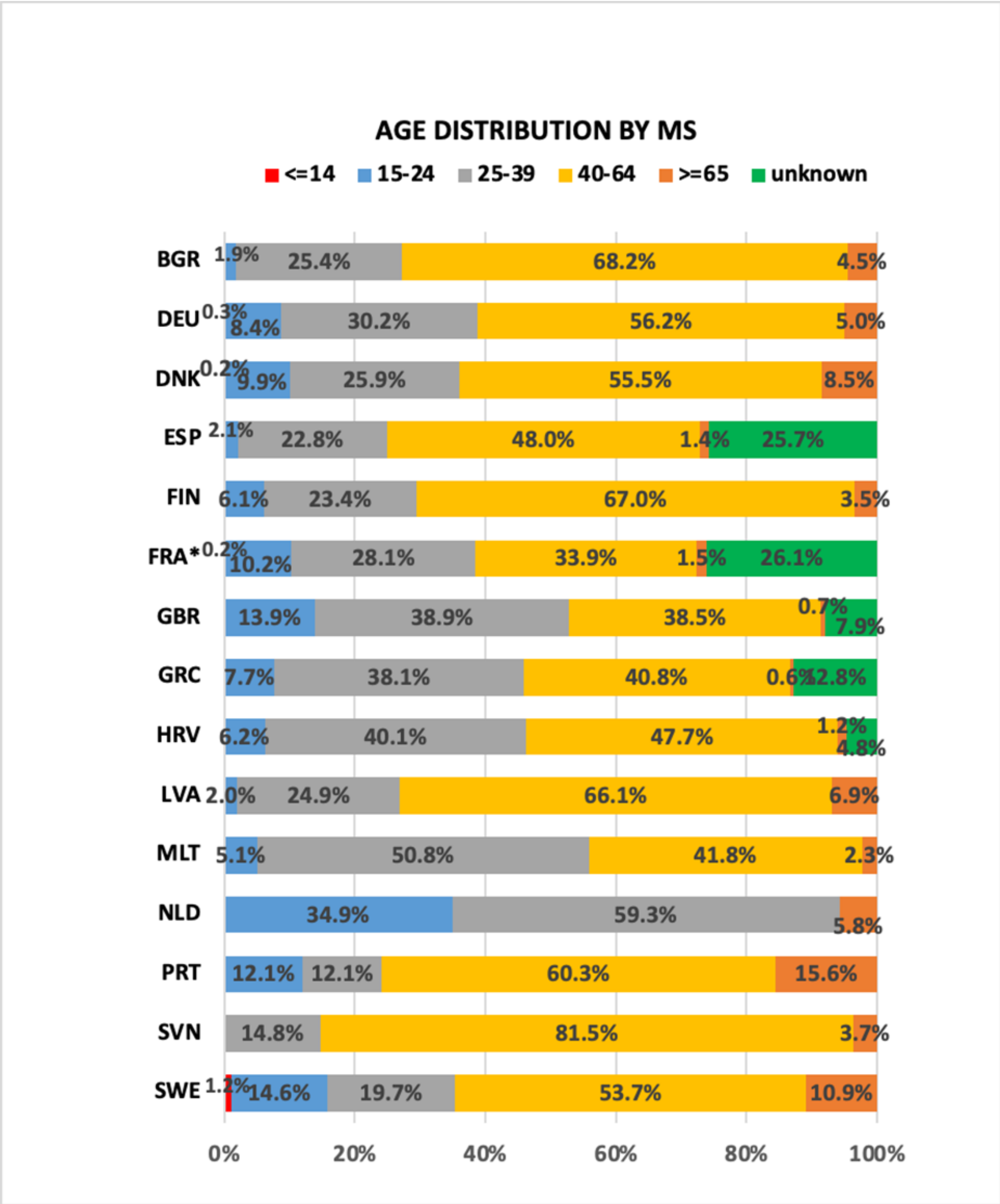


Source: MS data submissions under the 2020 Aquaculture data call and elaboration by the EWG.

The 40-64 age class made up the largest proportion (43.4%) of people employed in the EU aquaculture sector, followed by the 25-39 age class (27.5%). A further 7% were apportioned to the 15-24 age class, 2.2% to the over 65 years category, 0.1% to the 14 or less age category and 19.8% were unknown.

It should be noted, that in comparison with the fisheries and the fish-processing sector the percentage of people in the 40-64 age class is lowest in the aquaculture sector. The 40-64 age class made up the largest proportion (58%) of people employed in the EU fishing fleet (STECF-19-03) and made up the largest proportion (50%) of people employed in the processing industry (STECF-19-15). However, in order to keep the consistency between the requirements for the three sectors, EWG 20-12 recommends for the future, to split the age group 40-64 into smaller groups, which will ensure a more detailed analysis of the age class variable.

Figure 7.2.2: Age distribution by MS, 2017



Source: MS data submissions under the 2020 Aquaculture data call and elaboration by the EWG. *Data refers to 2018.

The percentage of the age group 40-64 is highest in Slovenia (81.5%), Bulgaria (68.2%) and Latvia (66.1%). Over 59% of the employees in Netherlands were in the age class 25-39, followed by 50.8% in Malta and 40.1% in Croatia. The highest percentage of employees over 65 years is in Portugal and Sweden – 15.6% and 10.9%, respectively.

7.3 Education

Member states were required to report education by categories low, medium, high, and unknown.

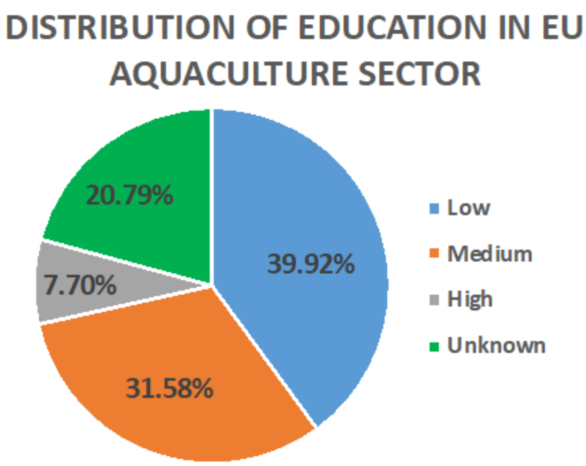
The education level categories required were based on the International Standard Classification of Education (ISCED) academic qualification classifications. For more information on the ISCED levels included in the age, categories see the Table 7.3.1.

Table 7.3.1: ISCED Academic qualification categories

ISCED code	**ISCED Educational attainment levels**	**Education Level**
1	Primary	Low
2	Lower Secondary School	
3	Upper Secondary School	Medium
4	Post-secondary non-tertiary education	
5	Short-cycle tertiary education	High
6	Bachelor's or equivalent level	
7	Master's or equivalent level	
8	Doctoral or equivalent level	

Overall, the data analysed demonstrates that 39.9% of people employed in the EU aquaculture sector only had a low level of education, followed by 31.6%, which had a medium level education. Only 7.7% had a higher-level education. More than 20% of the education level was reported as unknown.

Figure 7.3.1: Education distribution in EU, 2017



Source: MS data submissions under the 2020 Aquaculture data call and elaboration by the EWG

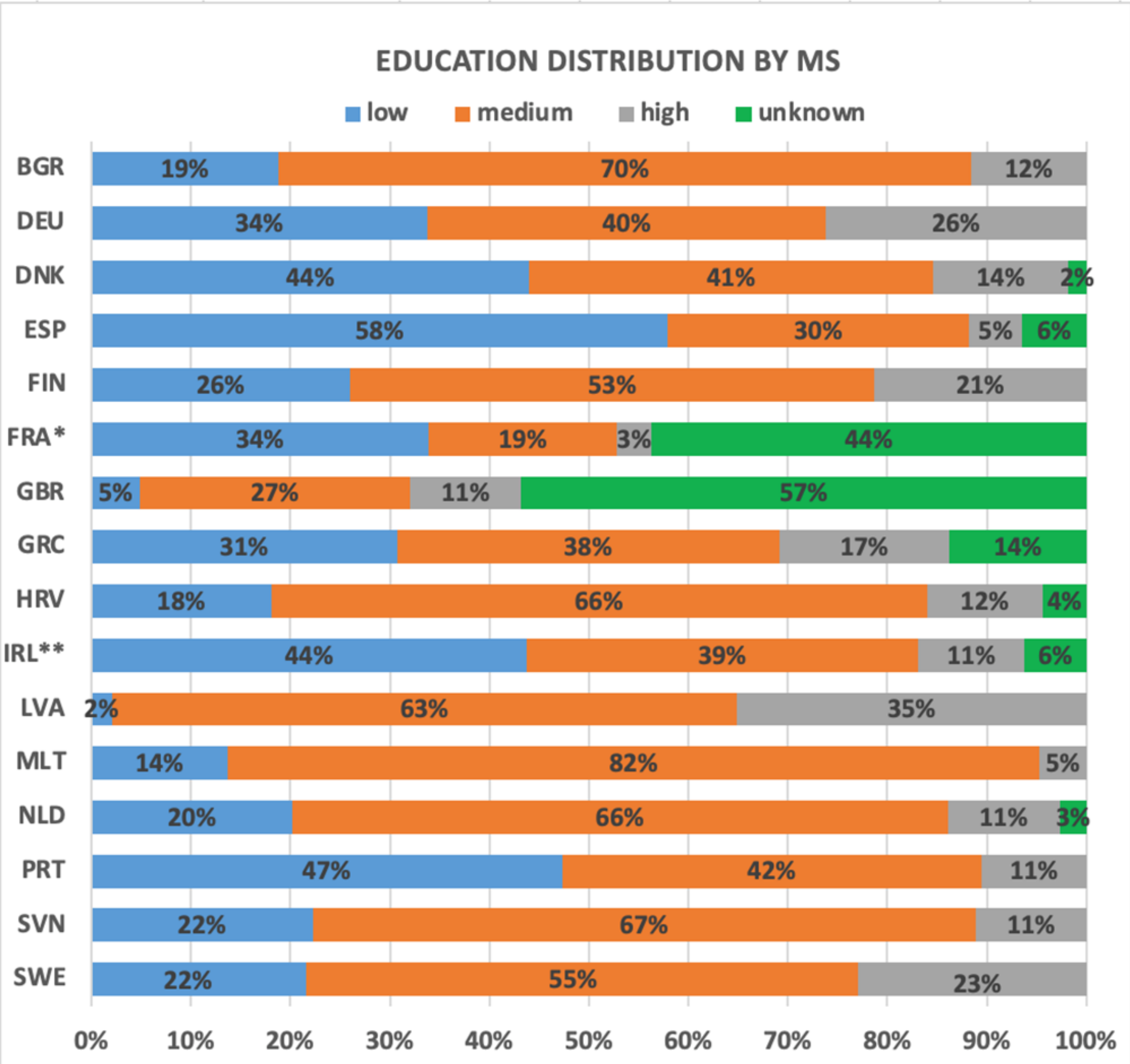
During the 2020 Aquaculture data call, 17 MSs provided the data regarding the education level.

Ireland provided the distribution by education level but the classes do not correspond to data submitted by other MS, so they were converted to be comparable with the other MS.

The percentage of the higher education group is highest in Latvia (35%), followed by Germany (26%), Sweden (23%) and Finland (21%). 58% of the employees in Spain, 47% of Portuguese and 44% of Irish employees had a low education level.

The largest percentage distribution is for the medium education level. With medium education are 82% of the employees in Malta, 70% in Bulgaria, 67% in Slovenia, 66% in Croatia and in Netherlands. The comparison with the fisheries and processing industry was not possible for this variable, because in both sectors the percentage of unknown was much higher than in the aquaculture enterprises.

Figure 7.3.2: Education distribution by MS, 2017



Source: MS data submissions under the 2020 Aquaculture data call and elaboration by the EWG

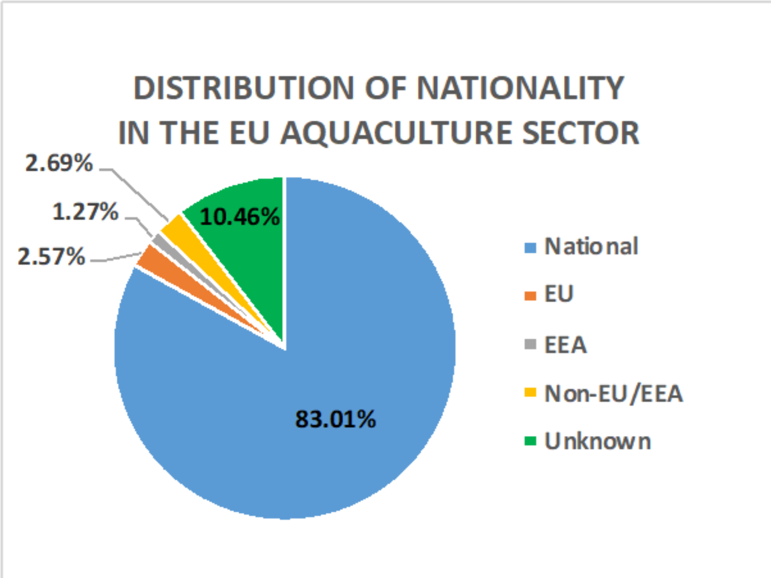
*Data refers to 2018.

**Ireland provided education in different categories than agreed by PGECON, so they were converted as follow: PrimaryEd to Low, SecondaryEd to Medium, ThirdEd to High and Other to Unknown

7.4 Nationalities

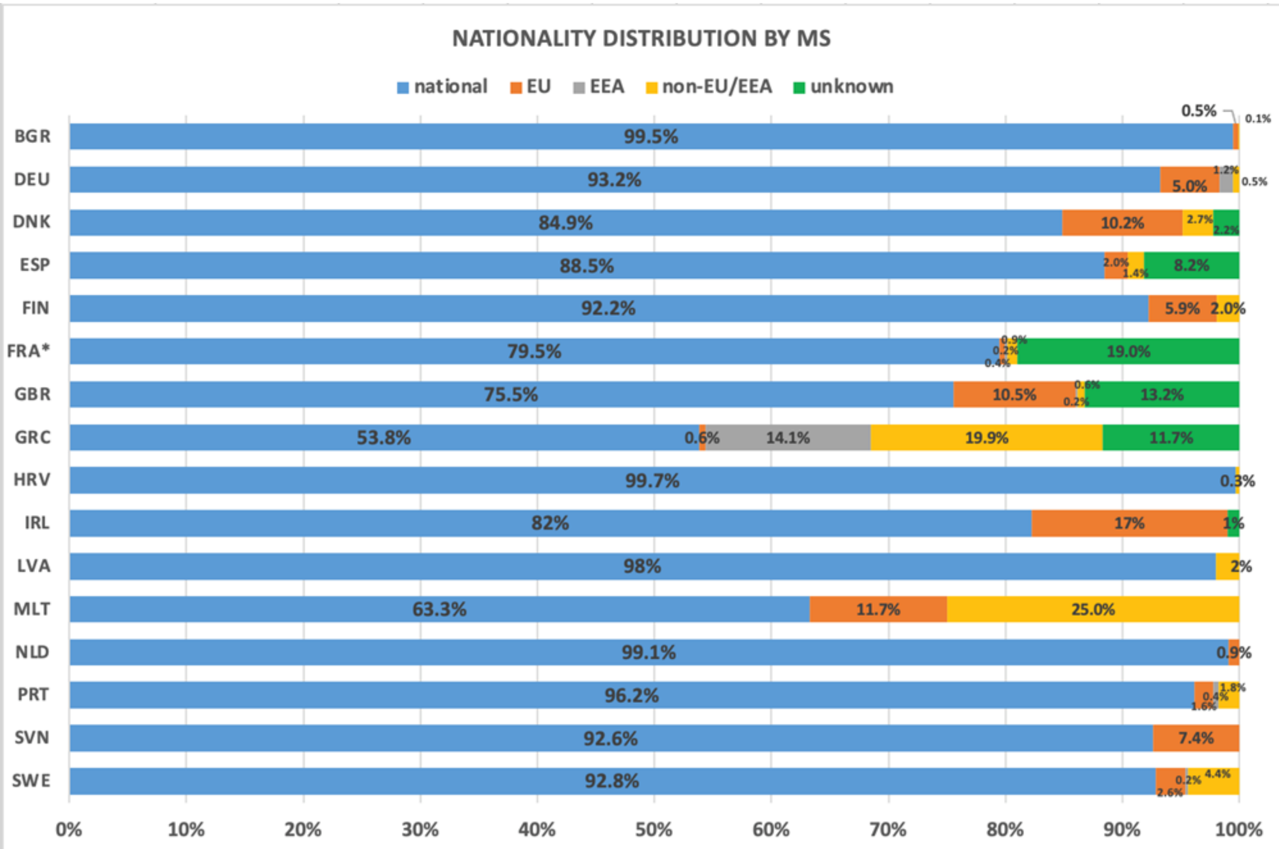
For all member states, it was required to report social data by nationality group. The nationality groups used were: Nationals, EU, EEA, non-EU/EEA and unknown.

Figure 7.4.1: Nationality distribution in EU, 2017



Source: MS data submissions under the 2020 Aquaculture data call and elaboration by the EWG

Figure 7.4.2: Nationality distribution by MS, 2017



Source: MS data submissions under the 2020 Aquaculture data call and elaboration by the EWG

*Data refers to 2018.

The majority (83%) of people employed in the EU aquaculture sector were nationals of their own country, followed 2.7% from non-EU/EEA nations, 2.6% from EU, 1.3% from EEA and 10.5% of the employees were with unknown nationality.

The situation in the aquaculture sector is relatively similar to the EU fishing fleet (STECF-19-03) where the majority of people employed were nationals of their own country (85.9%) and with the fish processing industry with 83% (STECF-19-15).

In all the MS, the national employees are the main employees. The proportion of nationals varied from 99.5% in Bulgaria to 53.8% in Greece. The other workers are mainly from EU MS. The percentage of the unknown in MS was always less than 20%.

7.5 Socio-demographics by production technology

Aquaculture is not a homogeneous industry but uses a wide set of production technologies. Different technologies might for example require employees with different educational levels. To highlight such differences, the social data is provided by technology.

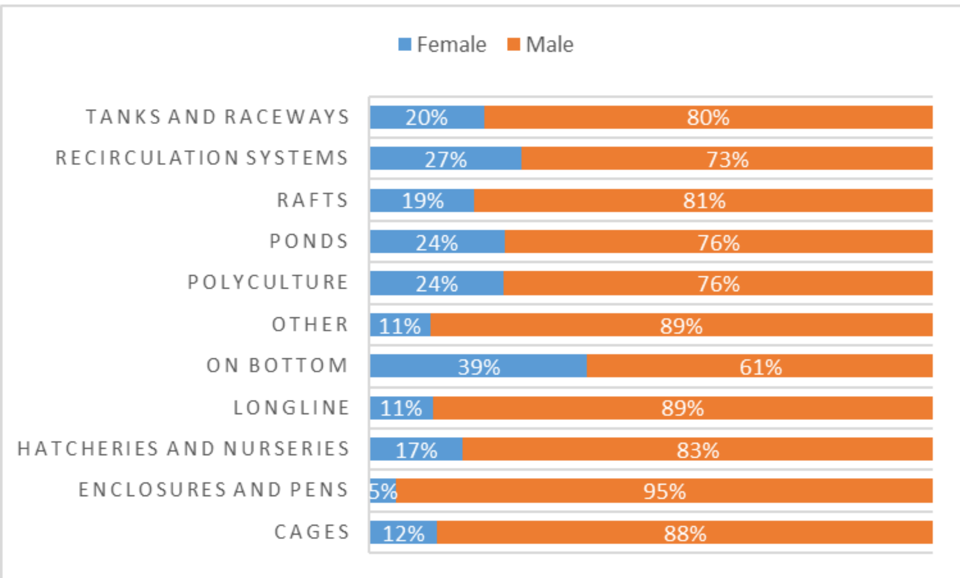
The following countries have provided input on production technologies: Bulgaria (BGR), Germany (DEU), Denmark (DNK), Spain (ESP), UK (GBR), Greece (GRC), Croatia (HRV), Ireland (IRL), Latvia (LVA), Netherlands (NLD), Slovenia (SVN), and Malta (MLT).

