



Scientific Technical and Economic Committee for Fisheries (STECF) — The 2024 Aquaculture Economic Report (STECF 24-14)

Nielsen, R., Llorente, I.,
Virtanen, J., Guillen, J. (eds.).

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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 2024 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 2022 and nowcasting for 2023. The focus within this report is on the period 2017 to 2022 covering data provided under the EU-MAP data collection. The data collected is reported by national totals and by segments divided on species. The EU aquaculture sector reached 1.2 million tonnes in sales volume and €4.8 billion in turnover, in 2022. This correspond to a 1% increase in volume and 13% increase in value compared to 2021. The overall number of enterprise were estimated to 14 thousand, whereas the total number of employees and full time employed reached 73 thousand and 41 thousand in 2022, respectively. The report furthermore contains two special chapters. A chapter analysing the economic sustainability of the EU aquaculture sector using economic sustainable indicators and a chapter providing information on the latest nowcast analysis.

Authors

STECF advice:

BASTARDIE, Francois; BORGES, Lisa; CASEY, John; DASKALOV, Georgi; DÖRING, Ralf; DROUINEAU, Hilaire; GOTI ARALUCEA, Leyre; GRATI, Fabio; HAMON, Katell; IBAIBARRIAGA, Leire; JARDIM, Ernesto; JUNG, Armelle; LIGAS, Alessandro; MANNINI, Alessandro; MARTIN, Paloma; MOORE, Claire; MOTOVA, Arina; NIELSEN, Rasmus; NIMMEGEERS, Sofie; NORD, Jenny; PINTO, Cecilia; PRELLEZO, Raúl; RAID, Tiit; SABATELLA, Evelina Carmen; SAMPEDRO, Paz; SOMARAKIS, Stylianos; STRANSKY, Christoph; ULRICH, Clara; URIARTE, Andres; VALENTINSSON, Daniel; VAN HOOF, Luc; VELASCO GUEVARA, Francisco; VRGOC, Nedo.

EWG 24-14 report:

NIELSEN, Rasmus; LLORENTE, Ignacio; AVDIC MRAVLJE, Edvard; BARRELET, CANO, Suzana; Johna; CARPENTER, Griffin; COZZOLINO, Maria; DANATSKOS, Christos; DAVIDJUKA, Irina; DENNIS, John; FERNANDEZ POLANCO, Jose Manuel; FERNÁNDEZ-GONZÁLEZ, FERREIRA, Ines; Raquel; GUILLEN, Jordi; HANNON, Colin; HOEKSTRA, Geert; IOANNOU, Myrto; KAZLAUSKAS, Edvardas; KIELISZEWSKA, Małgorzata; KREISS, Cornelia; MORINEAU, Baptiste; MYTLEWSKI, Adam; NICHEVA, Simona; PENNER, Johan; SCHKEEPER, Caroline; SCIBERRAS, Andrew; VALVE, Joonas; VIRTANEN, Jarno; VIŠNIĆ NOVAKOVIĆ, Svjetlana.

STECF Report on EWG 24-14

Request to the STECF¹

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

STECF comments

EWG 24-14 met online 21-25 October 2024. The EWG was attended by a group of aquaculture economic experts consisting of 25 experts from 20 countries, three JRC experts and five observers. The economic report of the EU aquaculture sector is made on a biennial basis. The 2024 report is the ninth of its kind. It provides a comprehensive overview of the latest information available on the production, economic value, structure and competitive performance of the aquaculture sector at the Member State and EU level. The report covers the years 2008 to 2022, with the focus on 2017-2022 trends and nowcast for 2023. The report includes the marine finfish, shellfish, freshwater finfish and Algae segments.

STECF notes that following the 2024 call for economic data on the EU aquaculture sector, EWG 24-14 was requested to analyse and comment on the economic performance of the EU and national aquaculture sectors in 2021 and 2022 and produce a nowcast for 2023. The EWG was also requested to develop a short new section of the report that focuses on the economic sustainability of the EU aquaculture sector, which includes the use of economic sustainability indicators. Furthermore, the experts were requested to provide an analysis of the period 2017-2022 showing how these economic sustainability indicators evolved. To answer to that request, EWG 24-14 updated the time-series of the previous 2022 report, with data for 2021 and 2022.

STECF observes that the collection of social data is only mandatory every three years according to the EU-MAP and the next dataset containing all Member States social indicators will be delivered in 2026 referring to 2023. However, some Member States collect social data every year according to their national work program. These countries provided data to the EWG. STECF notes that based on these submissions the EWG assessed the quality of the social indicators and provided suggestions for improvement in the Member State reporting of data.

STECF notes that definitions and how to report social data in a coherent way is still an issue and it requires additional preparation (such as development of a reporting template) before the next data submission in 2026.

STECF acknowledges that the EWG delivered a comprehensive report within two weeks after the meeting ended and acknowledges the difficulty faced during the meeting due to data re-submissions during the meeting week and data updates after the meeting.

STECF observes that the total nominal turnover from the EU aquaculture sector reached 1.2 million tonnes corresponding to a sales value of €4.8 billion in 2022. This corresponds to a 1% increase in volume and a 13% increase value in 2022 compared to 2021. The nowcast estimates referring to 2023 predict a small decline in both sales volume and sales value in 2023, however there is a high uncertainty as regards this estimation and the decline should be taken with caution. The EU 27 aquaculture sector directly employed around 73 000 persons working and 41 000 FTE's in 2022 distributed on close to 14 000 enterprises.

¹ The contact details of the STECF members are reported in Annex VII.