Gender

Starting with gender, the sector on average employs 77% male and 23% female. The male domination is consistent overall production technologies although differences occur. The technology with highest share of female is On bottom mussel production with 39% female and 61% male. On bottom is a commonly used technology with over 5 000 employed persons primarily located in Spain.

The gender distribution by production technology is provided in figure 7.5.1 below.

Figure 7.5.1. Gender distribution by production technology



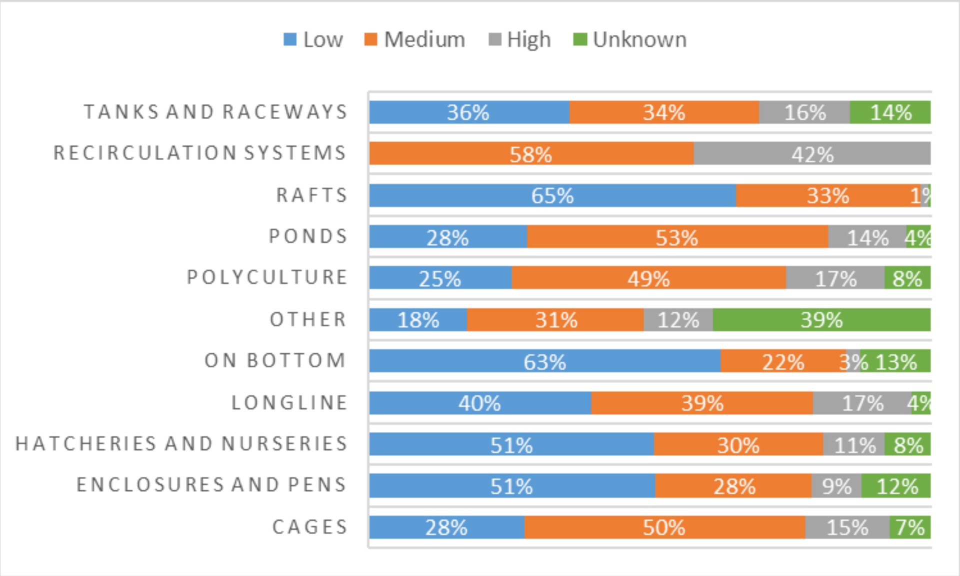
Source: MS data submissions under the 2020 Aquaculture data call and elaboration by the EWG

Education level

On average, 39.9% if the employees in the aquaculture industry have low education and 7.7% have high. However, the educational level differs among production technologies. Four technologies (enclosures and pens, hatcheries and nurseries, on bottom, and rafts) are primarily employing persons with low education (more than 50%).

On the other hand, recirculation systems only employ high or medium skilled workers. It should, however, be noted that recirculation system is a small segment compared to the others and the shares are therefore uncertain. Other technologies with a low share of low educated employees are ponds (28%), polyculture (25%), other (18%), and cages (28%).

Figure 7.5.2. Educational level by production technology



Source: MS data submissions under the 2020 Aquaculture data call and elaboration by the EWG

Age

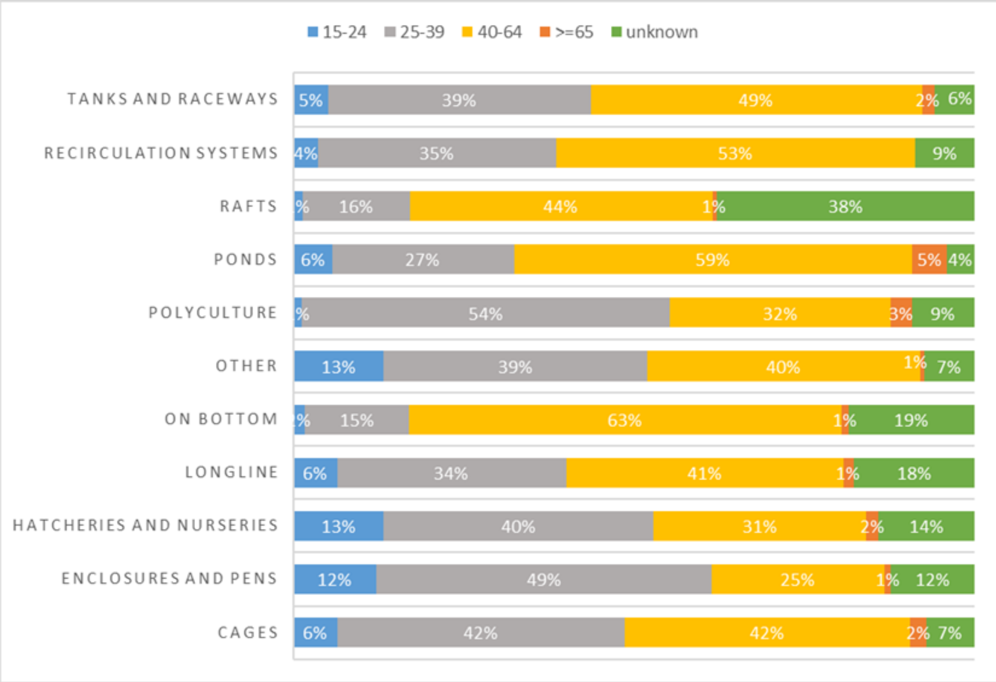
The most common age category is 40-64 years and this is the case for most production technologies as well. This is expected since this is the category with the widest age range (25 years).

The technology with highest share in this age category is On bottom (63%), which also has a low share of younger persons employed (note that On bottom was also characterized by low education and large share of female employees).

Polyculture, hatcheries and nurseries, enclosures and pens, and cages are examples of production technologies that have high shares of young people.

The age distribution by technology is presented in figure 7.5.3.

Figure 7.5.3. Age distribution by production technology.



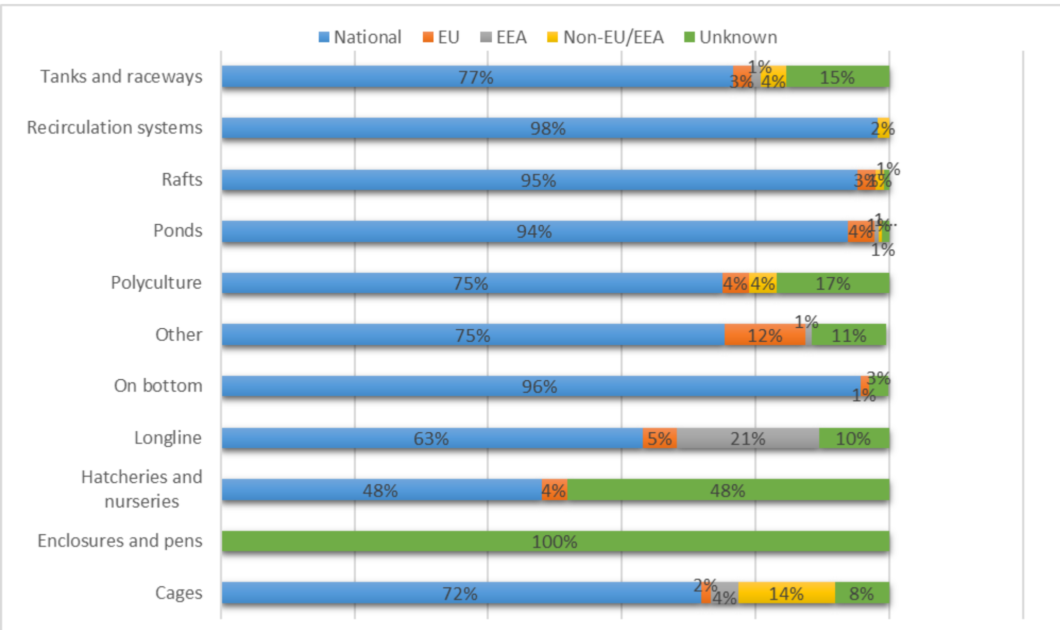
Source: MS data submissions under the 2020 Aquaculture data call and elaboration by the EWG

Nationality

Persons from their respective home nations dominate employment in all production technologies. Most technologies employ only a few percentages from outside the nation. An exception is the longline technology where 21% is from the EEA countries.

In figure 7.5.4 below, the nationality is provided by production technology.

Figure 7.5.4. Nationality by production technology.



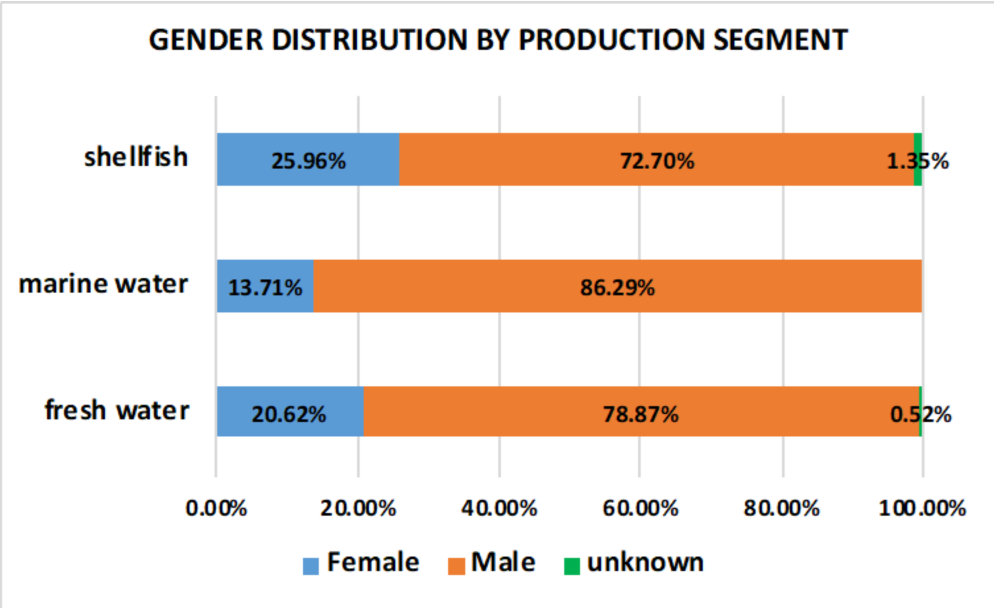
Source: MS data submissions under the 2020 Aquaculture data call and elaboration by the EWG

7.6 Socio-demographics by production sector

The socioeconomic variables are further presented by production sectors or main species groups, in other words if production is of freshwater finfish, marine finfish or shellfish. The following countries have reported data on the production sector: Bulgaria (BGR), Germany (DEU), Denmark (DNK), Spain (ESP), France (FRA), UK (GRB), Greece (GRC), Croatia (HRV), Ireland (IRL), Latvia (LVA), Malta (MLT), Portugal (PRT), the Netherlands (NLD), Sweden (SWE), and Slovenia (SVN).

The employment by gender and production sector presented in figure 7.6.1, showed that females are representing between 14 and 26% of the employees in the aquaculture enterprises. Male employees are dominating in the three sectors, representing 86% in the marine water enterprises, followed by 79% in the freshwater and 73% in the shellfish. The percentage of unknown is negligible, with 1.35% in the shellfish and 0.52% in the freshwater farms.

Figure 7.6.1. Gender distribution by production sector.

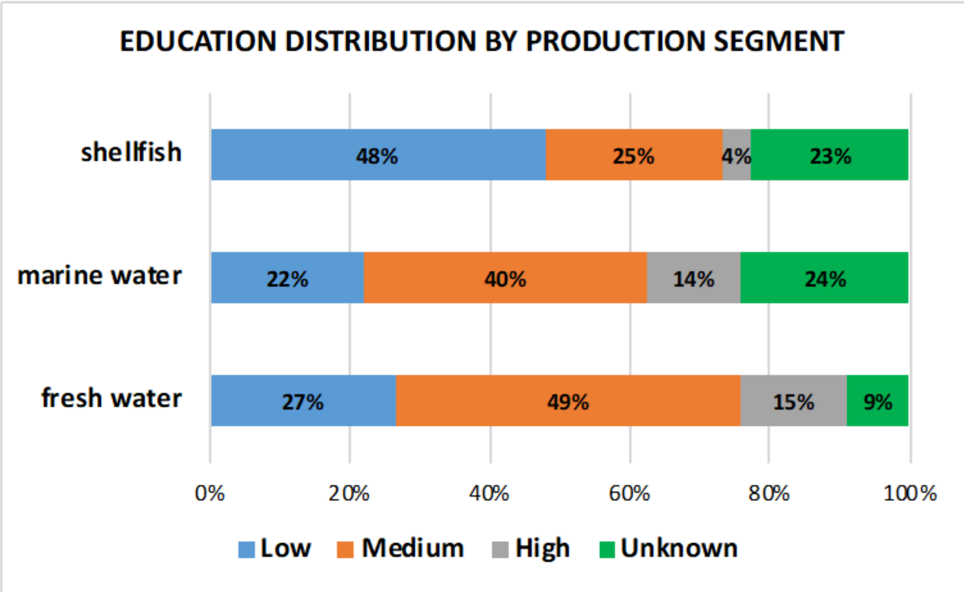


Source: MS data submissions under the 2020 Aquaculture data call and elaboration by the EWG

From all the social variables, collected under the 2020 Aquaculture data call, the education is the one showing highest fluctuations between the different production sectors. While in the marine water and in the freshwater the employees with low education are 22% and 27%, the percentage of lower educated persons in the shellfish is twice higher (48%). The medium educated employees are mainly in the freshwater enterprises (49%), followed by marine water (40%) and shellfish with 25%. The high educated employees are covering almost the same percentage in fresh water and marine water – 15% and 14% respectively, while in the shellfish farms they are just 4%. The level of unknown is relatively high in the shellfish and marine water (23% and 24%), while in the freshwater it is only 9%.

The education level by production sector is presented in figure 7.6.2 below.

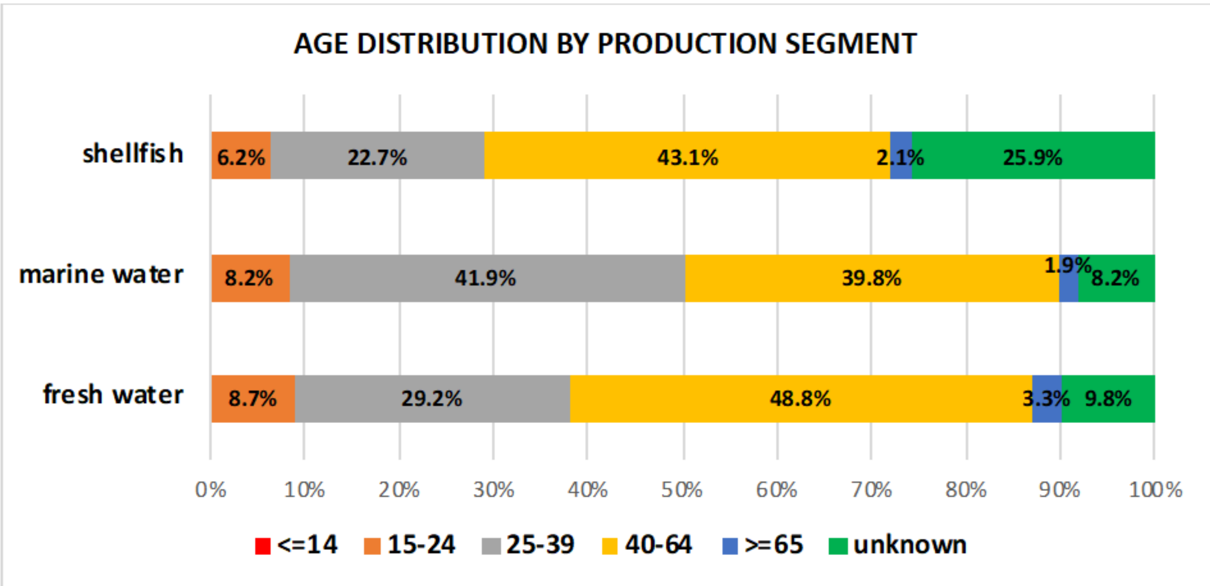
Figure 7.6.2. Education level by production sector



Source: MS data submissions under the 2020 Aquaculture data call and elaboration by the EWG

The major share of the employees in the shellfish and freshwater sector are between 40 and 65 years, while in the marine water enterprises the percentage is highest of the people between 25-39 years. 25.9% in the shellfish are with unknown age, followed by 9.8% for the freshwater and 8.2% for the marine water farms.

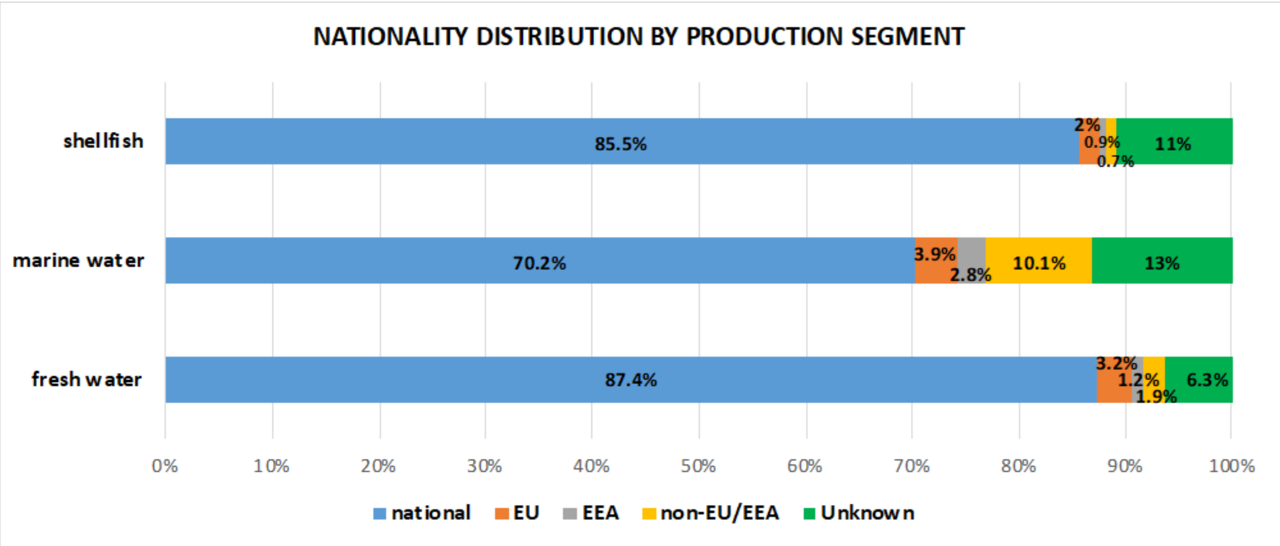
Figure 7.6.3. Age by production sector



Source: MS data submissions under the 2020 Aquaculture data call and elaboration by the EWG

In the three sector, the nationals from the MS are the main employees. The percentage of nationals is highest in the freshwater enterprises (87.4%), followed by shellfish (85.5%). The rest of the categories (EU, EEA and non-EU/EEA) are modestly presented, except the non-EU/EEA employees in the marine water sector (10.1%). The percent of unknown is under 14% for all the sectors. The nationality of the employees is presented by production segments in figure 7.6.4.

Figure 7.6.4. Nationality by production sector



Source: MS data submissions under the 2020 Aquaculture data call and elaboration by the EWG

7.7 Main conclusions and data issues

The main conclusions and issues identified by the EWG 20-12 during the analysis of the first social data submitted for the aquaculture sector under EU-MAP are:

- Gender: 76% of the persons employed in the sector are male, and thus European aquaculture is clearly gender biased. This differs from the processing industry, which shows an equal gender distribution. The large share of male is prevalent in all member states and in all production technologies, however, the shellfish segment employs a higher percentage of female workers.
- Age: The age class 40-65 constitutes about 43% of total employment, which is similar to the processing industry (50%) and fisheries (58%). It is the largest age class for most member states, as well as for both marine and freshwater production. The 25-39 age class covered 28%, whereas the 15-24 age class only covered 2%. Furthermore, 20% was reported as unknown.
- Education: Overall, the data analysed showed that 40% of people employed in the EU aquaculture sector had a low-level degree of education. 31% had a medium level education, whereas only 8% had a higher-level degree of education. For the education indicator, more than 20% of the education level was reported as unknown.
- Nationality: The vast majority (83%) of people employed in the sector are EU nationals of their own country, the rest mainly being workers from other EU MSs. This is true for all technologies and production segments as well. The high share of national employment is in line with the findings for the processing industry.

Data issues

- Ireland provided the age classes in different segmentation than the one recommended by PGECON and, for this, their data were not included in the EU overview. In order to provide an accurate EU analysis and comparison among MSs, EWG 20-12 concludes that it would be advisable that all MSs will submit data according to the age classes recommended by PGECON.

- Ireland provided education in different categories than agreed by PGECON. Again, EWG 20-12 concludes that for an accurate analysis of the trends in the educational levels of people employed in the aquaculture sector, it would be advisable to have all MSs data harmonized to the PGECON suggested categories for educational attainments.
- Germany provided employment status in different categories than the ones agreed during PGECON.
- Greece did not provide data for employment status.
- Romania submitted the social data in a wrong format. Romanian social data in the correct format was uploaded during the meeting and the group could not include the data in the analysis.
- Finland did not report social data by sector (main species group) or by technology.
- Italy submitted the social data in a wrong format. Italian social data in the correct format was uploaded just after the meeting and the group could not include the data in the analysis.

Recommendations: Follow PGECON

- EWG 20-12 concludes that to provide a more comprehensive analysis on the trends in the age classes it would be advisable, for the future, to split the age group 40-64 into smaller groups (indeed, this group is the one with highest share of employment, for some MSs being higher than 70%).
- EWG 20-12 recommend that MS's, wherever possible, social data should be collected by segment and/or by technology as this would increase the possibility to make further analysis on these variables for the EU aquaculture industry.

7.8 References

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9 ANNEXES

9.1 Annex I: United Kingdom

Overview of United Kingdom aquaculture

UK aquaculture has maintained a first sale value in excess of €1 billion since 2016. Inter-annual variation and trends are driven by a single segment - Atlantic salmon – which contributes >80% tonnage and >90% value. Over the DCF/EUMAP data period (2008-2018) the total weight of sales has not increased significantly, but value has increased in real terms due to above inflation increases in the sales price of salmon.

9.1.1 Total Production and sales

Data on production volume and value is available for all UK aquaculture segments over the DCF/EUMAP time period (2008-2018) (Table 4.7.1). In 2017, the total sales weight was 227 642 tonnes valued at €1 301 million. In 2018, sales weight decreased by 17% to 189 921 tonnes, and value decreased by 16% to €1 087 million. However, these decreases are not indicative of longer-term trends. Over the period 2008-2018, total sales weight has fluctuated around an average of 203 000 tonnes, with no trend (r=+0.37, p>0.2). In contrast, sales value shows a significant positive trend (r=+0.91, p<0.001), and remains significant after correction for £GB to € conversion and inflation (r=+0.81, p<0.01). The interannual changes in sales weight and trends in value are attributable to the Marine sector, i.e. variation for the salmon segment, which continues to contribute the majority of UK production weight and sales value (82% and 91% respectively in 2018).

Table 9.1.1 Production and sales, industry structure and employment for United Kingdom: 2008-2018.

Variable	2008	2010	2012	2014	2016	2017	2018	Change 2017-18	Develop. 2018/(08-17)
Sales weight (thousand tonnes)	**185.0**	**201.4**	**203.7**	**214.7**	**194.5**	**227.6**	**189.9**	-17%	-35%
Marine	130.8	155.2	162.8	179.7	163.2	190.4	156.7	-18%	-3%
Shellfish	40.7	31.5	27.4	21.6	16.9	23.7	20.9	-12%	-24%
Freshwater	13.5	14.6	13.5	13.4	14.4	13.5	12.3	-9%	-88%
Sales value (million €)	**666.4**	**603.4**	**724.6**	**992.6**	**1,023.2**	**1,301.0**	**1,087.6**	-16%	42%
Marine	558.2	519.2	643.2	895.9	937.2	1,204.9	1,000.0	-17%	48%
Shellfish	55.6	38.7	40.9	44.1	28.3	46.3	32.1	-31%	-31%
Freshwater	52.6	45.5	40.5	52.6	57.7	49.8	55.6	11%	33%
Number of enterprises			**596**	**551**	**473**	**469**	**464**	-1%	-12%
Marine			70	59	52	50	46	-8%	-20%
Shellfish			237	225	205	210	205	-2%	-6%
Freshwater			289	267	216	209	213	2%	-15%
Employment			**3,071**	**3,310**	**3,285**	**3,291**	**3,302**	0%	3%
Marine			1,481	1,752	1,904	1,871	1,885	1%	9%
Shellfish			707	706	651	716	675	-6%	-2%
Freshwater			883	852	730	704	742	5%	-8%
FTE			**2,567**	**2,761**	**2,802**	**2,797**	**2,833**	1%	4%
Marine			1,343	1,587	1,756	1,753	1,800	3%	13%
Shellfish			526	495	481	493	459	-7%	-7%
Freshwater			698	679	565	551	574	4%	-10%

Source: EU Member States DCF data submission

9.1.2 Industry structure and total employment

Data on enterprises and employment is available for all UK aquaculture segments (summarised in Table 4.7.1). Data is submitted on nine segments across Marine (finfish), (marine) Shellfish and Freshwater (finfish) sectors. UK aquaculture production is for human consumption, cleaner fish, stocking angling waters with game and coarse fish, and stock enhancement and conservation restocking. Additional aquaculture production for the ornamental (pet) trade is excluded from DCF/EUMAP figures to ensure consistency with Eurostat data.

In 2018, 464 authorised aquaculture enterprises operated in the UK – the majority (81%) were small (5 or less employees) and only 8% employed more than 10 people. However, four large (multinational) salmon companies are responsible for much of UK aquaculture production and employment. There is a significant negative trend in number of enterprises ($r=-0.97$, $p<0.01$).

In 2018, UK aquaculture employed 3 302 people: the salmon segment employed the majority (55%), with the trout (17%), mussel (11%) and oyster (8%) segments being other major employers. There is an indication of trends for increasing employment and FTE ($r=+0.76,+0.91$; $p<0.1$, 0.02 respectively), although the data availability is limited (2012-2018). The FTE per Employee ratio is consistently around 85%, indicating that full-time positions are most common within UK aquaculture.

The apparent contradiction in trends for UK enterprises and employment can be explained by enterprise consolidation and increased employment within the Salmon segment; this has offset the decreases in employment (and enterprises) within other segments.

9.1.3 Overall Economic performance

Total income (Table 4.7.2) includes sales and is therefore estimated for all segments of UK aquaculture. However, sales value estimates are deficient for some segments where production is largely counted by number (rather than tonnage), e.g. cleaner fish within the Other marine fish segment, and coarse fish within the Carp and Other freshwater fish segments. Furthermore, detailed economic data have only been submitted for the three main segments of UK aquaculture (salmon, trout and mussel) for the period 2012-2018. In addition, the dominance of the Salmon segment means UK totals largely reflect this single segment. Due to these weaknesses in the combined economic figures for the UK (Table 4.7.2), interpretation is reserved for segment level discussions below.

Table 9.1.2 Economic performance of the United Kingdom aquaculture sector: 2008-2018.

Variable	2008	2010	2012	2014	2016	2017	2018	Change 2017-18	Develop. 2018/(08-17)
Total income	666.4	603.4	721.3	995.1	1032.7	1311.5	1098.9	-16%	29%
Total operating costs	518.0	539.0	653.8	763.2	849.0	892.2	922.9	3%	35%
Total wages	68.0	73.0	87.5	97.2	103.0	118.8	118.2	0%	34%
Gross Value Added	216.4	137.4	160.0	341.0	286.7	538.1	294.3	-45%	13%
Depreciation of capital			32.0	44.1	56.6	57.9	57.6	0%	19%
Earning before interest and taxes			40.7	200.1	127.0	361.4	118.4	-67%	-18%
Financial costs, net			5.8	9.0	10.1	11.2	7.0	-38%	-57%
Net profit			34.9	191.1	116.9	350.1	111.4	-68%	-13%
Total value of assets	286.0	255.0	612.5	598.7	868.6	656.8	744.1	13%	34%
Capital productivity (%)	75.7	53.9	26.1	57.0	33.0	81.9	39.5	-52%	-29%
Return on Investment (%)			6.6	33.4	14.6	55.0	15.9	-71%	-29%

Source: own elaboration from EU Member States DCF data submission

9.1.4 Main species produced and economic performance by segment

The UK's aquaculture industry ranks as one of the largest in the EU and is also one of the most diverse (Figure 4.7.1) covering nine segments: Salmon (36 enterprises in 2018) and Other marine fish (10 enterprises) segments with the Marine sector; Mussel (98 enterprises), Oyster (93 enterprises), Crustacean (6 enterprises) and Other molluscs (8 enterprises) within the Shellfish sector; Trout (136 enterprises), Carp (56 enterprises), Other freshwater fish (21 enterprises) within the Freshwater sector. Various wild-seeded clam species (e.g. common edible cockle) are harvested by Mussel and Oyster enterprises. Despite this diversity, recorded UK aquaculture production tonnage and estimated value in 2018 continued to be attributable largely to Atlantic salmon (82% & 91%), with mussels (8%, 4%) and trout (6%, 4%) making up most to the balance (Figure 4.7.1). Although the other six UK aquaculture segments were minor by comparison, these encompassed 194 enterprises, provided employment for 582 staff, and their (underestimated) sales value was €12.4 million. Production of cleaner-fish (lumpfish and wrasse) within the Other marine fish segment is expanding and seen as important for the future of the salmon segment. Production of carp, other freshwater (coarse) fish and salmonids for stocking support the UK's game and coarse angling industries which are considered to be of great economic, social and environmental importance.

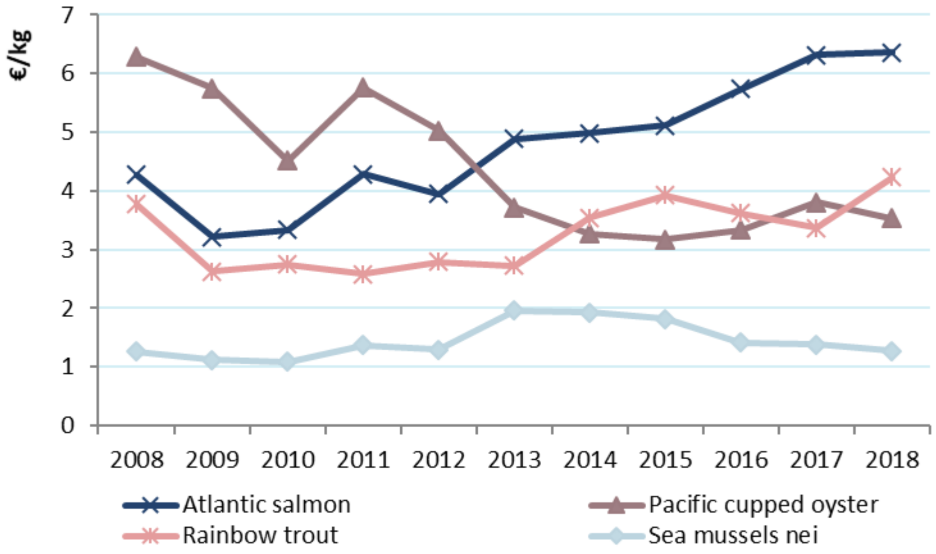
Figure 9.1.1 Main species in terms of weight and value in United Kingdom production: 2018.

Source: EU Member States DCF data submission

Estimated unit prices (€/Kg) over the time period 2008-2018 for the four most important species in the UK are plotted (Figure 4.7.2). These data demonstrate the low unit price of mussels relative to other shellfish (oyster) and finfish. The plot is somewhat deceptive, as the values need to be corrected for the GB£:€ exchange rate and inflation before interpretation. After such corrections, the price for:

- Atlantic salmon has increased (r=+0.74, p<0.01), which will reflect global markets and contribute to profitability.
- Rainbow trout has been static (r=+0.06, n.s.), and is notably lower than salmon.
- Mussels has been static (r=-0.06, n.s.)
- Pacific cupped oyster has decreased (r=-0.87, p<0.001), which may reflect demand from within the UK and market competition for sales within the EU.

Figure 9.1.2 Average prices €/kg for the main species produced in United Kingdom: 2008-2018.



Source: own elaboration from EU Member States DCF data submission

The three main segments of UK aquaculture are discussed below, with associated data presented in Table 4.7.3 and Figures 4.7.3-4.7.5.

Segment 1: Salmon Other methods (previously Salmon combined)

- All UK salmon production was attributed to the EUMAP segment "Other methods" method (rather than separated into hatcheries and nurseries, cages, tanks and raceways, recirculation systems) because enterprises are often vertically integrated, operating across categories within the production cycle and to ensure consistency between years. This segment therefore represents freshwater tanks (hatcheries and nurseries including recirculation aquaculture systems), freshwater net-pens (nurseries), seawater tanks (broodstock/harvest) and seawater net-pens (for ongrowing to harvest).
- The bulk of salmon production is located in Scotland. The trend in decreasing enterprises is real, and explained by consolidation within the industry, while employment (FTE) has increased.
- Sales volume fluctuates notably between years; this is largely thought to reflect biological issues (e.g. parasites (sea-lice and amoebic gill disease), pathogenic diseases, and blooms of harmful plankton) and weather events affecting production[21].
- The economic performance indicators fluctuate between years as production volumes change[22]. The increasing unit sales price has provided a buffer to enable the upward trend in total income, and for the segment to be profitable.
- Operating costs mainly comprised other operational costs (37%), feed (35% of total), and wages and salaries (11%).
- Other operating costs covers goods and services not included within the other economic variables, and represents a large proportion of total costs. It is currently unclear what costs are reflected by this variable, e.g. health management, insurance, equipment rental, etc. In any future revision of EUMAP it might be worthwhile revising the economic variables

[21] Mowi Scotland volumes see 36% drop – Fish Farmer Magazine
[22] The rising costs of salmon production | The Fish Site

to provide greater transparency on this key economic variable, or alternatively capture information via typical farm or case study approaches.

Segment 2: Trout Other methods (previously Trout combined)

- All UK trout production was attributed to the EUMAP segment "Other methods", rather than separated into hatcheries and nurseries, tanks and raceways, and cages because enterprises often operate across categories.
- Rainbow trout (harvested from both freshwater and marine systems) dominated the segment; production of smaller volumes of brown/sea trout, Arctic char and hybrid trout continued. Trout were grown for table consumption and restocking angling waters. There is anecdotal evidence that demand for restocking trout is declining due to decreasing interest in trout angling.
- Although production from freshwater systems dominated production, large rainbow trout produced in seawater net-pens and harvested at a similar size to salmon, continued to contribute around 27% of the species total. The estimated unit price (GB£/kg) of large rainbow trout is around 30% higher than that of portion size fish. It is understood that some freshwater trout farmers have started to grow fish to a larger size before harvest for the table to benefit from such a price differential. The long-standing production of trout to stock angling waters has traditionally produced fish of a range of sizes, including large fish.
- Annual trout production has fluctuated over the DCF/EUMAP period, but there is a long-term trend of decreasing production since a peak in late 1990s-early 2000s.
- The number of enterprises and employment (FTE) have decreased over the DCF/EUMAP period; these trends are thought to be real and reflect closure of enterprises and the marginal profitability of trout farming in the UK.
- The structure of operating costs is similar to salmon, comprised mainly of other operational costs (21%), feed (33% of total) and wages and salaries (15%); a notable difference is the additional higher contribution of livestock costs (22%) because UK trout operations tend to buy in stock for ongrowing, rather than being vertically integrated.
- The feed price for trout is similar to that for salmon. However, the trout segment lacks the economy of scale of salmon farming and suffers from a lower sales price for fish produced for the table.

Segment 3: Mussel Other

- Mussel aquaculture in the UK uses a variety of systems (on bottom, long lines, rafts). Due to difficulties in separating production systems (companies may operate different systems and seed may be moved between system types) and to ensure consistency between years, all production within the mussel segment was categorised under the DCF/EUMAP segment "Mussel other".
- Annual mussel production volume has declined by 62% since peaking in 2008. However, there is some evidence that production has plateaued since 2016. A large long-line site, recently established in southern England, has started to report production and may reverse the decreasing trend.
- The number of enterprises and employment (FTE) have decreased over the DCF/EUMAP period; these trends are thought to be real, and reflect the closure of enterprises.
- The structure of operating costs differs to finfish due to lack of feed costs. The main costs were wages and salaries (28%), other operational costs (22%), livestock costs (17%) and consumption of fixed capital (16%).

- The economic performance indicators indicate that the UK mussel segment is typically profitable; however, the segment suffers from a static sales price.

Table 9.1.3 Economic performance of main United Kingdom aquaculture segments: 2008-2018.