STECF observes that the overall information on the EU sector has improved compared to the previous report due to the reporting of more data under the freshwater aquaculture segment and due to the new estimations, allowing to bridge data gaps and present time trends (by using imputation and nowcasting tools). However, despite the progress, the EWG continues to experience issues with data submission and resubmission during the meeting by Member States. STECF notes that erroneous data makes the work of the EWG to obtain key performance indicators of the EU aquaculture sector challenging. Furthermore, the data resubmission during or after the meeting improves the data quality but decreases the time dedicated to analysis of the data presented in the report. It also hinders experts to engage in deeper economic analysis and to provide in-depth explanations of the development.

STECF reiterates its observation from PLEN 22-03 that in order to provide comprehensive and in-depth analysis of the aquaculture sector in the EU, the data sets, submissions and templates for national analysis should be finalised prior to the meeting.

STECF conclusions

STECF concludes that EWG 24-14 adequately addressed all ToRs including provision of a nowcast for the sector for 2023 and an analysis of economic sustainability indicators.

STECF concludes that the report provides a good and reliable overview of the economic performance of the EU aquaculture sector over the 2017-2022 period. However, some data provision issues remain, including non-submission and continuous re-submission during the meeting, which reduces the available time that the EWG has to analyse the data and indicators produced.

STECF reiterates its conclusion from PLEN 22-03 that in order to provide a comprehensive and in-depth analysis of the aquaculture sector in the EU, the data sets, submissions and templates for the analysis, should be finalised prior to the meeting. Therefore, STECF considers that the EWG should be divided into two shorter meetings:

1. an online preparatory 2-3 days meeting for data finalisation and drafting of national chapters and,
2. a shorter 3 days meeting with a smaller number of experts in person to produce in depth analysis of the EU level trends, segments overviews and special chapters.

STECF also concludes that provision of social indicators needs to be better aligned to be able to compare between Member States. This requires a preparatory methodological discussion on the definitions of the social variables requested under the EU-MAP and the development of a common template for future data calls, which may be undertaken by RCG ECON and the newly established Intersessional Subgroup (ISSG) on social aspects.

REPORT TO THE STECF

EXPERT WORKING GROUP ON

The 2024 Aquaculture Economic Report

(EWG-24-14)

Virtual meeting, 21-25 October 2024

This report does not necessarily reflect the view of the STECF and the European Commission and in no way anticipates the Commission's future policy in this area

1 INTRODUCTION

The 2024 biennial Economic Report of the EU Aquaculture Sector is the ninth 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 2017 to 2022.

Europe represents one of the largest markets for seafood. It is the second largest trader of seafood products in the world and the main importing region of aquatic products of animal origin as consumption has steadily increased over the past decades. On a global level, production of seafood for human consumption is nowadays led by aquaculture that supplied more than the half of aquatic animal foods in 2022. 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 imports making up around 60% of the total supply. To increase EU own supply of seafood products, aquaculture seems to be the most obvious choice as the supply from fisheries has been stagnating since the late 1990's.

The future demand for seafood 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, the EU aquaculture production has been quite stable over the period from 2008 to 2022 and the EU contribution to world aquaculture production (including aquatic plants) has been decreasing over time in both volume and value terms, representing only 0.86% and 1.6% of global production in 2022 (FAO, 2024).

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 techniques used in the sector. Furthermore, it provides the foundation for evaluating the performance of the EU farmers and their ability to stay competitive on the global market for seafood products.

This report responds to the requirements of the Terms of References (TOR), through the following structure. After this short introduction in chapter 1, chapter 2 provides an overview of the EU aquaculture sector. Chapter 3 includes a detailed analysis of the aquaculture sectors (i.e. marine fish, freshwater fish, shellfish and algae) 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. The report also includes two special chapters. Chapter 5 provides an overview of the economic sustainability indicators developed within the report and how these indicators has evolved over the period 2017-2022. Chapter 6 provides an overview of the nowcasting exercise provided for this report assessing the development in 2023.

Again, this year, a special effort has been made to provide time trends for the data collection period from 2008 to 2022 using estimated values (imputation of missing data) when data has not been available under the DCF or EU-MAP. To support this effort, the nowcasting tool has been applied to estimate data for the years 2023 and 2024. However, due to difficulties in obtaining reliable data for the aquaculture production and values in 2024, only estimates for 2023 are presented. The results of this effort can be seen in the EU overview (chapter 2) and the method is further described in two annexes, one explaining the methodology for construction of overall EU trends (imputation) (Annex 2), and the other one that provides the nowcast methodology (Annex 3).

The availability of data for the year 2021 has made it possible to analyse the quality of the second nowcast exercise developed during the previous report. The comparison of the estimated values for 2021 and the actual values for 2021 shows a negative deviation of only 2% in sales volume and a positive deviation in total sales value of 5%.

This report follows the segmentation under the EU-MAP and therefore only data from 2017 to 2022 is presented in tables and figures. However, data for the years 2008 to 2016 can be found on the STECF website.

Data delivered from the reporting countries continue to improve considering that data for freshwater aquaculture are now reported by most countries. However, the EWG still encountered some data gaps, which have been managed by implementing FAO data. Details about data issues and how they have been addressed are explained in annex V. Furthermore, a returning issue is that countries have to correct data during the meeting, which heavily influence the time that is available for deeper economic analysis. A suggestion for future meetings could be to have two separate meetings: One for writing the National chapters including data corrections and re-upload of data. And a second meeting for writing the EU overview and related species chapters, including special chapter. This way experts time will be much better utilized and the quality of the report improved.