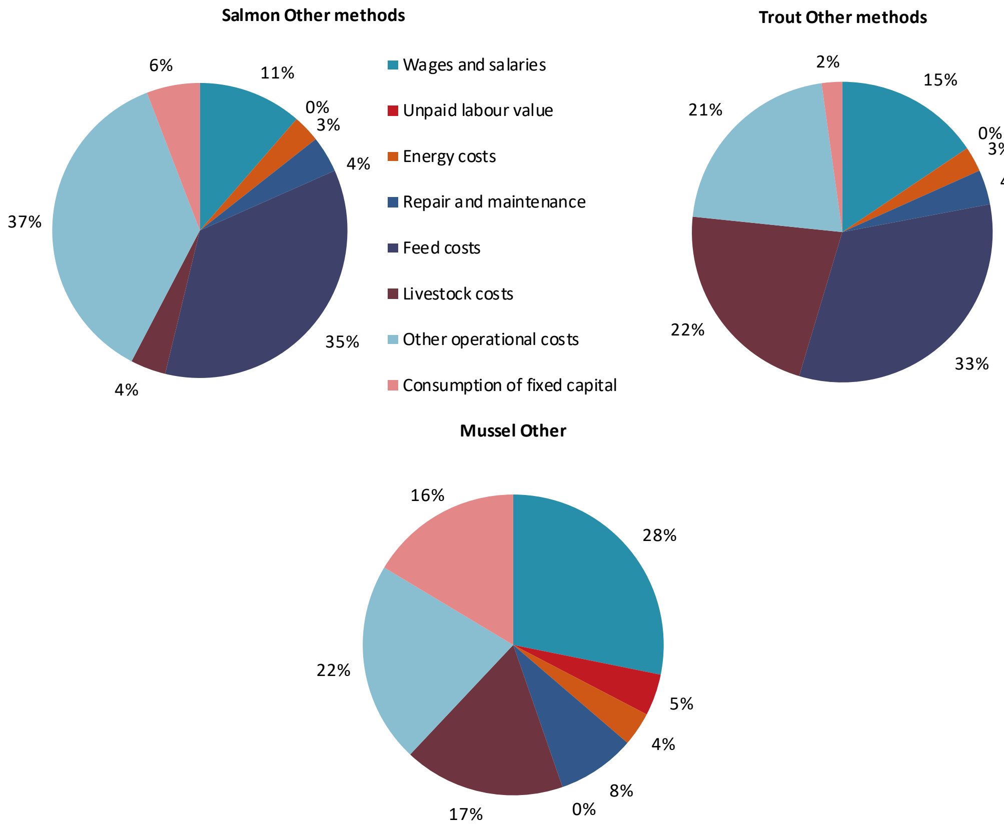
Variable	2008	2010	2012	2014	2016	2017	2018	Change 2017-18	Develop. 2018/(08-17)
Salmon Other methods									
Number of enterprises			62	47	40	38	36	-5%	-23%
FTE			1311	1540	1691	1677	1721	3%	12%
Average wage (thousand €)			53.0	53.6	50.2	60.4	60.0	-1%	9%
Labour productivity (thousand €)			94.6	194.0	138.6	273.6	142.7	-48%	-10%
Total sales volume (thousand tonnes)	128.7	154.6	162.5	179.4	163.1	190.3	156.6	-18%	-3%
Total income (million €)	549.7	515.7	642.7	904.7	942.8	1211.4	1008.1	-17%	33%
Total operating costs (million €)			588.2	688.4	773.6	823.5	854.5	4%	18%
Gross Value Added (million €)			124.1	298.7	254.0	489.2	256.8	-48%	0%
Net profit (million €)			27.7	169.2	108.7	326.1	95.3	-71%	-23%
Total value of assets (million €)			533.2	533.4	817.6	571.1	650.5	14%	2%
Net investments (million €)			84.9	70.9	83.9	56.1	90.0	60%	35%
Capital productivity (%)			23.3	56.0	31.1	85.7	39.5	-54%	-8%
Return on Investment (%)			5.3	33.2	14.4	58.8	15.5	-74%	-31%
Future Expectation Indicator (%)			11.0	6.0	4.0	0.7	5.7	730%	35%
Mussel Other									
Number of enterprises			118	116	103	100	98	-2%	-11%
FTE			305	293	238	255	238	-7%	-13%
Average wage (thousand €)			20.6	21.6	31.6	35.0	26.6	-24%	-11%
Labour productivity (thousand €)			79.6	67.4	28.3	71.6	40.2	-44%	-38%
Total sales volume (thousand tonnes)	37.5	30.2	26.0	20.0	14.7	21.4	18.7	-13%	-26%
Total income (million €)	47.0	32.8	34.3	40.1	21.7	39.8	25.6	-36%	-32%
Total operating costs (million €)			16.2	26.4	20.9	22.7	17.9	-21%	-28%
Gross Value Added (million €)			24.3	19.8	8.6	26.7	14.6	-45%	-30%
Net profit (million €)			10.1	9.5	-3.3	10.9	2.6	-76%	-63%
Total value of assets (million €)			42.6	45.1	26.8	69.0	78.8	14%	65%
Net investments (million €)			20.7	5.6	4.0	7.9	4.8	-40%	-53%
Capital productivity (%)			57.0	43.8	32.1	38.7	18.5	-52%	-58%
Return on Investment (%)			33.3	21.6	-11.1	17.8	5.2	-71%	-66%
Future Expectation Indicator (%)			39.6	3.9	0.7	4.6	1.6	-65%	-87%
Trout Other methods									
Number of enterprises			192	164	144	139	136	-2%	-16%
FTE			508	489	443	437	439	0%	-8%
Average wage (thousand €)			17.5	16.9	23.0	18.0	18.3	2%	-4%
Labour productivity (thousand €)			3.5	20.9	20.0	15.8	18.8	19%	12%
Total sales volume (thousand tonnes)	13.5	14.2	13.2	13.0	14.2	13.3	12.1	-9%	-12%
Total income (million €)	52.5	40.8	37.2	50.3	55.4	46.7	52.9	13%	15%
Total operating costs (million €)			44.2	48.4	54.6	46.0	50.4	10%	4%
Gross Value Added (million €)			1.8	10.2	11.2	8.6	10.5	22%	16%
Net profit (million €)			-9.4	0.1	-1.4	-0.4	1.2	412%	140%
Total value of assets (million €)			31.6	20.2	24.1	16.6	14.7	-11%	-40%
Net investments (million €)			1.5	1.0	1.2	2.1	1.6	-23%	36%
Capital productivity (%)			5.7	50.7	46.3	51.6	71.2	38%	81%
Return on Investment (%)			-27.3	4.1	-3.1	-1.2	8.9	850%	221%
Future Expectation Indicator (%)			-0.1	-0.4	-1.6	7.0	3.1	-56%	193%

Source: own elaboration from EU Member States DCF data submission

Figure 9.1.3 Economic performance in € million, indicators for the main **Error! Reference source not found.** Kingdom segments: 2008-2018.

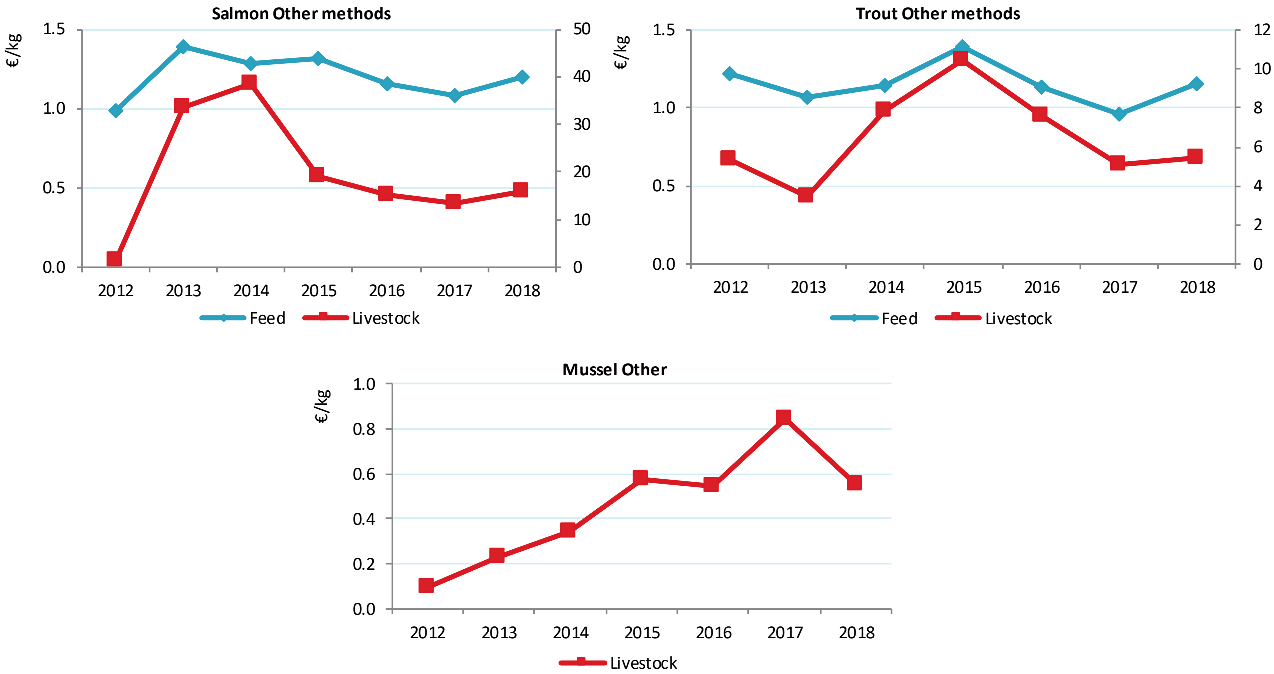
Source: own elaboration from EU Member States DCF data submission

Figure 9.1.4 Cost structure of the main segments in United Kingdom: 2018.



Source: EU Member States DCF data submission

Figure 9.1.5 Feed (left axis) and livestock (right axis) average prices €/kg for the main United Kingdom segments: 2012-2018.



Source: own elaboration from EU Member States DCF data submission

9.1.5 Outlook

Nowcasts for 2019-20

At the time of writing, 2019 production volumes and values are only available for Scotland; statistics are not yet available for the rest of the UK because data collection was delayed by COVID restrictions.

In 2019, production of Scottish salmon increased by 31% from 2018, reaching a new peak of 203,881 tonnes. Although the unit sales price decreased by 8%, there was still a 22% increase in the sales value of salmon. There were also increases in production volumes of rainbow trout (both freshwater and seawater) and Pacific cupped oyster, although as with salmon, unit prices decreased. Consequently, there was a notable 29% increase in Scottish aquaculture production volume and 21% increase in sales value. As most aquaculture production is based in Scotland, it can be assumed that the UK volume and value will show similar increases.

Data on production in 2020 is not available and the impact of the COVID pandemic is yet to be documented. Scottish production volumes of both salmon and rainbow production were projected to increase[23], although this was based on data collected early in 2020. The effects on total value from fluctuation in unit prices are also yet to be determined.

9.1.6 Trends and triggers

UK aquaculture production is dominated by salmon farming in Scotland. After a period of variability, salmon production volume appears to be on an upward trajectory: projections suggest that more smolts were being produced that would further increase production in 2021. Biological factors (e.g. parasites, pathogens, algal blooms, jellyfish swarms) continue to contribute to variability in annual production volumes[24] [25]. Salmon is Scotland's largest food export[26] and the Scottish Government recognises the contribution of aquaculture[27] in helping to sustain economic growth in the rural and coastal communities and support (up- and down-stream) jobs across Scotland and the catalytic effect of that income across the economy. However, concerns over the environmental impacts of salmon farming persist and have been subject to parliamentary investigation[28]. Regulatory changes are therefore foreseen intended to progress sustainable development of salmon farming in Scotland[29] [30].

Although aquaculture in other UK regions is less important, the authorities still recognise it as having potential for sustainable seafood production if environmental concerns can be addressed. Despite the existence of aquaculture development plans, the main segments in other UK regions, i.e. trout and mussel, continue to decline. The only species other than salmon that is increasing production in the UK is Pacific cupped oyster; however, it is subject to continuing environmental scrutiny as a non-native invasive species. A new English Aquaculture Strategy was published in November 2020 which intends to catalyse growth within this region.

Further factors that may affect the future of UK aquaculture are:

- Sales prices – Salmon is a global commodity and prices are somewhat volatile responding to global supply and demand[31] [32] [33] [34] [35]. The above analyses illustrate that differences

[23] Scottish Fish Farm Production Survey 2019 - gov.scot (www.gov.scot)
[24] Grieg set to quit Shetland – Fish Farmer Magazine
[25] Biology blights Mowi Scotland results – Fish Farmer Magazine
[26] Scottish salmon UK's top food export again – Fish Farmer Magazine
[27] Scottish aquaculture worth £885 million – Fish Farmer Magazine
[28] Marine Harvest welcomes 'guide to growth' – Fish Farmer Magazine
[29] Sea lice legislation next year says Ewing – Fish Farmer Magazine
[30] SEPA plans tighter controls but bigger farms – Fish Farmer Magazine
[31] Salmon prices at record levels – Fish Farmer Magazine
[32] Scottish farmer dismissed from price fixing case – Fish Farmer Magazine

between species in unit sales price and trends over time are a key determinant of profitability.

- EU-exit – A significant portion of UK aquaculture production is exported rather than being consumed domestically. Following the end of the transition period, on 01/01/21 a new Fish Exports certification process was launched; "teething problems" associated with documentation have been experienced by seafood exporters to the EU early in 2021[36] [37] [38]. An additional potential issue for UK bivalve producers are EU hygiene regulations preventing export of live shellfish from the UK which require depuration; depuration facilities within the UK are limited and such shellfish had previously been sold for depuration at large plants within mainland Europe.
- Grant funding - Although aquaculture enterprises have lost access to EMFF funding for aquaculture development, new domestic funding schemes have been introduced.

9.1.7 COVID-19 impact

In response to the pandemic, the various administrations across the UK implemented compensation / job retention schemes[39] [40] which some segments of the aquaculture industry could access depending upon criteria.

The impact of the pandemic appears to have differed between segments:

- Shellfish and trout businesses have suffered losses due to hospitality closures across the UK and Europe[41].
- Although salmon export volume and sales values have been affected[42] [43], the salmon segment appears to have been better able to weather the crisis as demand for the product seems to have been less affected. Indeed, some companies within the segment have decided to repay Government COVID support funding[44].

9.1.8 Data Coverage and Data Quality

Data quality and availability

Under aquatic animal health regulations, all aquaculture production businesses (APBs) are required to be authorised by the regional competent authorities for fish and shellfish health. There are three separate bodies covering England and Wales, Scotland, and Northern Ireland, which have a full overview of farm sites and businesses. All APBs are included in annual censuses which collect information on species, production volumes, systems and employment with coverage approaching 100%. Census data were provided direct from the administrations and summed to provide UK totals. Production volumes (tonnes) were therefore fully recorded and can be considered precise.

Farm gate prices (GBP/tonne) were based on estimates by experts and producer organisations. Turnover was imputed from volume x estimated farm gate price. All GB£ values were converted

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33 Cooke Aquaculture Scotland saw revenue up, profits down in 2019 – Fish Farmer Magazine
34 High temperatures hits salmon prices in Scotland and Norway – Fish Farmer Magazine
35 Norway records jump in salmon prices, at last – Fish Farmer Magazine
36 Export advice offered for Scotland's seafood sector – Fish Farmer Magazine
37 New fund offers help for Scottish seafood producers – Fish Farmer Magazine
38 Two cheers for Brexit compensation offer – Fish Farmer Magazine
39 https://www.gov.uk/government/publications/fisheries-response-fund-support-for-fishing-and-aquaculture-businesses
40 £10m support for seafood sector 'on its knees' – Fish Farmer Magazine
41 Live shellfish exports face 'indefinite' EU ban – Fish Farmer Magazine
42 Seafish reports tough summer for UK producers – Fish Farmer Magazine
43 Salmon price falls again – Fish Farmer Magazine
44 Scottish Sea Farms pay back furlough funds – Fish Farmer Magazine

to € using average annual conversion factors from Eurostat. Turnovers are therefore estimates which can be considered good.

Statistics on employment were recorded within the censuses of enterprises:

- Data on numbers of enterprises (wrt number of employees) can be considered fully recorded and precise.

- Numbers of full-time and part-time employees are recorded across the UK. The total number of employees was therefore fully recorded and can be considered exact.

- Data on FTE were only collected for England and Wales. For Scotland and Northern Ireland, FTE was estimated for all part-time staff by segment. Total FTEs are therefore estimates which can be considered good.

All other economic variables were collected by questionnaire survey (salmon all enterprises; trout & mussel – main producers). Response rate to this voluntary survey declined further to 31% for 2018 data. It must be recognised that responders are self-selecting, and tend to be the larger and more compliant enterprises more willing and able to provide the data and bear the burden of responding. Due to the relative small population of UK salmon enterprises and responses from major producers, the scaling factors (i.e. the multipliers applied to sample totals to extrapolate population estimates) were ≤1.62 for the salmon segment, indicating some confidence in the resultant estimates. For the trout and mussel segments, smaller proportions of much larger populations of enterprises were sampled, so scaling factors were much higher (≤ 6.4 and ≤17.6). Please note that scaling factors vary between variables within a segment in relation to the specific variable (i.e. whether scaled by production value, volume or employment), and missing values within returned questionnaires.

Other data issues or missing data

The Sales, Economic and Social data sets required for the 2020-2021 data call were submitted so there was no missing data for the UK.

It should be noted that the STECF tabulated/plotted financial data above do not correct for inflation, which would require conversion to “real” values. This is important when assessing temporal trends. Conversion to real values has been attempted for some variables in the text discussion, with additional back-conversion of € to GB£ to eliminate variation introduced by changes in exchange rate.

The pilot study for Social data focused on the Scottish salmon segment, but small numbers of Scottish trout and mussel enterprises were also included. Submission of the pilot study data required extrapolation to the whole UK population; scaling factors for the Salmon, Trout and Mussel segments were 1.24, 6.6 and 7.8 respectively. It is worth emphasising that the age categories suggested by PGECON in 2017 and used for the pilot survey, are too broad to be of use in assessing potential age sustainability issues, e.g. 40-64 will not identify if a large proportion of the workforce could be approaching retirement.

9.2 Annex II: Methodology for construction of overall EU trends (imputation)

Background

The EWG 18-19 report (STECF, 2018) was the first time that an exercise of imputation was undertook in the economic report of the EU aquaculture sector, with the conviction that the methodology would be further applied and developed in future reports. The EWG 20-12 TORs states that "*the data for EU total should reflect an estimation of the actual evolution and should not be distorted by the inclusion (or exclusion) of Member States throughout the analysed period. The compilation of EU aggregates may require the use of imputation in some Member States*". In this context, prior to EWG 20 12, it was developed a preparatory work in order to define a methodology of imputation with the purpose of facilitate that even with some missing values, the EWG is able to analyse aggregate figures at the EU level.

Imputations techniques are employed to address issues with data gaps for particular years and/or indicators in Member State data submissions, and Member States that, due to their small aquaculture sector, are not required to submit data under the data collection framework. Specifically, it was necessary to estimate certain values at national level for EU aggregate series.

This section describes the methodology used to do the necessary imputations in the EU overview chapter in the EWG 20 12, that is based on the methodologies applied for the construction of the overall EU trends in the previous EU Aquaculture Sector report (STECF, 2018), the last edition of the fish processing report (STECF 19-15), and the principles for using alternative sources to address major data gaps in the estimation of the main variables for EU aggregates approved by the STECF plenary in 2019 for the fish processing sector (STECF, 2019). Missing data are imputed at environment level (Finfish marine, finfish freshwater, shellfish), and then aggregated at national totals.