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

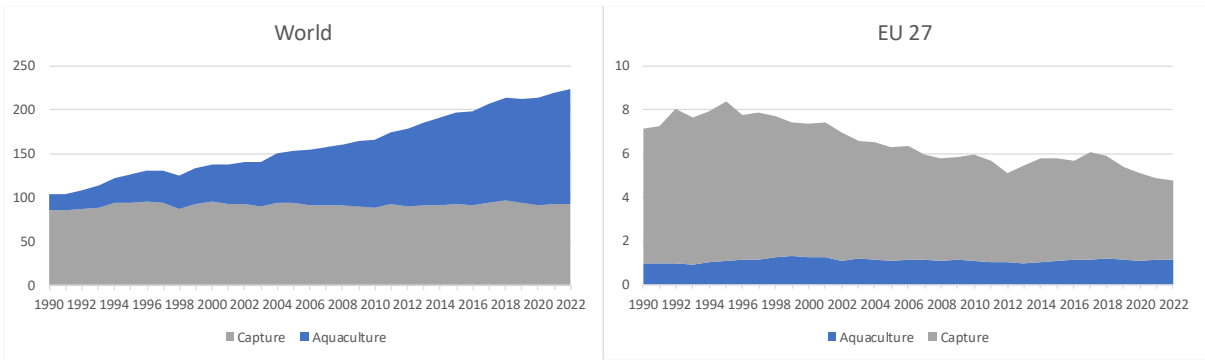
The 2024 Aquaculture report supersedes all previous STECF aquaculture report. Comparisons across STECF aquaculture reports cannot not be made.

2 EU AQUACULTURE SECTOR OVERVIEW

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 57% in 2022 including aquatic plants. The total estimated global production from captured fisheries and aquaculture increased from 199 million tonnes in 2016 to 223.2 million tonnes in 2022. The production from world capture fisheries has been fluctuating around 90 million tonnes per year during the last two decades. In contrast, the global aquaculture production has been steadily increasing about 2-3% per year, as shown in Figure 1.

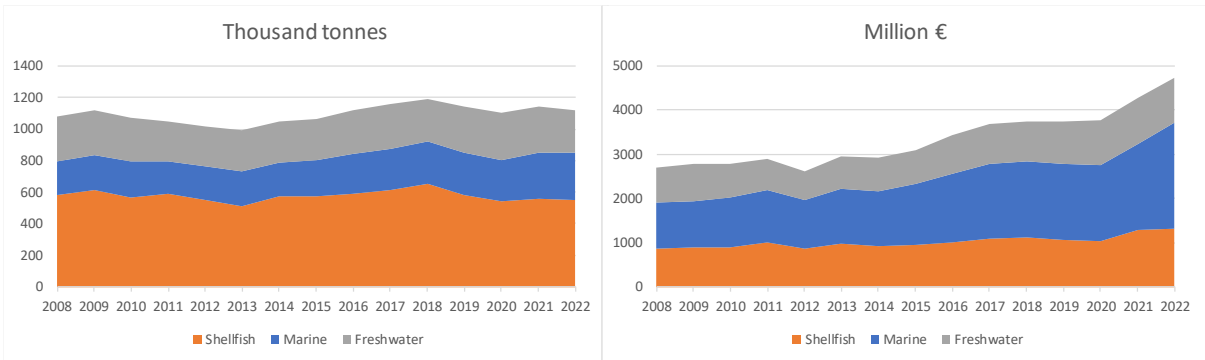
Figure 1. World and EU27 seafood production (capture and aquaculture in million tonnes): 1990-2022.



Source: Own elaboration from FAO (2024) data

The global value of aquaculture production reached €296 billion (312 billion USD) in 2022 (FAO, 2024). The sector has increased production more than 4 times since 1990 (see Figure 1). However, this growth has primarily been driven by Asian countries producing almost 90% of the world's aquaculture products. China is the most important producer of aquaculture products in the world, producing 57% of the global aquaculture products. European Union aquaculture production represented only 0.86% of the world aquaculture production in terms of weight and 1.6% in value.

Figure 2. EU (27) aquaculture production in weight and value by subsector: 2008-2022.



Source: Own elaboration from FAO (2024) data

The aquaculture production in the EU has increased by 14% from 1990; however, since 2018 the production has declined by 6% (FAO, 2024). As EU capture fisheries production has been showing a decreasing trend from 1990 to 2022, aquaculture has become relatively more important to supply the seafood market. In 2022, the aquaculture sector provided around 23% of the fish and shellfish supply in the EU.

In 2022, marine fishes, freshwater fishes and shellfish accounted for 27%, 24% and 49% of the EU production of aquaculture in terms of weight, respectively. In value terms, marine fishes, freshwater fishes and shellfish accounted for 51%, 22% and 28% of the production value (Figure 2).

2.2 The EU aquaculture sector

For the third time in the EU aquaculture economic 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 is lower than in the fishing sector, where a pre-set target for production volumes (TAC) and production capacity are available in the beginning of the year to support the nowcasting exercise for fisheries. This exercise follows the recommendations and principles for estimation of the main variables for EU aggregates approved by the STECF plenary in 2019.

The scope of the nowcast is limited to estimating the production in volume (Total weight of sales), the production in value (Gross sales), and the employment (both total employees and 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 2023, based on data from EU-MAP 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 2023 is equivalent to 90.2% of the production volume and value in 2022. In the case of employment, the availability of data has been lower and the nowcast coverage decreases to 64% and 55% in the case of FTE and employees, respectively. In the EU overview, the 2023 estimates were produced by the nowcast exercise for EU 27 totals regarding production, gross sales and employment. For countries with missing nowcast data for 2023, values from 2022 were used as an approximation.