The indicators of the EU overview covered by the imputation methodology are: total sales volume, turnover, number of enterprises, employment and FTE.

Other economic performance indicators (labour productivity, capital productivity, average wage, GVA, EBIT, ROI) proved in the previous Economic Aquaculture EWG (STECF 18-19) to be too difficult to provide a reliable time series for, as there are significant data gaps in input costs for major aquaculture producing Member States. The last Fish Processing Sector Economic Report (STECF-19-15) also developed a gaps imputation exercise to build EU aggregated indicators based in the same protocol approved by the STECF 19-02. In the case of the fish processing industry, the EWG was able to develop estimations on several input cost such as energy, wages and salaries or gross investments. This was possible because fish processing is an industrial activity that is included in the Eurostat´s Structural Business Statistics (SBS). Unfortunately, aquaculture is not included in SBS, so in the case of these other economic performance indicators, it is recommended to follow the recommendations given by the previous group of experts.

Continuous improvements in data collection and analyses provided new information in recent years. These new data, together with the improvements in the imputation techniques used, facilitates the EWG to provide better information on the evolution of the aquaculture sector in the EU.

In order to produce a time series of the EU aquaculture sector for some key economic indicators, a number of steps needed to be taken, considering the principles described above and the availability of data. These steps are described for each indicator below.

Total sales volume

The main data source for total sales volume is the submission of data by Member States through the DCF or EU MAP. Where there are data gaps, the most recent reporting year was adjusted based on the percentage change in FAO production data.

$$(1) \qquad TSV_{est}^{n} = TSV_{DCF}^{n-1} \cdot \left(\frac{Production_{FAO}^{n}}{Production_{FAO}^{n-1}}\right)$$

Where:

TSV = Total sales volume

Production = Total production in quantities

n = year n

n-1 = year n-1

est = estimated value

DCF = data from DCF/EU MAP

FAO = data from FAO

For Member States that do not report data on total sales volume through the data collection framework for any year, FAO production data was taken directly.

$$(2) \qquad TSV_{est}^{n} = Production_{FAO}^{n}$$

Where:

TSV = Total sales volume

Production = Total production in quantities

n = year n

est = estimated

FAO = data from FAO

Turnover

The main data source for turnover is the submission of data by Member States through the DCF or EU MAP. Where there are data gaps, the most recent reporting year was adjusted based on the percentage change in FAO value of production data.

$$(3) \qquad Turnover_{est}^{n} = Turnover_{DCF}^{n-1} \cdot \left(\frac{Value_{FAO}^{n}}{Value_{FAO}^{n-1}}\right)$$

Where:

Turnover = Turnover

Value = Value of production

n = year n

n-1 = year n-1

est = estimated value

DCF = data from DCF/EU MAP

FAO = data from FAO

For Member States that did not report turnover through the data collection framework, FAO data on value of production was taken directly. The data are converted from USD dollars to Euros using the European Central Bank average annual exchange rate.

$$(4) \qquad Turnover_{est}^{n} = Value_{FAO}^{n}$$

Where:

Turnover = Turnover

Value = Value of production

n = year n

est = estimated

FAO = data from FAO

Number of enterprises

The main data source for the number of enterprises is the submission of data by Member States through the DCF or EU MAP. Where there are data gaps, the most recent reporting year was used as the number of enterprises is very stable and does not change significantly when there are changes in production volume or value.

$$(5) \qquad Enterprise_{est}^{n} = Enterprise_{DCF}^{n-1}$$

Where:

Enterprise = Number of enterprises
n = year n
n-1 = year n-1
est = estimated value
DCF = data from DCF/EU MAP

For Member States that do not report any data on the number of enterprises through the data collection framework, the number of enterprises is estimated by applying the ratio of turnover per enterprise calculated for DCF reporting Member States to the turnover for the Member States without data on the number of enterprises. This has been the criterion applied in previous reports, so which provides consistency to the data series.

Total employees

The main data source for employment is the submission of data by Member States through the DCF or EU MAP. Where there are data gaps, the most recent reporting year is adjusted based on half the percentage change in turnover. This estimation methodology was selected and applied in the previous aquaculture economic report based on an analysis of standard errors for the Member States, where changes in employment and changes in production volume and value could be analysed. That half the percentage change in turnover was the strongest estimation of employment and it makes some sense as production weight can fluctuate significantly with shellfish production (particularly mussels) and also that employment has a slow and often more muted response to changes in economic performance (‘employment stickiness’).

$$(6) \qquad Employment_{est}^{n} = Employment_{DCF}^{n-1} * (1 + \frac{\left(\frac{Turnover_{DCF}^{n}}{Turnover_{DCF}^{n-1}} - 1\right)}{2})$$

Where:

Employment = Total number of employees

Turnover = Turnover

n = year n

n-1 = year n-1

est = estimated

DCF = data from DCF

For Member States that do not report total employment through the data collection framework, employment data from the OECD is used wherever available. For the remaining Member States, employment is estimated by applying the ratio of turnover per employee for DCF reporting Member States to the turnover for the Member States without employment data.

FTE

An employment time series is also reported for FTEs. Again, the main data source is the submission of data by Member States through the DCF or EU MAP. Where there are data gaps the most recent reporting year is adjusted based on half the percentage change in turnover (as previously described). For Member States that do not report total employment through the data collection framework, a factor is applied to total employment as calculated from those Member States reporting both total employment and FTE employment.

$$FTE_{est}^{n} = Employment_{est}^{n} \cdot \left(\frac{FTE_{MS}^{n}}{Employment_{MS}^{n}}\right) \quad (7)$$

Where:

Employment = Total number of employees,

FTE = FTE,

n = year n,

est = estimated value,

MS = total MS data from DCF/EU MAP

The tables summarising the source and/or estimation methodology for each of the five indicators listed above is available at the 2018 report.

9.3 Annex III: Nowcast methodology

The nowcast methodology for the EWG on The EU Aquaculture Sector is inspired in what has already been done for the report on fleet economics, and follows the recommendations and principles for estimation of the main variables for EU aggregates approved by the STECF plenary in 2019. In addition, we try to apply the estimation principles defined for imputation on missing data.

The indicators included in this first nowcast exercise for EU Aquaculture Sector report are "Total weight of sales", "Gross sales", and employment measured both through the "Persons employed" and "Persons employed FTE".

The scope of the nowcast exercise is finally conditioned by the availability of information. This section describes the methodology used for the analysis of the quantitative information available for 2019 and 2020.

9.3.1 General methodology

At the time of conducting the economic analysis, the data lag is usually two years, so the projection is made for years t + 1 and t + 2, being "t" the last year requested in the EU-MAP data call. In the present case, t = 2018, t+1= 2019 and t+2 = 2020.

In the general case of the nowcasting methodology, a variable "A" in year t+1 is estimated by the same variable "A" in year t and the change in variable "B" between year t and t+1, when the value for variable "B" in year t+1 is known (STECF, 2020[45]). Unless otherwise noted, the relationship between t + 2 and t + 1 is the same as between t + 1 and t. Therefore, the following general formulation is used:

$$A_{est}^{t+1} = A_{EUMAP}^{t} * \left(1 + \left(\frac{B^{t+1} - B^{t}}{B^{t}}\right)\right)$$

$$A_{est}^{t+2} = A_{est}^{t+1} * \left(1 + \left(\frac{B^{t+1} - B^{t}}{B^{t}}\right)\right)$$

Where:

A = explained variable

B = explanatory variable

t = year t

t+1 = year t+1

t+2 = year t+2

est = estimated value

EUMAP = data from EU-MAP

[45] Scientific, Technical and Economic Committee for Fisheries (STECF): The 2020 Annual Economic Report on the EU Fishing Fleet (STECF 20-06) Annex. EUR 28359 EN, Publications Office of the European Union, Luxembourg, 2020a, ISBN 978-92-76-27421- 6, doi:10.2760/597156, JRC123089.

Where data for variable "A" is already reported in the EU-MAP for t+1, this data is automatically selected rather than the nowcasting estimation. The variable "B" can be the same indicator, for example, an estimation of the "Gross sales", but also a proxy of it, such as the value of the production from aquaculture excluding hatcheries and nurseries from Eurostat (fish_aq2a).

9.3.2 *Total weight of sales*

The total weight of sales (TWS) in 2019 is estimated by adjusting the 2018 EU-MAP data with the grow rate experimented by sales (volume) between 2018 and 2019 according to the variable B. Total sales in 2020 is estimated by adjusting the TWS estimated in 2019 with the increase/decrease experimented by sales (volume) between 2019 and 2020 according to indicator B. If any country has provided their data for 2019 in the EUMAP, this data is used instead of the estimate described below.

$$TWS_{est}^{t+1} = TWS_{EUMAP}^{t} * \left(1 + \left(\frac{B^{t+1} - B^{t}}{B^{t}}\right)\right)$$

$$TWS_{est}^{t+2} = TWS_{est}^{t+1} * \left(1 + \left(\frac{B^{t+2} - B^{t+1}}{B^{t+1}}\right)\right)$$

Where:

TWS = Total weight of sales

est = estimated value

EUMAP = data from EU MAP

B= proxy variable selected

9.3.3 *Gross sales*

Gross sales in 2019 is estimated by adjusting the 2018 EUMAP data with the grow rate experimented by variable B between 2018 and 2019. The value of the production in 2020 is estimated by adjusting the gross sales estimated in 2019 with the increase/decrease experimented by variable B between 2019 and 2020. If any country has provided their data for 2019 in the EUMAP, this data is used instead of the estimate described below.

$$GS_{est}^{t+1} = GS_{EUMAP}^{t} * \left(1 + \left(\frac{B^{t+1} - B^{t}}{B^{t}}\right)\right)$$

$$GS_{est}^{t+2} = GS_{est}^{t+1} * \left(1 + \left(\frac{B^{t+1} - B^{t}}{B^{t}}\right)\right)$$

Where:

GS = Gross sales

est = estimated value

EUMAP = data from EU MAP

B= proxy variable selected

9.3.4 Employment

Employment in 2019 is estimated by adjusting the 2018 EUMAP data with the grow rate experimented by Persons employed between 2018 and 2019 according to the explanatory variable B. Employment in 2020 is estimated by adjusting the employment estimated in 2019 with the increase/decrease experimented by B between 2019 and 2020. If any country has provided their employment data for 2019 in the EUMAP, this data is used instead of the estimate described below.

$$PE_{est}^{t+1} = PE_{EUMAP}^{t} * \left(1 + \left(\frac{B^{t+1} - B^{t}}{B^{t}}\right)\right)$$

$$PE_{est}^{t+2} = PE_{est}^{t+1} * \left(1 + \left(\frac{B^{t+1} - B^{t}}{B^{t}}\right)\right)$$

$$FTE_{est}^{t+1} = FTE_{EUMAP}^{t} * \left(1 + \left(\frac{B^{t+1} - B^{t}}{B^{t}}\right)\right)$$

$$FTE_{est}^{t+2} = FTE_{est}^{t+1} * \left(1 + \left(\frac{B^{t+1} - B^{t}}{B^{t}}\right)\right)$$

Where:

PE = Persons employed

FTE = Persons employed FTE

est = estimated value

EUMAP = data from EU MAP

B= proxy variable selected

9.4 Annex IV: Survey: Impact of COVID-19 on the EU fishing activity

The coronavirus outbreak is having growing impacts on the global economy with unpredictable consequences, and the aquaculture sector is no exception. This survey intends to collect information from experts and organization (POs, associations, etc.) about the impact of the COVID-19 on the aquaculture industry. As such, we would like to invite you to complete the questionnaire below. Your answers will be of great value in identifying the several impacts of COVID-19 on the aquaculture industry.

All information received will be treated in strict compliance with the General Data Protection Regulation (EU Regulation 2016/679) in relation to data protection and privacy. Any data published will be anonymized and will be used only for scientific purposes. Respondents are entitled (at any moment) to access and/or rectify their personal data, as well as to delete their data. Please send the completed questionnaire by **January 15th 2021** to Prof. Sebastián Villasante (USC) at sebastian.villasante@usc.es. If you have questions or comments, please contact Sebastián Villasante. We will be happy to supply you with any further information you may need. We will also share our findings with you at the end of the study.

Thank you for your participation.

I agree to participate (mark with an *x*) ☐

Information about you:

Name:

Organization/association/enterprise you represent:

Location (Region):

Country:

Occupation in the organization/association/enterprise:

Contact (E-mail/phone):

Characteristics of the aquaculture activity

1. Economic and social variables (indicate the 3 most important species produced by your organization, association or enterprise)

	Questions for both organisations and enterprises						**Reply to these variables only if you represent an organisation or an association**					
Species group	**Sales Volume** (ton)		**Sales Value** (€ million)		**Employment** (Full time employment)		**Number of enterprises or producers**		**% of your production /national production (in ton)**		**% of your exports/national exports (in ton)**	
	2018	2019	2018	2019	2018	2019	2018	2019	2018	2019	2018	2019
Mussels												
Salmon												
Trout												
Seabass												

Seabream											
Carp											
Oyster											
Clams (Carpet shell and others)											
Other:											
Other:											
Other:											

2. Indicate the main production method used in your organisation, association, or enterprise

Method	Mark the main one with an x
Extensive	
Semi-intensive	
Intensive	

<u>Impacts of COVID19 on the aquaculture activity</u>

3. What was the impact on each of these **economic measures due to COVID-19?**

3.1. Impact of COVID on the economic variables: Indicate how the economic variables have evolved between 2019 and 2020 due to the impact of COVID (**mark with an x**)

Variable	**INCREASED in 2020 with respect to 2019 by…**					**DECREASED in 2020 with respect to 2019 by…**				
	More than 40%	**30% - 40%**	**20%-30%**	**10%-20%**	**1%-10%**	**1% - 10 %**	**10% - 20%**	**20% - 30%**	**30% - 40%**	**More than 40%**
Sales (volume)										
Prices										
Income										
Turnover										
Costs										
Wages and salaries										
Raw materials (feed costs)										
Energy costs										
Repair and maintenance										
FTE employment										

3.2. Other impacts in 2020 (**e.g. diseases and environment**)**:** Indicate how the economic variables have evolved between 2019 and 2020 due to other impacts (**mark with an x**)

Variable	**INCREASED in 2020 with respect to 2019 by…**					**DECREASED in 2020 with respect to 2019 by…**				
	More than 40%	**30% - 40%**	**20%-30%**	**10%-20%**	**1%-10%**	**1% - 10 %**	**10% - 20%**	**20% - 30%**	**30% - 40%**	**More than 40%**
Sales (volume)										
Prices										
Income										
Turnover										
Costs										
Wages and salaries										
Raw materials (feed costs)										
Energy costs										
Repair and maintenance										
FTE employment										

4. Reasons of the COVID-19 impact. Indicate if the following reasons have been important in the socioeconomic impact suffered by the aquaculture activity due to the crisis caused by COVID-19? (**mark with an *x***) (From 1 meaning not important, to 5 meaning very important):

	1	**2**	**3**	**4**	**5**
Prices decrease					
Lower sales at markets (demand)					
Difficulties in logistics on transportation					
Difficulty/insolvency/abandonment by insurance companies					
Difficulties of suppliers of providing feed					
Loss of markets					
Due to the absence of tourists					
International markets					
Key customers (schools, restaurants, etc.)					
Buyers (middlemen)					
Difficulties to find workers in your organization					

Other (please specify):					

5. Impact on health and well-being. Indicate the importance of the following impacts of the COVID-19 pandemic on the health and well-being of aquaculture farmers/workers? (**mark with an x**):

	1	2	3	4	5
Farmers/workers are scared about the virus					
Workers in the aquaculture sector are more vulnerable to getting the virus					
Farmers/workers have to take care of their families					
Lack/shortage of personal protective equipment (gloves, masks, hand sanitizer)					
Inadequate working conditions (e.g. overcrowding)					
Other (please specify):					

6. Did you plan to do investments in your aquaculture sector before the COVID-19 event?

6.1. Yes __ No__

6.2. Do you still plan to do the investment? Yes __ No __

Explain why you decided to make the investment, or why you decided not to

____

7. Adaptation measures. What adaptation measures has your organisation, association, or enterprise implemented to face the crisis caused by COVID-19? And how relevant are these measures for you? (**mark with an x**) (From 1 meaning not important, to 5 meaning very important):

	Implemented		Relevant for your activity				
	Yes	No	1	2	3	4	5
Direct sales to final customers							
Hiring new workers							
Change to new buyers (e.g. canning industry) or markets							
Stocking							
Other (please specify):							

8. Financial support. Have you received financial support from the European, national or regional authorities to deal with the COVID-19 impacts (**mark with an x**)

Yes, from the EMFF (European Maritime and Fisheries Fund): __

Yes, from SURE: __

Yes, de minimis: __

Yes, from national schemes: __

Yes, from regional schemes: __

No, no financial support was received: __

9. Purpose of the financial support. If you have received financial support, please indicate how the public intervention to support the sector was used (or will be used) during the COVID-19 crisis (**mark with an x**) (from 1 meaning not important, to 5 meaning very important):

	1	**2**	**3**	**4**	**5**
Technological development, innovation and knowledge transfer					
Enhancement of the competitiveness and viability of aquaculture enterprises					
Initiatives to protect and restore aquatic biodiversity and ecosystems related to aquaculture					
Promotion of aquaculture having a high level of environmental protection, of animal health and welfare and of public health and safety					
Development of professional training, new professional skills and lifelong learning					
Other (please specify):					

10. Additional comments. Please provide any further comment you consider of relevance to consider. Thanks for your participation.

Thank you very much for participating and for your time!