In the case of 2024, estimates were only obtained from 6 countries, which does not allow for a quantitative nowcast. Furthermore, the economic shocks (e.g., price increase) and the extreme weather events (such as the cold drop (DANA) that occurred at the end of October 2024 at the Spanish Mediterranean coast) increase uncertainty during 2023 and 2024. Therefore, all the above points make extrapolation of data from previous years highly uncertain and the experts have therefore refrained from presenting estimates for 2024.

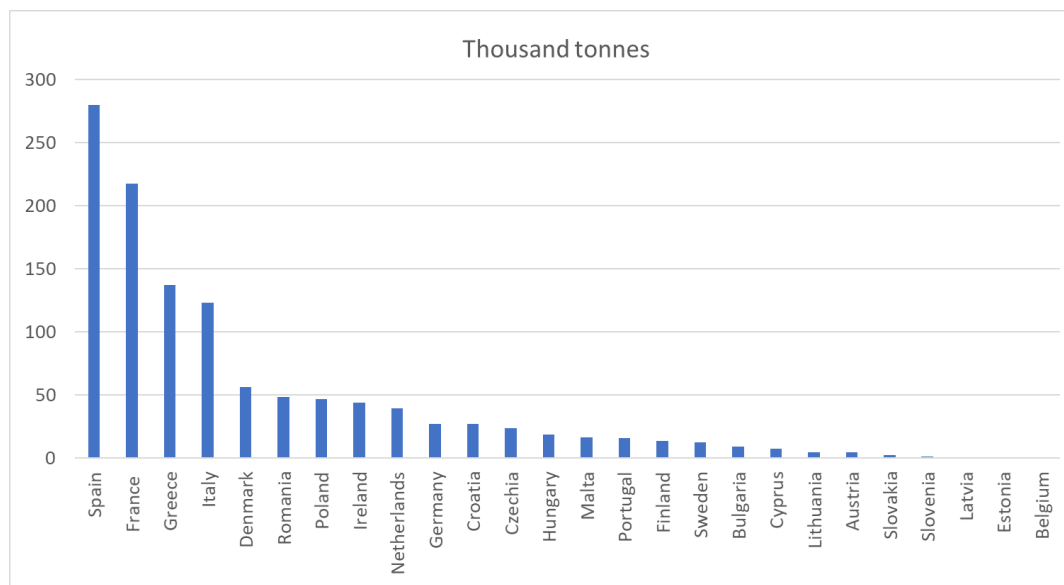
In this section, a special effort has been made by the EWG to present the development of the entire EU aquaculture sector, covering all 27 Member States from 2008 to 2022. The totals and the time trends presented in this chapter are based on the data collected under DCF and EU-MAP, supplemented with 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 was almost 1.2 million tonnes and accounted for €4.8 billion in 2022 (DCF and EWG estimates). According to FAO (2024) data, the EU represents 0.86% of the world aquaculture production in volume and 1.6% in value. EU aquaculture production is mainly concentrated in four countries: Spain (24%), France (18%), Greece (12%), and Italy (10%). These four countries account for 64% of the total EU aquaculture production volume (Figure 3).

In terms of value, France is the largest contributor in the EU with 19% of the total turnover, followed by Spain (17%), Greece (16%) and Italy (8%). These four countries combine 60% of the total EU aquaculture turnover (Figure 4).

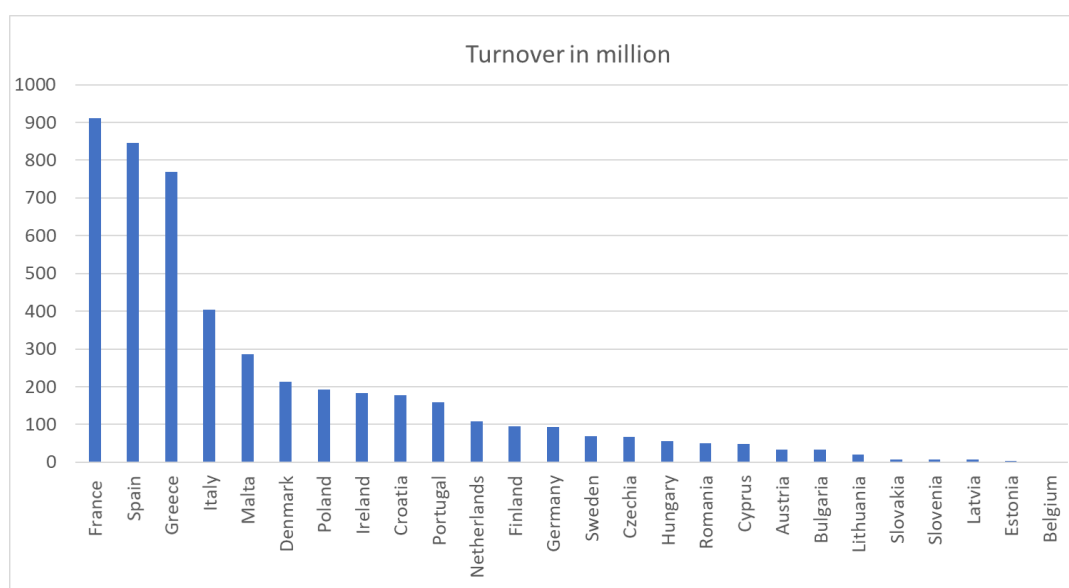
It should be noted that even though Spain has the largest aquaculture production volume (24%), it is only second in value (17%). This is due to the relatively low market value of mussels, which represented almost three quarters of the Spanish aquaculture production volume but only one quarter of the sales value.