9.5 Annex V: Summary of surveys' results about the COVID-19 impacts on economic variables

Figure 9.4.1. Origin of the survey responses

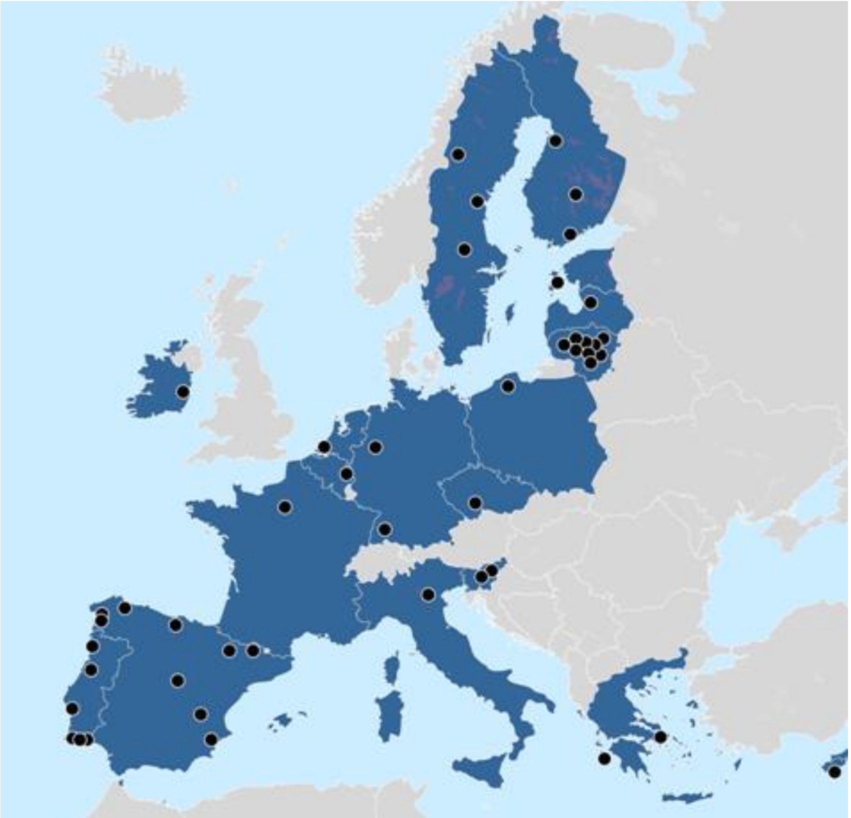


Figure 9.4.2. Most important species produced reported in the survey

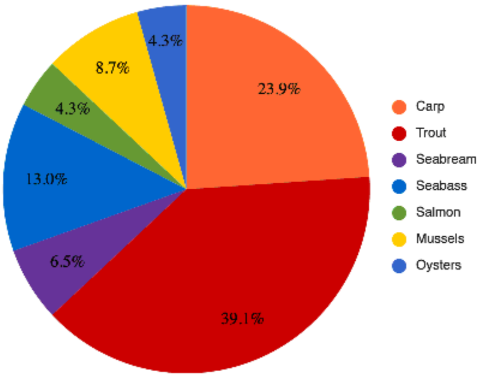


Figure 9.4.3. Main production methods reported in the survey

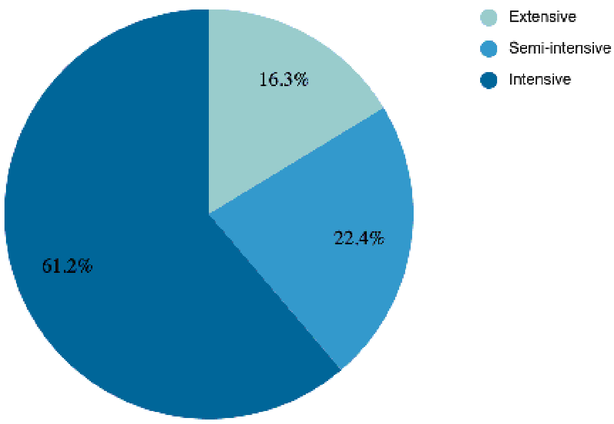


Figure 9.4.4. Impact of COVID-19 on the performance of key economic variables comparing 2019 and 2020

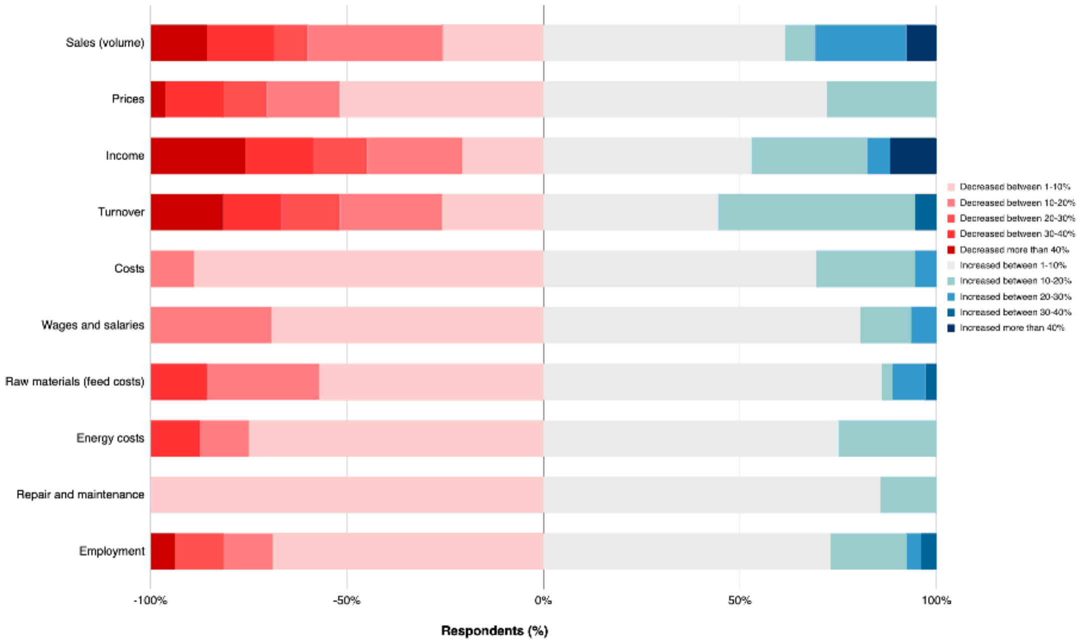


Figure 9.4.5. Impact of other drivers (e.g. environmental changes, diseases, etc.) on the performance of key economic variables comparing 2019 and 2020

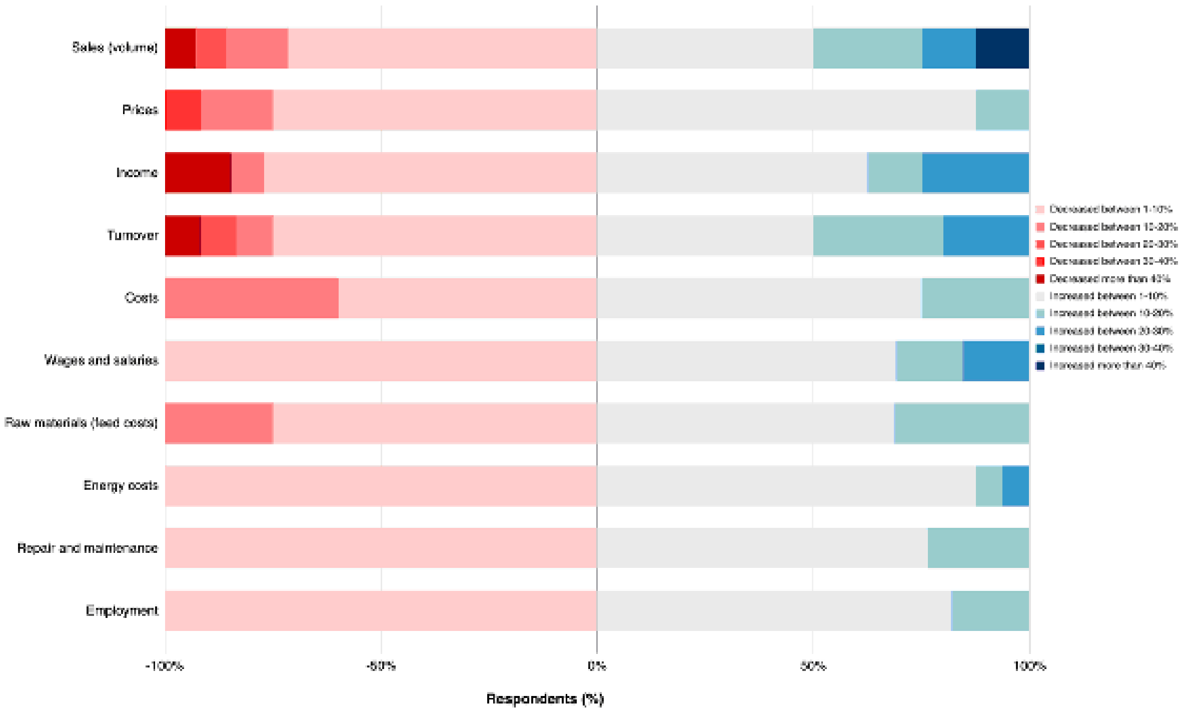


Figure 9.4.6. Socioeconomic impacts suffered by the aquaculture activity due to the COVID-19 pandemic

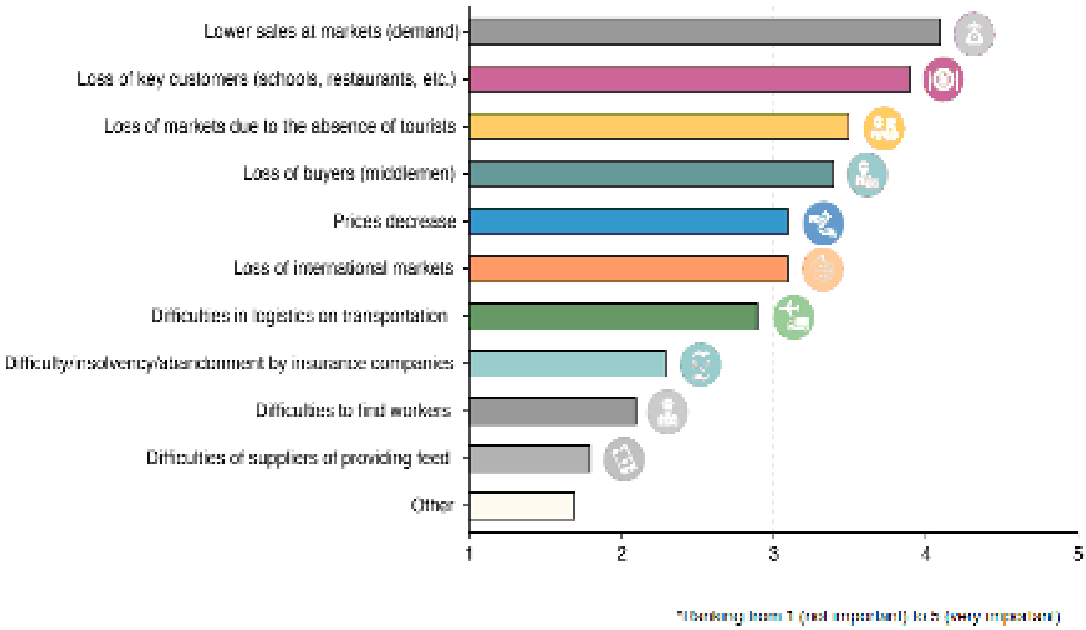
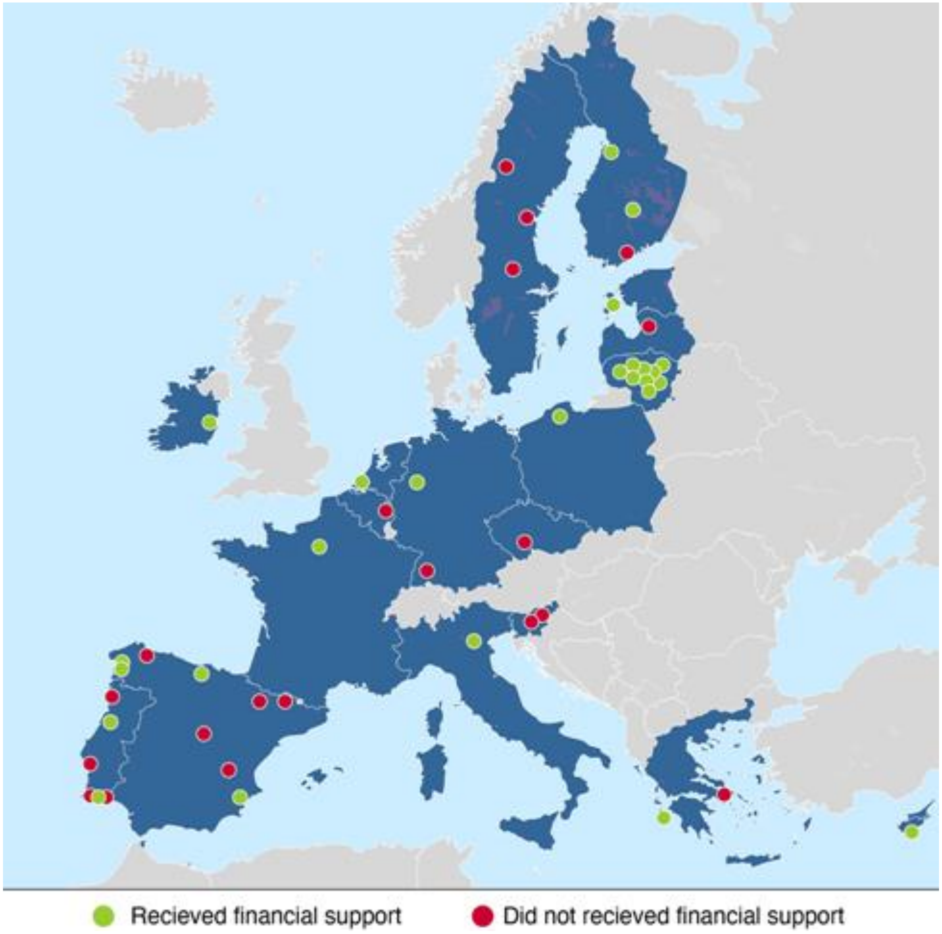


Figure 9.4.7. Distribution of financial support to deal with the COVID-19 pandemic on January 2021



9.6 Annex VI: Data collected under DCF and EU-MAP

This report represents a transition from the former DCF program to the new and the recently implemented EU-MAP program. For this data call Member States was allowed to report either under the DCF or under the EU-MAP. Below the requested variable and segmentations for both programs are listed.

9.6.1 Parameters requested under the DCF

The economic variables to be collected for the aquaculture industry sector under the Data Collection are specified in section A of the Chapter IV and in Appendix X of Commission Decision 2010/93/EC of the 18th of December 2010, on Adopting a multiannual Community programme pursuant to Council Regulation (EC) No 199/2008 establishing a Community framework for the collection, management and use of data in the fisheries sector and support for scientific advice regarding the common fisheries policy.

Table 7.4.1: DCF data requirements

Variable Group	Variable	Unit
Income	Turnover	Euro
	Subsidies	Euro
	Other Income	Euro
	Total Income	Euro
Personnel Costs	Wages and salaries	Euro
	Imputed value of unpaid labour	Euro
Energy Costs	Energy Costs	Euro
Raw Material Costs	Livestock costs	Euro
	Feed costs	Euro
Repair and maintenance Costs	Repair and maintenance	Euro
Other operational Costs	Other operational costs	Euro
Capital Costs	Depreciation of capital	Euro
	Financial Costs, net	Euro
Extraordinary Costs	Extraordinary Costs, net	Euro
Capital Value	Total Value of Assets	Euro
Investments	Net Investments	Euro
Debt	Debt	Euro
Raw Material Volume	Livestock	Tonne
	Fish Feed	Tonne
Total volume	Total sales volume	Tonne
Employment	Male employees	Number
	Female employees	Number
	Total employees	Number
	Male FTE	Number
	Female FTE	Number

	Total FTE	Number
Number of enterprises	less or equal than 5 employees	Number
	6-10 employees	Number
	more or equal than 11 employees	Number

Following DCF the statistical unit for the aquaculture data collection is defined as enterprise, which is the lowest legal entity for accounting purposes. The population refers to enterprises whose primary activity is defined according to the EUROSTAT definition under NACE Code 05.02: 'Fish Farming'. More detailed definitions of parameters can be found in the glossary (section 8.2). Data is requested to be reported by segment and in National totals. Segments are defined as a combination of the main species cultured and the technology used for their production.

9.6.2 Parameters requested under the EUMAP

Under the provisions of Council Regulation 2017/1004, there are requested the economic variables for the aquaculture sector detailed in Table 7 of the Commission Decision (EU) 2016/1251. Member States are invited to submit listed data following the segmentation set out in Table 9 of the Commission implementing decision (EU) 2016/1251.

Table 7.4.2: EUMAP data requirements

Variable Group	**Variable**	**Unit**
Income	Gross sales (total)	Euro
	Operating Subsidies	Euro
	Other Income	Euro
Personnel Costs	Wages and salaries	Euro
	Imputed value of unpaid labour	Euro
Energy Costs	Energy Costs	Euro
Raw Material Costs	Livestock costs	Euro
	Feed costs	Euro
Repair and maintenance Costs	Repair and maintenance	Euro
Other operational Costs	Other operational costs	Euro
Capital Costs	Consumption of fixed capital	Euro
	Financial Income	Euro
	Financial Expenditure	Euro
Capital Value	Total Value of Assets	Euro
Investments	Net Investments	Euro
	Subsidies in investments	Euro
Debt	Debt	Euro
Raw Material Weight	Livestock used	Kg
	Fish Feed used	Kg
Total volume	Total weight of sales	Kg
Employment	Persons employed	Number
	Persons employed FTE	Number
	Number of hours worked by employees and unpaid labour	Number

	Unpaid labour	Number
	Unpaid labour FTE	Number
Number of enterprises	Less or equal than 5 employees	Number
	6-10 employees	Number
	More or equal than 11 employees	Number

9.7 Annex VII: Glossary of variables and indicators reported under the DCF and EUMAP

9.7.1 Parameters requested under the DCF

Turnover:

“Turnover” comprises the totals invoiced by the observation unit during the reference period, and this corresponds to market sales of goods or services supplied to third parties.

Turnover includes all duties and taxes on the goods or services invoiced by the unit with the exception of the VAT invoiced by the unit vis-à-vis its customer and other similar deductible taxes directly linked to turnover.

It also includes all other charges (transport, packaging, etc.) passed on to the customer, even if these charges are listed separately in the invoice. Reduction in prices, rebates and discounts as well as the value of returned packing must be deducted. Income classified as other operating income, financial income and extraordinary income in company accounts is excluded from turnover. Operating subsidies received from public authorities or the institutions of the European Union are also excluded (Structural Business Statistics (SBS) Code 12 11 0, Commission Regulation (EC) No 2700/98).

Subsidies:

“Subsidies” are the financial assistance received from public authorities or the institutions of the European Union which are excluded from turnover.

It includes direct payments, e.g. compensation for stopping trading, refunds of fuel duties or similar lump sum compensation payments; excludes social benefit payments and indirect subsidies, e.g. reduced duty on inputs such as fuel or investment subsidies.

Other income:

“Other income” refers to other operating income included in company accounts which are excluded from turnover; income coming from other activities than aquaculture, e.g. the licensing of ponds for recreational fishery purposes.

Wages and salaries:

“Wages and salaries” is equivalent to “Personnel costs” on the Structural Business Statistics.

“Personnel costs” are defined as the total remuneration, in cash or in kind, payable by an employer to an employee (regular and temporary employees as well as home workers) in return for work done by the latter during the reference period. Personnel costs also include taxes and employees' social security contributions retained by the unit as well as the employer's compulsory and voluntary social contributions.

Personnel costs are made up of:

- wages and salaries
- employers' social security costs

All remuneration paid during the reference period is included, regardless of whether it is paid on the basis of working time, output or piecework, and whether it is paid regularly or not. Included are all gratuities, workplace and performance bonuses, ex gratia payments, thirteenth month pay (and similar fixed bonuses), payments made to employees in consideration of dismissal, lodging, transport, cost of living and family allowances, commissions, attendance fees, overtime, night work etc. as well as taxes, social security contributions and other amounts owed by the employees and retained at source by the employers. Also included are the social security costs for the employer. These include employer's social security contributions to schemes for retirement pensions, sickness, maternity, disability, unemployment, occupational accidents and diseases, family allowances as well as other schemes. These costs are included regardless of whether they are statutory, collectively agreed, contractual or voluntary in nature. Payments for agency workers are not included in personnel costs. (Structural Business Statistics (SBS) Code 13 31 0, Commission Regulation (EC) No 2700/98).

Wages and salaries: Wages and salaries are defined as "the total remuneration, in cash or in kind, payable to all persons counted on the payroll (including homeworkers), in return for work done during the accounting period." regardless of whether it is paid on the basis of working time, output or piecework and whether it is paid regularly or not. Wages and salaries include the values of any social contributions, income taxes, etc. payable by the employee even if they are actually withheld by the employer and paid directly to social insurance schemes, tax authorities, etc. on behalf of the employee. Wages and salaries do not include social contributions payable by the employer. Wages and salaries include: all gratuities, bonuses, ex gratia payments, "thirteenth month payments", severance payments, lodging, transport, cost-of-living, and family allowances, tips, commission, attendance fees, etc. received by employees, as well as taxes, social security contributions and other amounts payable by employees and withheld at source by the employer. Wages and salaries which the employer continues to pay in the event of illness, occupational accident, maternity leave or short-time working may be recorded here or under social security costs, depending upon the unit's accounting practices. Payments for agency workers are not included in wages and salaries. (Structural Business Statistics (SBS) Code 13 32 0, Commission Regulation (EC) No 2700/98).

Social security costs: Employers' social security costs correspond to an amount equal to the value of the social contributions incurred by employers in order to secure for their employees the entitlement to social benefits. Social security costs for the employer include the employer's social security contributions to schemes for retirement pensions, sickness, maternity, disability, unemployment, occupational accidents and diseases, family allowances as well as other schemes. Included are the costs for all employees including homeworkers and apprentices. Charges are included for all schemes, regardless of whether they are statutory, collectively agreed, contractual or voluntary in nature. Wages and salaries which the employer continues to pay in the event of illness, occupational accident, maternity leave or short-time working may be recorded here or under wages and salaries, dependent upon the unit's accounting practices. (Structural Business Statistics (SBS) Code 13 33 0, Commission Regulation (EC) No 2700/98).

Imputed value of unpaid labour:

Unpaid workers normally refer to persons who live with the proprietor of the unit and work regularly for the unit, but do not have a contract of service and do not receive a fixed sum for the work they perform. This is limited to persons who are not included on the payroll of another unit as their principal occupation.

Thus, imputed value of unpaid labour estimates the value of the salaries that these unpaid workers would have received if their work was remunerated.

The chosen methodology to estimate this imputed value of unpaid labour should be explained by the Member State in their national programme.

Energy costs:

“Energy costs” corresponds to the “Purchases of energy products (in value)” on the Structural Business Statistics.

Purchases of all energy products during the reference period should be included in this variable only if they are purchased to be used as fuel. Energy products purchased as a raw material or for resale without transformation should be excluded. This figure should be given in value only. (Structural Business Statistics (SBS) Code 20 11 0, Commission Regulation (EC) No 2700/98).

Livestock costs:

Livestock costs should correspond to the variable livestock volume.

In the Structural Business Statistics, it is included inside 13 11 0 “Total purchases of goods and services”.

Feed costs:

Feed costs include the purchasing costs of the feed during the reference period. The feed costs should correspond to feed volume.

In the Structural Business Statistics, it is included inside 13 11 0 “Total purchases of goods and services”.

Repair and maintenance:

Under repair and maintenance there should be included the costs incurred to bring an asset back to its earlier condition or to keep the asset operating at its present condition (as opposed to improving the asset).

On the Structural Business Statistics is included inside 13 11 0 “Total purchases of goods and services”.

Other operational costs:

Other operating costs should comprise outsourcing costs, property or equipment rental charges, the cost of raw materials and supplies that cannot be held in the inventory and have not been already specified (i.e. water, small items of equipment, administrative supplies, etc.), insurance premiums, studies and research costs, external personnel charges, fees payable to intermediaries and professional expenses, advertising costs, transportation charges, travel expenses, the costs of meetings and receptions, postal charges, bank charges (but not interest on bank loans) and other items of expenditure.

On the Structural Business Statistics is included inside 13 11 0 “Total purchases of goods and services”.

Depreciation of capital:

Depreciation refers to the decline in value of the assets. In accounting, it is used as the allocation of the cost of tangible assets to periods in which the assets are used, in order to reflect this decline in their value.

The chosen methodology to allocate these costs over periods should be explained in the national programme. ESA (6) 6.02 to 6.05 European System of Accounts 1995 (Regulation (EC) No 2223/96, Regulation (EC) No 1267/2003, Eurostat ESA 1995 manual).

Financial costs, net:

“Financial costs, net” should be calculated as costs, coming from financial activity of the enterprise, minus the financial income.

Extraordinary costs, net:

“Extraordinary costs, net” is the difference between “Extraordinary charges” and “Extraordinary income”.

“Extraordinary income” and “Extraordinary charges” are the income and costs that arise otherwise than in the course of the company's ordinary activities (Article 29 of the Fourth Council Directive 78/660/EEC of 25 July 1978).

Total value of assets:

This parameter corresponds to the Balance sheet total of the Structural Business Statistics and the Capital value in the European System of Accounts.

Balance sheet total consists of the sum of items 1 to 16 of the asset side of the balance sheet or of the sum of items 1 to 14 of the liability side of the balance sheet. (Structural Business Statistics (SBS) Code 43 30 0, Commission Regulation (EC) No 2700/98).

Capital value is the total accumulated value of all net investments in the enterprise at the end of the year. ESA 7.09 to 7.24 European System of Accounts 1995 (Regulation (EC) No 2223/96, Regulation (EC) No 1267/2003, Eurostat ESA 1995 manual).

Net Investments:

“Net investments” refers to the difference between Purchase (Gross investment in tangible goods) and Sale (Sales of tangible investment goods) of assets during the year.

Gross investment in tangible goods is the Investment during the reference period in all tangible goods. Included are new and existing tangible capital goods, whether bought from third parties or produced for own use (i.e. Capitalised production of tangible capital goods), having a useful life of more than one year including non-produced tangible goods such as land. The threshold for the useful life of a good that can be capitalised may be increased according to company accounting practices where these practices require a greater expected useful life than the one-year threshold indicated above.

All investments are valued prior to (i.e. gross of) value adjustments, and before the deduction of income from disposals. Purchased goods are valued at purchase price, i.e. transport and installation charges, fees, taxes and other costs of ownership transfer are included.

Own produced tangible goods are valued at production cost. Goods acquired through restructurations (such as mergers, take-overs, break-ups, split-off) are excluded. Purchases of small tools which are not capitalised are included under current expenditure. Also included are all additions, alterations, improvements and renovations which prolong the service life or increase the productive capacity of capital goods. Current maintenance costs are excluded as is the value and current expenditure on capital goods used under rental and lease contracts. Investment in intangible and financial assets are excluded. Concerning the recording of investments where the invoicing, delivery, payment and first use of the good may take place in different reference periods, the following method is proposed as an objective:

i) Investments are recorded when the ownership is transferred to the unit that intends to use them. Capitalised production is recorded when produced. Concerning the recording of investments made in identifiable stages, each part-investment should be recorded in the reference period in which they are made.

In practice this may not be possible and company accounting conventions may mean that the following approximations to this method need to be used:

i) investments are recorded in the reference period in which they are delivered,

ii) investments are recorded in the reference period in which they enter into the production process,

iii) investments are recorded in the reference period in which they are invoiced,

iv) investments are recorded in the reference period in which they are paid for.

Gross investment in tangible goods is based on Gross investment in land (15 12 0) + Gross investment in existing buildings and structures (15 13 0) + Gross investment in construction and alteration of buildings (15 14 0) + Gross investment in machinery and equipment (15 15 0). (Structural Business Statistics (SBS) Code 15 11 0, Commission Regulation (EC) No 2700/98).

Sales of tangible goods includes the value of existing tangible capital goods, sold to third parties. Sales of tangible capital goods are valued at the price actually received (excluding VAT), and not at book value, after deducting any costs of ownership transfer incurred by the seller. Value adjustments and disposals other than by sale are excluded. (Structural Business Statistics (SBS) Code 15 21 0. Commission Regulation (EC) No 2700/98).

Debt:

Financial assets created when creditors lend funds to debtors, either directly or through brokers, which are either evidenced by non-negotiable documents or not evidenced by documents.

Short-term loans: loans whose original maturity is normally one year or less, and in exceptional cases two years at the maximum, and loans repayable on demand.

Long-term loans: loans whose original maturity is normally more than one year, and in exceptional cases more than two years at the minimum.

"Debts" account for provisions and long- and short-term debt (STECF meeting SGECA 06-01).

Livestock (volume):

Volume of livestock purchased during the reference period. The livestock volume should correspond to the livestock cost.

Fish feed (volume):

Volume of feed purchased during the reference period. The feed volume should correspond to feed cost.

Volume of sales:

The volume of sales should correspond to the variable on turnover value. In case of hatcheries and nurseries conversion factors from numbers to tonnes should be stated in the national programmes.

Number of persons employed (Total employment):

This indicator refers to the number of people employed (including full-time and part-time employees) (SGECA-09-03). It corresponds to the Number of people employed of the Structural Business Statistics.

The number of persons employed is defined as the total number of persons who work in the observation unit (inclusive of working proprietors, partners working regularly in the unit and unpaid family workers), as well as persons who work outside the unit who belong to it and are paid by it (e.g. sales representatives, delivery personnel, repair and maintenance teams). It includes persons absent for a short period (e.g. sick leave, paid leave or special leave), and also persons on strike, but not those absent for an indefinite period. It also includes part-time workers who are regarded as such under the laws of the country concerned and who are on the pay-roll, as well as seasonal workers, apprentices and home workers on the pay-roll. The number of persons employed excludes manpower supplied to the unit by other enterprises, persons carrying out repair and maintenance work in the enquiry unit on behalf of other enterprises, as well as those on compulsory military service. Unpaid family workers refer to persons who live with the proprietor of the unit and work regularly for the unit, but do not have a contract of service and do not receive a fixed sum for the work they perform. This is limited to those persons who are not included on the payroll of another unit as their principal occupation. (Structural Business Statistics (SBS) Code 16 11 0, Commission Regulation (EC) No 2700/98).

The number of employees should be reported by gender.

FTE National:

"FTE national" is the number of employees converted in full time equivalents (calculation methodologies vary between countries).

It corresponds to the "Number of employees in full time equivalent units" of the Structural Business Statistics.

The number of employees converted into full time equivalents (FTE). Figures for the number of persons working less than the standard working time of a full-year full-time worker, should be converted into full time equivalents, with regard to the working time of a full-time full-year employee in the unit. Included in this category are people working less than a standard working day, less than the standard number of working days in the week, or less than the standard number of weeks/months in the year. The conversion should be carried out on the basis of the number of hours, days, weeks or months worked. (Structural Business Statistics (SBS) Code 16 14 0, Commission Regulation (EC) No 2700/98).

Reporting the number of FTE national by gender is optional.

Number of enterprises:

The "Number of enterprises" parameter corresponds to a count of the number of enterprises active during at least a part of the reference period (SGECA-09-03).

A count of the number of enterprises registered to the population concerned in the business register corrected for errors, in particular frame errors. Dormant units are excluded. This statistic should include all units active during at least part of the reference period. (Structural Business Statistics (SBS) Code 11 11 0, Commission Regulation (EC) No 2700/98).

Both definitions are similar. However, there are often some divergences with Eurostat data. This is mostly due to the use of the Veterinary list (which is necessary to trade with food products) to update the business register and so companies that are dormant or focusing on other products have been excluded.

Moreover, under the DCF regulation, the number of companies should be disaggregated by the number of persons employed (in ≤5; 6-10 and >10 FTE) (Structural Business Statistics (SBS) Code 16 14 0, Commission Regulation (EC) No 2700/98).

9.7.2 Indicators calculated under the DCF

Average wage:

The average salary or mean wage estimates the salary an employee working full time is receiving on this sector. It includes the salaries themselves, the social security costs and imputed value of unpaid labour.

Mean wage = (Wages and salaries + Imputed value of unpaid labour) / FTE

Gross Value Added (GVA):

Gross Value Added measures the contribution of the sector to the economy.

The Gross Value Added indicator calculated in this report is similar, but does not fully correspond to the Value added at factor cost of the Structural Business Statistics.

Value added at factor cost as defined in the Structural Business Statistics is the gross income from operating activities after adjusting for operating subsidies and indirect taxes. It can be calculated from turnover, plus capitalised production, plus other operating income, plus or minus the changes in stocks, minus the purchases of goods and services, minus other taxes on products which are linked to turnover but not deductible, minus the duties and taxes linked to production. Alternatively, it can be calculated from gross operating surplus by adding personnel costs. Income and expenditure classified as financial or extra-ordinary in company accounts is excluded from value added. Value added at factor costs is calculated "gross" as value adjustments (such as depreciation) are not subtracted. (Structural Business Statistics (SBS) Code 12 15 0, Commission Regulation (EC) No 2700/98).

Thus, Gross Value Added is calculated on this report as:

GVA = Turnover + Other Income – Energy costs – Livestock costs – Feed costs - Repair and maintenance - Other Operational costs.

GVA to Revenues:

Gross value added to revenue ratio - indicates the share of revenue that contributes to the economy through factors of production (returns to labour and returns to capital). Indicator is calculated as the ratio between gross value added and revenue (the sum of Turnover and Other Income). Expressed as a percentage.

$$GVA\ to\ Revenue = \frac{GVA}{Turnover + Other\ Income} 100\%$$

Earnings Before Interest and Tax (EBIT):

“Earnings before interest and taxes (EBIT)” or “Operating profit” is a measure of a firm's profitability that excludes interest and income tax expenses.

EBIT = Turnover + Other Income + Subsidies – Energy costs – Wages and salaries - Imputed value of unpaid labour - Livestock costs – Feed costs – Repair and maintenance – Other Operational costs – Depreciation of capital

Net profit:

"Net profit" is a measure of a firm's profitability that includes the results of financial activity of the enterprise.

$$Net\ profit = EBIT - Financial\_costs\_net$$

Net profit margin:

Net profit margin is a measure of the economic performance of a sector or enterprise expressed in relative terms. It is a difference between total income and all incurred costs (operating, capital and financial). Expressed in percentage.

$$Net\ profit\ margin = \frac{Net\ profit}{Total\ Income} 100\%$$

Return on Investment (ROI):

Return on investment is a performance measure to evaluate the profitability (efficiency) of an investment.

During the SGECA-10-04 meeting it was decided that it was more appropriate to calculate the Return on Investment using the "Earnings Before Interest and Tax (EBIT)", rather than the Net profit.

$$ROI = \frac{EBIT}{Total\_Value\_of\_Assets} * 100\%$$

Running Cost to Turnover Ratio (in %):

This indicator shows how much of the turnover (income) is consumed by production costs.

Running cost to turnover ratio = (Energy costs + Wages and salaries + Livestock costs + Feed costs + Repair and maintenance + Other Operational costs) x 100 / Turnover

Earnings Before Interest and Tax (EBIT) to Revenue ratio:

"Earnings before interest and taxes (EBIT) to revenue ratio" measures the margin of the companies' profit. Expressed in percentages.

$$EBIT\ to\ Revenue = \frac{EBIT}{Turnover + Other\ Income} * 100\%$$

Labour productivity (by FTE or Employee):

Labour productivity is calculated as the average output per worker or per time unit. It can be calculated as Gross Value Added (GVA) divided by Full Time Equivalents (FTE). This indicator describes the value added to the economy from the activity, in this case the value added to the economy by one FTE.

$$Labour\_productivity = \frac{GVA}{FTE}$$

When a MS cannot report the level of employment in FTEs, the number of employees is used as a second best alternative. However, this alternative compromises the comparison and should be clearly stated in the report.

Capital productivity:

Capital productivity is calculated as the average output per unit of capital. It can be calculated as Gross Value Added (GVA) divided by Capital value (total value of assets) in percentage. The indicator describes the value added to the economy by one unit of capital.

$$Capital\ productivity = \frac{GVA}{Total\ value\ of\ assets} 100\%$$

Future Expectations of the Industry indicator:

The indicator "Future Expectations of the Industry" can be interpreted as a proxy for the industry's intent to remain in the market in the medium/long term. If investment minus depreciation is positive, it has the meaning that the sector is allocating resources to increase its production capacity, and therefore it expects to remain in the market to recover the cost of the investment. If investment minus depreciation is close to zero, it could be interpreted as an indicator that the sector is only wishing to maintain its production capacity in the future, and that it is not planning to expand. The third case is where the sector is not even covering its depreciation costs, thus disinvesting with the possible intention to reduce its presence in the market in the future. Therefore, this indicator would be used to approximate the industry's investing behaviour in the future and it has been considered useful by the experts.

$$FEI = \frac{(Net\_investment - Depreciation)}{Total\_value\_of\_\ assets} * 100\%$$

Change 2016-15:

The indicator of the relative change in corresponding indicators compared to the previous year. Expressed in percentage, calculated as following:

$$Change\ 2016 - 15 = \frac{(X_{2016} - X_{2015})}{X_{2015}} * 100\%$$

Development 2016/(2008-2015):

The indicator of the relative change in corresponding indicators compared to the average of previous years for which the data are available (usually 2008-2015). The estimate is showing the long term development of the corresponding indicator. Expressed in percentages, calculated as following:

$$Development\ 2014/(2008 - 2013) = \frac{(X_{2014} - average(X_{2008,}X_{2009,}X_{2010,}X_{2011,}X_{2012,}X_{2013,}X_{2014,}X_{2015}))}{average(X_{2008,}X_{2009,}X_{2010,}X_{2011,}X_{2012,}X_{2013,}X_{2014,}X_{2015,})} * 100\%$$

9.7.3 Parameters requested under the EUMAP

Gross sales (total): corresponds to the DCF variable "Turnover".

Operating Subsidies: corresponds to the DCF variable “Subsidies”. It refers to direct payments which general government or the institutions of the European Union make to resident producers. (ESA D.3).

Other Income: corresponds to the DCF variable “Other Income”.

Wages and salaries: corresponds to the DCF variable “Wages and salaries”.

Imputed value of unpaid labour: corresponds to the DCF variable “Imputed value of unpaid labour”.

Energy Costs: corresponds to the DCF variable “Energy Costs”.

Livestock costs: corresponds to the DCF variable “Livestock costs”.

Feed costs: corresponds to the DCF variable “Feed costs”.

Repair and maintenance: corresponds to the DCF variable “Repair and maintenance”.

Other operational costs: corresponds to the DCF variable “Other operational costs”.

Consumption of fixed capital: corresponds to the DCF variable “Depreciation of capital”.

Total Value of Assets: corresponds to the DCF variable “Total Value of Assets”.

Net Investments: corresponds to the DCF variable “Net Investments”.

Debt: corresponds to the DCF variable “Debt”.

Livestock used: corresponds to the DCF variable “Livestock”.

Fish Feed used: corresponds to the DCF variable “Fish Feed”.

Total weight of sales: corresponds to the DCF variable “Total sales volume”.

Persons employed: corresponds to the DCF variable “Total employees”.

Persons employed FTE: corresponds to the DCF variable “Total FTE”.

Less or equal than 5 employees: corresponds to the DCF variable "Less or equal than 5 employees".

6-10 employees: corresponds to the DCF variable "6-10 employees".

More or equal than 11 employees: corresponds to the DCF variable "More or equal than 11 employees".

Financial Expenditure minus Financial Income: corresponds to the DCF variable "Financial Costs, net".