Figure 3. Aquaculture production in EU MS in terms of weight: 2022.



Source: Own elaboration from EU Member States DCF data submission

Figure 4. Aquaculture production in EU MS in terms of value: 2022.



Source: Own elaboration from EU Member States DCF data submission

2.3 Economic performance of the EU aquaculture sector

Table 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, France, has a sales volume of 217 thousand tonnes, which provided a turnover of €910.6 million of production in 2022. The production was carried out in 2 489 enterprises employing 16 890 persons, corresponding to 9 518 full time employees (FTE). A more detailed analysis of each of these indicators is presented in this section.

Table 1. Economic and employment indicators for the EU aquaculture sector: 2021-2022.

	Total weight of sales (tonnes)		Turnover (million euro)		Number of enterprises		Employment (number)		FTE (number)	
	2021	2022	2021	2022	2021	2022	2021	2022	2021	2022
Austria	4 920	4 719	34.3	32.8	196	157	893	725	536	435
Belgium	223	243	1.4	1.7	17	17	101	120	72	81
Bulgaria	11 691	9 440	33.3	32.6	756	714	1 503	1 518	1 219	1 236
Croatia	27 922	27 322	167.4	178.2	138	144	1 509	1 599	1 242	1 267
Cyprus	7 862	7 594	45.1	47.7	17	15	230	211	138	127
Czechia	23 508	24 077	47.5	66.3	480	440	2 180	2 463	1 308	1 478
Denmark	57 837	56 259	192.2	213.0	84	79	643	602	500	459
Estonia	581	506	3.0	3.4	17	16	78	75	47	45
Finland	12 598	13 929	79.4	94.2	173	161	575	583	395	385
France	224 763	217 687	871.7	910.6	2 304	2 489	15 381	16 890	9 056	9 518
Germany	26 052	27 381	85.0	93.7	2 382	2 283	4 837	4 980	2 745	2 932
Greece	136 420	137 082	578.3	769.8	648	657	4 903	5 007	3 918	3 958
Hungary	17 847	18 948	38.1	55.4	189	189	1 245	1 216	747	730
Ireland	42 607	44 040	178.0	183.4	298	281	2 002	2 045	1 111	1 153
Italy	141 340	123 446	459.1	404.1	582	582	7 800	7 283	1 969	2 017
Latvia	1 063	925	5.7	6.2	75	69	307	310	206	202
Lithuania	5 135	4 859	15.1	19.7	87	94	423	423	254	254
Malta	16 425	16 632	210.4	286.1	9	10	371	370	318	315
Netherlands	39 024	39 330	110.8	107.7	118	119	306	311	277	276
Poland	45 364	46 856	119.8	191.9	1 242	1 242	5 148	5 206	3 844	3 888
Portugal	16 012	16 063	134.9	158.2	680	715	1 579	1 981	1 185	1 482
Romania	11 714	48 316	47.0	49.9	490	463	2 274	1 956	2 621	1 956
Slovakia	2 514	2 614	7.2	7.8	41	38	934	934	560	560
Slovenia	1 719	1 603	6.1	7.1	36	33	191	177	124	114
Spain	280 673	279 696	677.3	845.4	2 880	2 757	16 777	15 381	5 333	5 593
Sweden	16 161	12 607	62.2	68.8	105	91	531	433	237	269
TOTAL	1 171 975	1 182 174	4 210	4 836	14 045	13 855	72 723	72 798	39 961	40 727

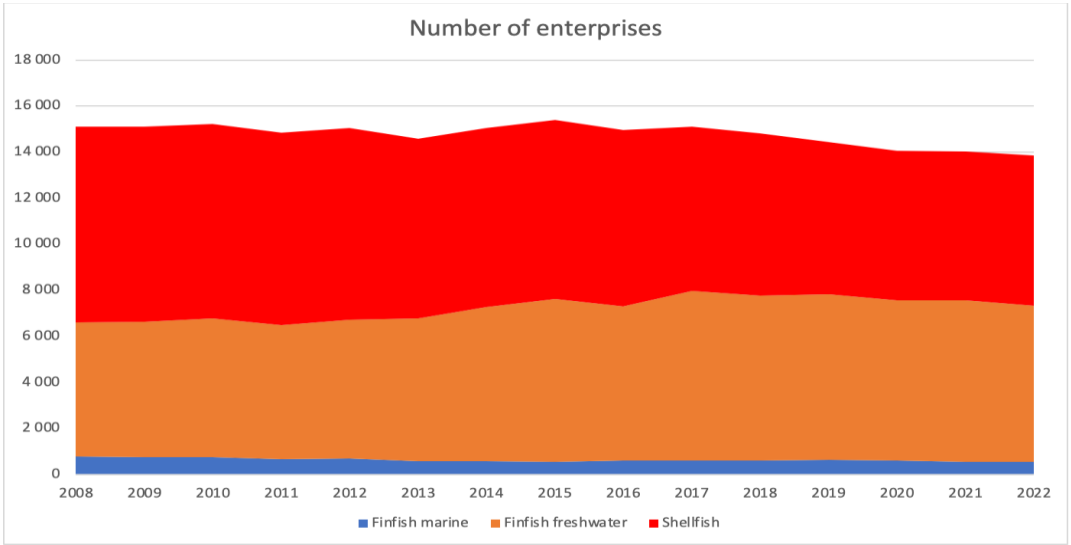
Source: Own elaboration from EU MS data submission (DCF, EU-MAP), Eurostat, FAO and EWG estimations, 2024.

Number of enterprises

A total of 12 026 enterprises were reported under EU-MAP in 2022. It is further estimated that the total number of enterprises in the EU aquaculture sector is around 13 855 taking into account the EU countries not reporting data. This number has fluctuated around 14 thousand, within a range of a few hundred enterprises, since 2008, and it is decreasing (Figure 5).

The Figure 5 shows that the enterprises mainly belong to the freshwater (49%) and shellfish (47%) sectors, whereas only 4% operate in the marine sector. The majority of the enterprises in the EU aquaculture sector are microenterprises with less than 10 employees.

Figure 5. Total Enterprises in the EU Aquaculture sector: 2008-2022.

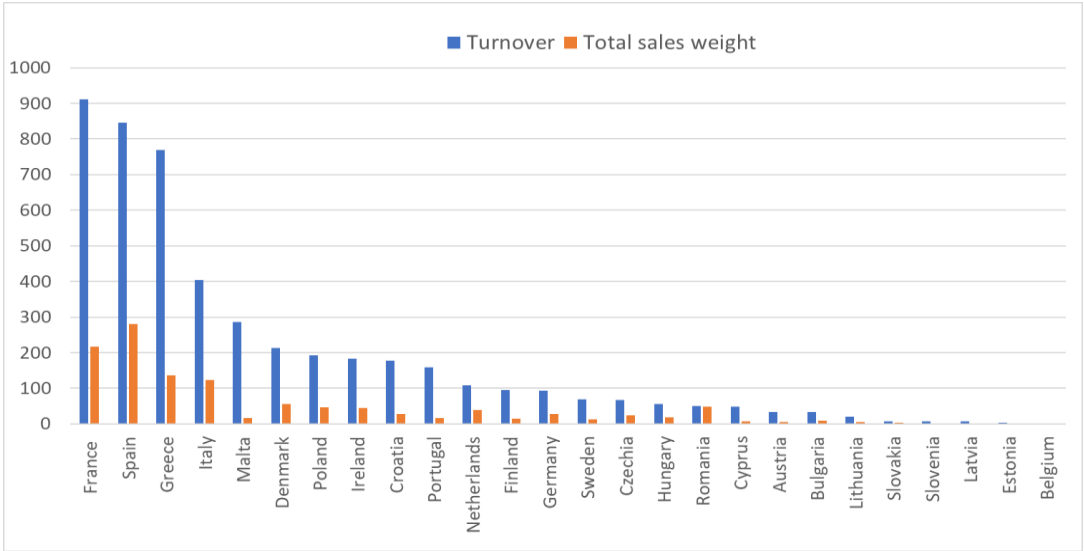


Source: Own elaboration from EU MS data submission (DCF, EU-MAP), Eurostat, FAO and EWG estimations, 2024.

Production and sales

The total EU aquaculture production is estimated to be 1 171 and 1 182 thousand tonnes in 2021 and 2022, respectively. This corresponds to a 4% increase from 2020 to 2021 and a 1% increase from 2021 to 2022.

Figure 6. Total sales weight (in thousand tonnes) and turnover (in million €) in the EU Aquaculture sector per MS: 2022.

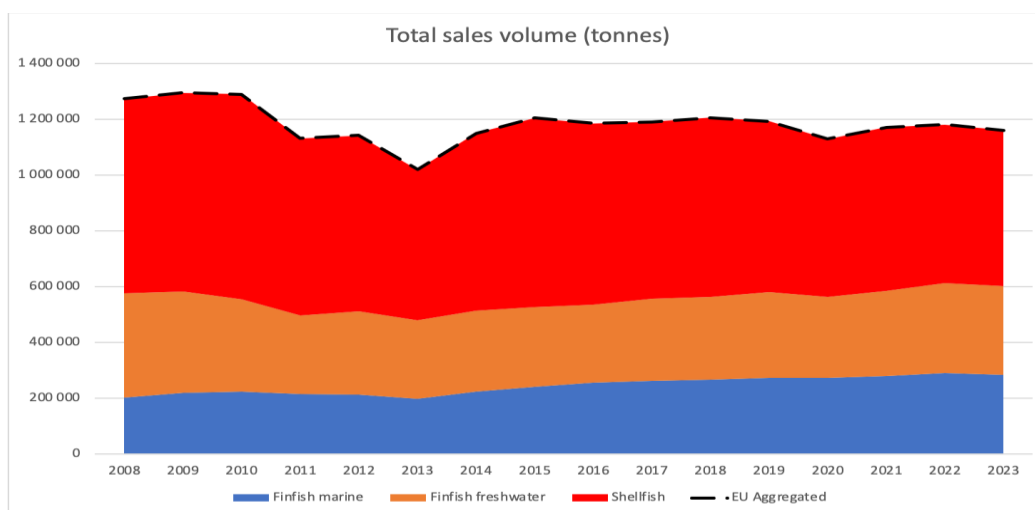


Source: Own elaboration from EU MS data submission and EWG estimations, 2024

Large differences in the volumes and turnovers from aquaculture are observed across the 27 EU Member States, with the four main producers being France, Greece, Spain, and Italy, with reported turnovers between €910.6 million and €404.1 million and production being between 279.6 and 123.4 thousand tonnes.