Subsidies in investments: Direct payments which general governments or the institutions of the European Union make to resident producers to finance all or part of the costs of their acquiring assets related to the company.

Number of hours worked by employees and unpaid labour: The aggregate number of hours worked by the persons employed and the unpaid labour during the reference period.

Unpaid labour: Number of workers that have not received compensation in the form of wages, salaries, fees, gratuities, piecework pay or remuneration in kind.

Unpaid labour FTE: The number of workers that have not received compensation in the form of wages, salaries, fees, gratuities, piecework pay or remuneration in kind converted into full time equivalent jobs (FTE).

9.7.4 Indicators calculated under the EUMAP

Average wage:

The average salary or mean wage estimates the salary an employee working full time is receiving on this sector. It includes the salaries themselves, the social security costs and imputed value of unpaid labour.

Under the EUMAP, the indicator is calculated as follows:

Mean wage = (Wages and salaries + Imputed value of unpaid labour) / (Persons employed FTE + Unpaid labour FTE)

$$\text{Mean wage } = \frac{Wages\ and\ salaries\ +\ Imputed\ value\ of\ unpaid\ labour}{Persons\ employed\ FTE\ +\ Unpaid\ labour\ FTE}$$

Gross Value Added (GVA):

Gross Value Added measures the contribution of the sector to the economy.

The Gross Value Added indicator calculated in this report is similar, but does not fully correspond to the Value added at factor cost of the Structural Business Statistics.

Value added at factor cost as defined in the Structural Business Statistics is the gross income from operating activities after adjusting for operating subsidies and indirect taxes. It can be calculated from turnover, plus capitalised production, plus other operating income, plus or minus the changes in stocks, minus the purchases of goods and services, minus other taxes on products which are linked to turnover but not deductible, minus the duties and taxes linked to production. Alternatively, it can be calculated from gross operating surplus by adding personnel costs. Income and expenditure classified as financial or extra-ordinary in company accounts is excluded from value added. Value added at factor costs is calculated "gross" as value adjustments (such as depreciation) are not subtracted. (Structural Business Statistics (SBS) Code 12 15 0, Commission Regulation (EC) No 2700/98).

Thus, under the EUMAP, the indicator is calculated as follows:

GVA = Gross sales (total) + Other Income – Energy costs – Livestock costs – Feed costs - Repair and maintenance - Other Operational costs.

GVA to Revenues:

Gross value added to revenue ratio - indicates the share of revenue that contributes to the economy through factors of production (returns to labour and returns to capital). Indicator is calculated as the ratio between gross value added and revenue (the sum of Turnover and Other Income). Expressed as a percentage. Under the EUMAP, Gross Value Added is calculated as under the DCF:

$$GVA\ to\ Revenue = \frac{GVA}{Turnover + Other\ Income} 100\%$$

Earnings Before Interest and Tax (EBIT):

"Earnings before interest and taxes (EBIT)" or "Operating profit" is a measure of a firm's profitability that excludes interest and income tax expenses. Under the EUMAP, the indicator is calculated as follows:

EBIT = Turnover + Other Income + Operating Subsidies + Subsidies on Investments – Energy costs – Wages and salaries - Imputed value of unpaid labour - Livestock costs – Feed costs – Repair and maintenance – Other Operational costs – Consumption of fixed capital.

Net profit:

"Net profit" is a measure of a firm's profitability that includes the results of financial activity of the enterprise. Under the EUMAP, the indicator is calculated as follows:

Net profit = EBIT – (Financial Expenditure - Financial Income)

Net profit margin:

Net profit margin is a measure of the economic performance of a sector or enterprise expressed in relative terms. It is a difference between total income and all incurred costs (operating, capital and financial). Expressed in percentage. Under the EUMAP, the indicator is calculated as follows:

$$Net\ profit\ margin = \frac{Net\ profit}{Turnover + Other\ Income + Operating\ Subsidies + Subsidies\ on\ Investments} 100\%$$

Return on Investment (ROI):

Return on investment is a performance measure to evaluate the profitability (efficiency) of an investment.

During the SGECA-10-04 meeting it was decided that it was more appropriate to calculate the Return on Investment using the "Earnings Before Interest and Tax (EBIT)", rather than the Net profit. Under the EUMAP, the indicator is calculated as under the DCF:

$$ROI = \frac{EBIT}{Total\_Value\_of\_Assets} * 100\%$$

Running Cost to Turnover Ratio (in %):

This indicator shows how much of the turnover (income) is consumed by production costs. Under the EUMAP, the indicator is calculated as under the DCF:

Running cost to turnover ratio = (Energy costs + Wages and salaries + Livestock costs + Feed costs + Repair and maintenance + Other Operational costs) x 100 / Turnover

Earnings Before Interest and Tax (EBIT) to Revenue ratio:

"Earnings before interest and taxes (EBIT) to revenue ratio" measures the margin of the companies' profit. Expressed in percentages. Under the EUMAP, the indicator is calculated as follows:

$$EBIT\ to\ Revenue = \frac{EBIT}{Turnover\ +\ Other\ Income\ +\ Operating\ Subsidies\ +\ Subsidies\ on\ Investments} * 100\%$$

Labour productivity (by FTE or Employee):

Labour productivity is calculated as the average output per worker or per time unit. It can be calculated as Gross Value Added (GVA) divided by Full Time Equivalents (FTE). This indicator describes the value added to the economy from the activity, in this case the value added to the economy by one FTE. Under the EUMAP, the indicator is calculated as follows:

$$Labour\_productivity = \frac{GVA}{Persons\ employed\ FTE\ +\ Unpaid\ labour\ FTE}$$

When a MS cannot report the level of employment in FTEs, the number of employees is used as a second best alternative. However, this alternative compromises the comparison and should be clearly stated in the report.

Capital productivity:

Capital productivity is calculated as the average output per unit of capital. It can be calculated as Gross Value Added (GVA) divided by Capital value (total value of assets) in percentage. The indicator describes the value added to the economy by one unit of capital. Under the EUMAP, the indicator is calculated as under the DCF:

$$Capital\ productivity = \frac{GVA}{Total\ value\ of\ assets} 100\%$$

Future Expectations of the Industry indicator:

The indicator “Future Expectations of the Industry” can be interpreted as a proxy for the industry’s intent to remain in the market in the medium/long term. If investment minus depreciation is positive, it has the meaning that the sector is allocating resources to increase its production capacity, and therefore it expects to remain in the market to recover the cost of the investment. If investment minus depreciation is close to zero, it could be interpreted as an indicator that the sector is only wishing to maintain its production capacity in the future, and that it is not planning to expand. The third case is where the sector is not even covering its depreciation costs, thus disinvesting with the possible intention to reduce its presence in the market in the future. Therefore, this indicator would be used to approximate the industry’s investing behaviour in the future and it has been considered useful by the experts. Under the EUMAP, the indicator is calculated as follows:

$$FEI = \frac{(Net\_investment - Consumption\ of\ fixed\ capital)}{Total\_value\_of\_\ assets} * 100\%$$

9.8 Annex VIII: Data coverage

As foreseen in the Regulation No 2017/1004, the Commission asked Member States to provide aggregated scientific data from within their National Data Collection programs to support scientific advice.

The data requested refers to 2017 and 2018 (with 2019 as voluntary); while previous years (2008-2016) could be submitted or resubmitted as full annual data sets in cases where the already submitted data are considered incomplete or required correction. Data requested for 2017 and 2018, in accordance within their National Data Collection programs, had to be provided under the provisions of Regulation 2017/1004 (i.e., EUMAP).

Under the provisions of Regulation 199/2008, there were collected in previous years: Income (turnover, subsidies and other income), Personnel costs (Wages and salaries of staff and Imputed value of unpaid labour), Energy costs, Raw material costs (livestock costs and feed costs), Repair and maintenance costs, Other operational costs, Capital costs (depreciation of capital and financial costs), Extraordinary costs, Capital value, Net Investments, Debt, Raw material volume (livestock and feed), Volume of sales, Employment (Number of persons employed, gender and FTE national) and number of enterprises pertaining to the EU aquaculture sector. Moreover, turnover and volume of sales need to be detailed by species. The segmentation is set out in the Appendix XI of the Commission Decision.

Under the provisions of Regulation 2017/1004, there were requested the economic variables for the aquaculture sector detailed in Table 7 of the Commission implementing decision (EU) 2016/1251. In particular, Income (gross total sales, operating subsidies and other income), Personnel costs (Wages and salaries of staff and Imputed value of unpaid labour), Energy costs, Raw material costs (livestock costs and feed costs), Repair and maintenance costs, Other operational costs, Capital costs (consumption of fixed capital), Financial income and Financial expenses, Capital value, Net Investments, Subsidies in investments, Debt, Raw material volume (livestock and feed), Volume of sales, Employment (Number of persons employed their FTE national, number of unpaid labour and their FTE, and Number of hours worked by employees and unpaid labour) and number of enterprises pertaining to the EU aquaculture sector. Moreover, turnover and volume of sales need to be detailed by species. The segmentation set out in Table 9 of the Commission implementing decision (EU) 2016/1251. In addition, Member States were requested to provide the social data (i.e., demographic variables) for the aquaculture sector detailed in Table 6 of the Commission implementing decision (EU) 2016/1251.

Collection of data for freshwater species is not mandatory. However, if collected, Member States were invited to provide it during the data call.

The Data Collection Framework (DCF) and EU-MAP requires data quality assurance by Member States. Data checks were performed by the JRC through the comprehensive analysis of the data submitted and by experts attending the meeting to elaborate this report. As a consequence of these data checks data has been resubmitted by some of the countries after the deadline and during the EWG meeting. There have also been a few countries resubmitting data after the meeting due to discrepancies found during the meeting.

This was the seventh call for data on aquaculture. Although there was an improvement in the overall data quality compared to the previous calls, there are still issues that have to be improved by the Member States. The Covid-19 pandemic lead to some countries submitting data after the deadline, and having to have a virtual also delayed the whole process. While the existence of thresholds to submit the aquaculture data on the Commission implementing decision (EU) 2016/1251 lead to reduced coverage compared to previous data calls under the DCF.

Under the DCF and EUMAP, the submission of marine aquaculture data is compulsory, while the submission of inland freshwater aquaculture data is voluntary. Therefore, landlocked countries (i.e., Austria, Czech Republic, Hungary, Luxembourg and Slovakia) are not obliged to report aquaculture data. On positive note, Hungary and Slovakia submitted some aquaculture data; while Austria and Czechia are having pilot studies and should be able to submit data on next data call.

Belgium and Lithuania only produce freshwater aquaculture, hence these MS did not carry out any data collection within the DCF and EUMAP frameworks. Moreover, aquaculture production in Belgium is very low.

Cyprus and Poland did not provide data, already since 2015, and Estonia since 2016 because their (marine) aquaculture production is below the thresholds set in the EUMAP regulation.

France and Italy submitted data for 2017 and 2018 on most of their aquaculture production, but not for all of their production.

The data coverage by country and variable is presented in the Table 9.7.1. The table is showing partially missing data by country and on the National total level.

Table 9.7.1: Coverage of the data provided during the data calls at National total level 2008-2018 (2019 voluntary) (Y = submitted).

	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2918	2019
Bulgaria	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	
Croatia	Croatia was not part of the EU				Y	Y	Y	Y	Y	Y	Y	Y
Cyprus	Y	Y	Y	Y	Y	Y	Y	Data not reported because of thresholds				
Denmark	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	
Estonia	Y	Y	Y	Y	Y	Y	Y	Y	Data not reported because of thresholds			
Finland	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	
France			Y	Y	Y	Y	Y	Y	Y	Y	Y	
Germany	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	
Greece	The data collection program was interrupted					Y	Y	Y	Y	Y	Y	
Ireland	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	
Italy	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	
Malta	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	
Netherlands	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	
Poland		Y	Y	Y	Y	Y	Y	Data not reported because of thresholds for marine production				
Portugal	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	
Romania		Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	
Slovenia	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	
Spain	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	
Sweden	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	
United Kingdom	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	
Latvia	Only freshwater aquaculture, not compulsory to report							Y	Y	Y	Y	Y
Belgium	Only minor freshwater aquaculture, not compulsory to report											
Lithuania	Only freshwater aquaculture, not compulsory to report											
Austria	Only freshwater aquaculture, not compulsory to report											
Czech Republic	Only freshwater aquaculture, not compulsory to report											
Hungary	Only freshwater aquaculture, not compulsory to report									Y	Y	
Slovakia	Only freshwater aquaculture, not compulsory to report									Y	Y	Y

Luxembourg	No aquaculture production

In chapter 2 of this report an EU overview is presented based on national total level data and estimated values covering the missing data for some countries or missing data from some years (as shown in the Table above). A brief description of the imputation methodology can be found in annex 2, and more detail in the 2018 aquaculture report.

In addition, the EU sector analysis in the chapter 3 is based on national aquaculture segment level data, which for each sector divided on production techniques and species produced. Missing data for some countries or missing data from some years can affect the results of the time series analysis. Thus, when reading this report, and in particular the EU overview in chapter 2 and the EU sector analysis in chapter 3, the numbers may not fully match.

Other relevant issues affecting quality and coverage of the data:

- Greece submitted data from 2014, with 2013 being partial data. 2014 Greek data was for the full aquaculture sector. Greece did not report the FTE variables (total FTE, male and female FTE) and the raw material volume: livestock for 2014.
- Croatia only submitted data from 2012 onwards because it became part of the EU only in 2013.
- Romania did not report 2008 data in previous aquaculture data calls, so 2008 data is also not available for Romania.
- France and Italy a submitted data for 2017 and 2018 on most of their aquaculture production, but not for all of their production.
- Slovenia and the Netherlands only reported marine aquaculture production.
- France provided a full set of economic variables on aquaculture segment level for 2010-2016 (missing 2008 and 2009), however there are missing variables for some minor segments.
- The United Kingdom started providing full datasets in 2011 and 2012 and significantly improved the quality of the data submitted. Most of economic variables are missing for the years 2008- 2010.
- Portugal submitted all data for the period 2009-16, but only partial data for 2008.
- These and other data issues are further detailed under the data issues in each national chapter.

In relation to the social data, data issues are detailed in chapter 7. However, here we highlight:

- Greece did not provide social data for employment status.
- Italy provided the social data after the meeting ended and is therefore not included in this report.

9.9 Annex IX: Quality and Coverage checking procedures on the data submitted under the 2021 aquaculture economic data call

Although the quality and coverage of the data reported under the Data Collection Framework (DCF) are a responsibility of the EU Member States, JRC (European Commission) has undertaken quality and coverage checking procedures on the data submitted, some carried out during the data uploading phase and some afterwards. The quality and coverage of the data has also been checked by national experts during the STECF EWG 20-12 meeting on the Economic Report of the EU aquaculture sector which took place online, during the week 1 to 5 February 2021.

Aquaculture data submitted under the 2021 data call and used for the STECF report have been checked in four subsequent steps. This section provides a synthetic description of each of them. More information of the quality and coverage checking procedures undertaken on DCF aquaculture data are available in the JRC technical report available at:

http://datacollection.jrc.ec.europa.eu/

Step 1- Data checks before and during uploading procedure to the JRC/DCF database

Several data checks are already embedded in the excel templates which the Member States are required to use for uploading data on their national aquaculture sector. In specific cells of these files, the data entry is restricted to certain records (e.g. acceptable codes, value types and ranges).

Furthermore, during the data uploading procedure, a number of automatic syntactic checks are carried out on the data before it is accepted by the DCF database hosted by JRC. Syntactic checks are carried out without any specific knowledge of what the data contains or its meaning. They tell if the data is present or not and in the correct format. These checks automatically reject data that do not confirm to specific restrictions, such as ensuring textual data is validated against defined parameters lists. In addition, numeric data are checked to make sure they contain numbers and not strings. Member States receive immediate feedback when attempting to upload their data submissions.

Step 2 - Results of the data quality checks/analyses are assessed by JRC experts

Once the datasets with the aquaculture data are successfully uploaded by the Member States, JRC produces different analyses on the data submitted in order to facilitate the assessment of its quality and coverage. Some of these analyses are presented in interactive online dashboards created using the software Tableau. The same software is also used for analyses not specifically related to data quality, i.e. analyses on the structure and economic performance of the EU aquaculture sector and overviews of the uploading status of DCF aquaculture data.

All the analyses performed by JRC in Tableau are available in interactive online dashboards, which are refreshed every morning and are accessible (only after authentication), on the following link:

https://datacollection.jrc.ec.europa.eu/da/aqua/quality

Besides developing the checks and analyses, JRC experts actively participate in the analysis of their results. All quality issues (e.g. inconsistencies, outliers and missing data) concerning the data submitted, identified through the analyses performed in Tableau or with manual checks are listed by JRC in excel files, one for each MS, including the most relevant information concerning the problems identified (e.g. description of the problem, structural and economic indicators affected and assessed impact on the analyses of the final STECF report), together with comments and actions recommended by JRC to solve the issues.

Step 3 – National correspondents receive a list of data transmission issues and may resubmit revised data

The excel files listing the data quality issues (and including JRC experts' comments and opinions on the action to undertake) are sent to the national correspondents (each national correspondent receives information only about the country he/she represents).

MS are requested to consider the potential anomalies listed in the excel file, amend and re-submit the data as necessary. They are also requested to go over the quality analyses performed in order to detect additional (if any) problems and add them to the list. Finally, they are asked to provide feedback (i.e. whether or not the problem has been resolved, which actions have been taken and possible comments) in designated columns of the excel file.

Step 4 – The quality and coverage of the data have been checked by the STECF Expert Working Groups

In addition to being analysed by JRC's experts, the quality and coverage of aquaculture data submitted under the DCF is also checked by national fisheries experts during the STECF EWG meeting. Data submitted under the 2021 aquaculture economic data call has been checked during the EWG meeting 20 12 which took place during the week 1 to 5 February 2021.

At the beginning of the meeting, the experts received the excel files with the list of data transmission issues of the MS assigned to them, which also included for each specific issue comments by JRC and feedback sent by the MS when available. MS have been contacted whenever an inconsistency was found and the expert attending the meeting could not solve it by resubmitting data. Furthermore, all experts have been given access to the tableau dashboards. This has allowed them to visualise changes in the data whenever the MS have uploaded revised data during the meeting or submitted new templates.

The experts reported in the Data Transmission Monitoring Tool the relevant data coverage and quality issues that remained unsolved by the end of the STECF EWG.

10 LIST OF ANNEXES

Electronic annexes are published on the meeting's web site on:
http://stecf.jrc.ec.europa.eu/ewg2012

List of electronic annexes documents:

EWG-20-12 – Annex 1 - Data

The economic data used to compile this report are provided in an Excel file as data tables at the following address: https://stecf.jrc.ec.europa.eu/data-reports.

11 LIST OF BACKGROUND DOCUMENTS

Background documents are published on the meeting's web site on:
http://stecf.jrc.ec.europa.eu/ewg2012

List of background documents:

EWG-20-12 – Doc 1 - Declarations of invited and JRC experts (see also section 8 of this report – List of participants)

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STECF

The Scientific, Technical and Economic Committee for Fisheries (STECF) has been established by the European Commission. The STECF is being consulted at regular intervals on matters pertaining to the conservation and management of living aquatic resources, including biological, economic, environmental, social and technical considerations.

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