Figure 7 shows the aggregated total production in the EU aquaculture sector from 2008 to 2022 and a nowcast estimate for 2023. Since 2011, the overall EU production seems to be rather stable, between 1.1 and 1.2 million tonnes. A noticeable decrease is observed between 2010 and 2013, which was 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 year’s production. Since then, production has remained stagnant, and even after growing slightly during 2021 and 2022, the estimate for 2023 reflects a new decline. The shellfish production accounted for 48%, freshwater finfish 27%, and marine finfish 25% of the total production in 2022.

Figure 7. Total production in the EU Aquaculture sector: 2008-2023.

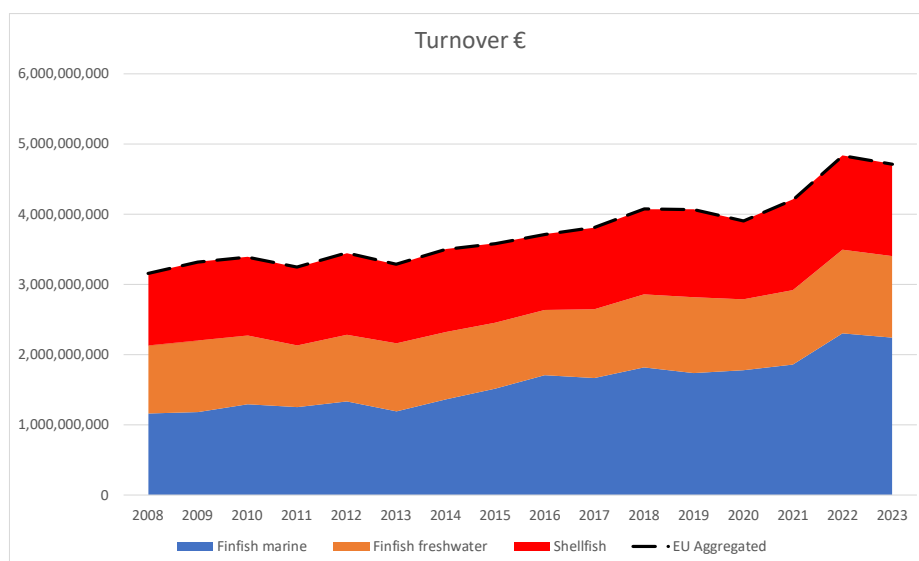


Source: Own elaboration from EU MS data submission and EWG estimations, 2024.

Turnover

The total nominal turnover from the EU aquaculture sector was almost €4.2 and €4.8 billion in 2021 and 2022, respectively. This represents a 13% increase in 2022 in comparison with 2021 data. Despite a general rise in prices, the total sales and turnover show an increasing trend from 2020. The majority of the turnover at the EU level comes from marine finfish production (48%), while shellfish production accounts for 28% and freshwater finfish production 25%. The nowcast estimate for 2023 indicates a rather stable turnover value around €4 715 million for the EU in total (Figure 8).

Figure 8. Aquaculture turnover in nominal and real values at EU27 level: 2008-2023.



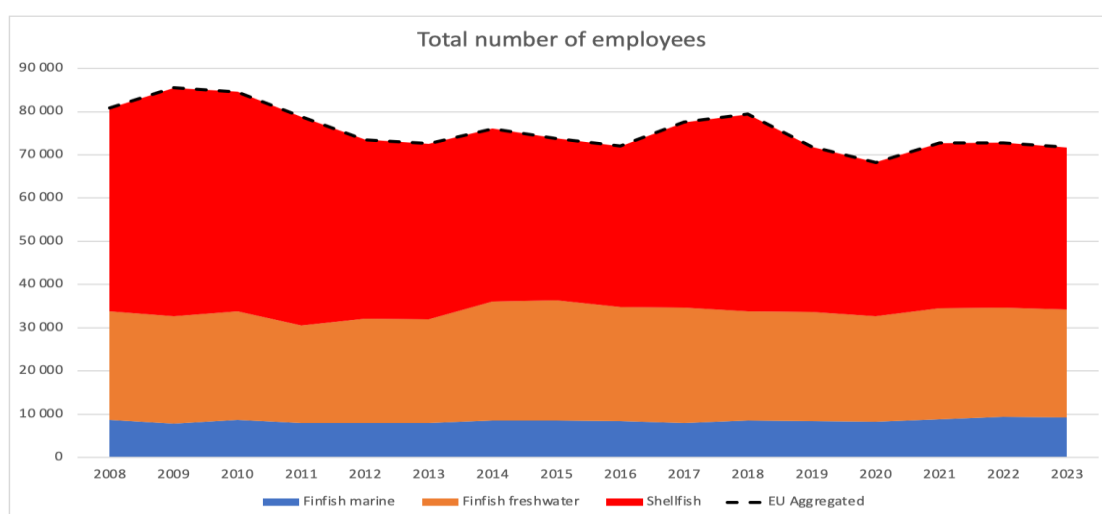
Source: Own elaboration from EU MS data submission and EWG estimations, 2024

Employment

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

The reported EU-MAP data displays an employment of approximately 69 875 persons in 2022, which was 1% less than in 2021 (70 812 employed). Taking into account the estimates for the Member States not reporting data, the EU 27 aquaculture sector directly employed around 72 798 persons in 2022 (Figure 9). The estimated EU 27 employment in 2021 show relatively stable values and was 72 723 persons.

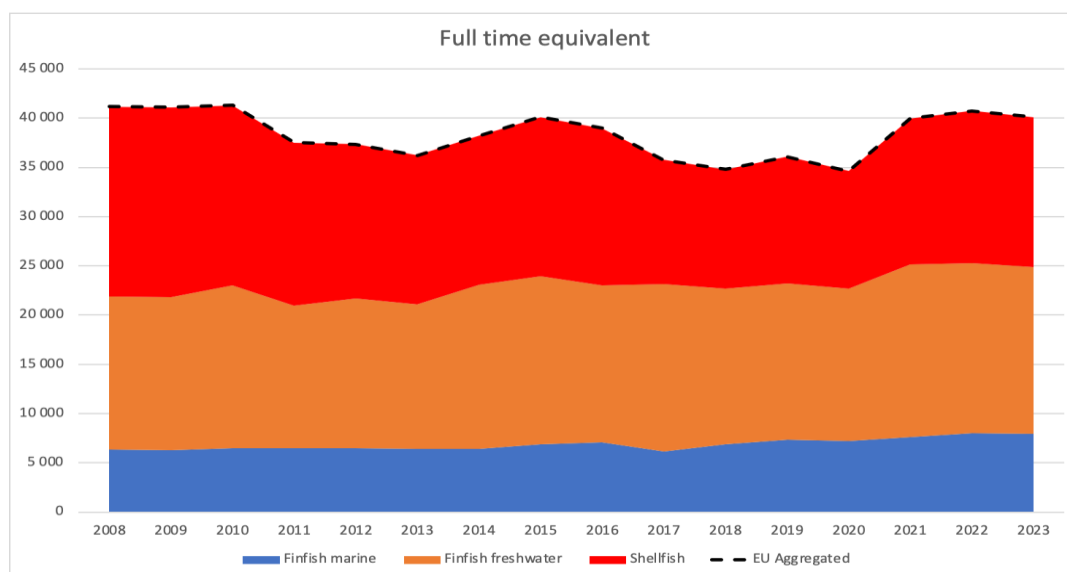
Figure 9. Numbers of Employees in the EU Aquaculture sector: 2008-2023.



Source: Own elaboration from EU MS data submission and EWG estimations, 2024.

The shellfish sector employs 52% of the employees in the sector, freshwater finfish production employs 35% and marine finfish production 13% of the persons employed in the EU aquaculture. The nowcast estimate for 2023 indicates a decrease of approximately 1% to 71 756 employees.

Figure 10. Number of FTEs in the MS Aquaculture sector: 2008-2023.

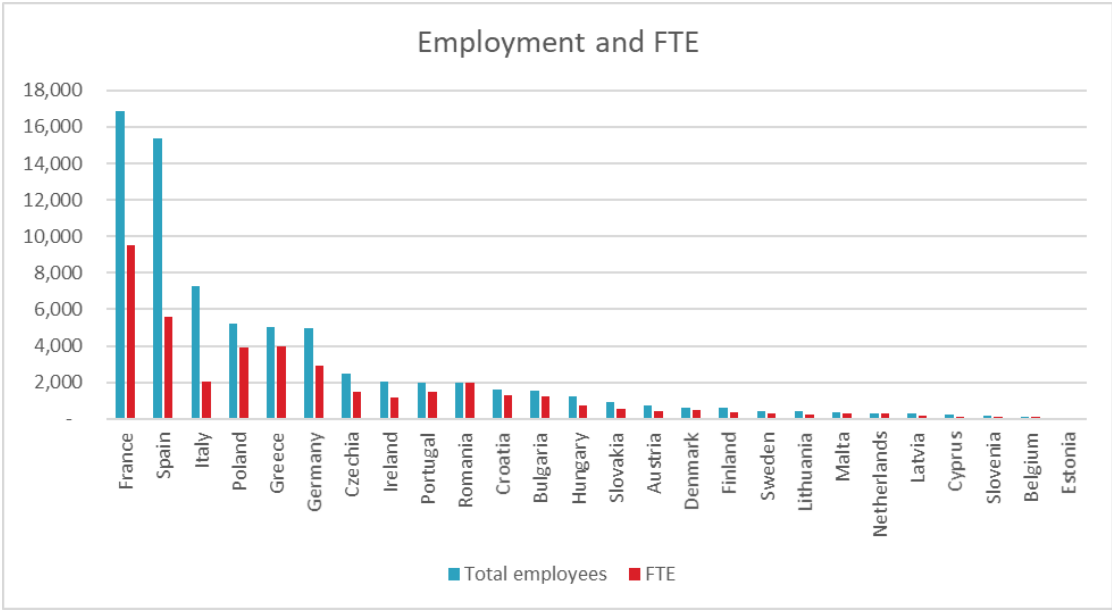


Source: Own elaboration from EU MS data submission and EWG estimations, 2024.

Looking at the full-time equivalents (FTEs) of the data collected under EU-MAP, there has been an increase of 9% from the 33 452 FTEs reported in 2021 to the 36 847 FTEs reported in 2022. In 2021 there was also an increase by 17% in comparison with 2020 data. Overall, it is estimated that the FTEs in the EU 27 countries amounted to 39 961 and 40 727 in 2021 and 2022, respectively. This corresponds to a 13% increase and a 2% increase compared to 2020 and 2021, respectively (Figure 10). The nowcast for 2023 indicates a minor decrease of full-time employment equivalents to 40 112 FTEs, corresponding to a drop of 2%.

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 grew from 0.5 and 0.51 in 2019 and 2020, respectively, to 0.55 in 2021 and 0.56 in 2022.

Figure 11. Numbers of Employees and FTEs in the Member States Aquaculture sector: 2022.

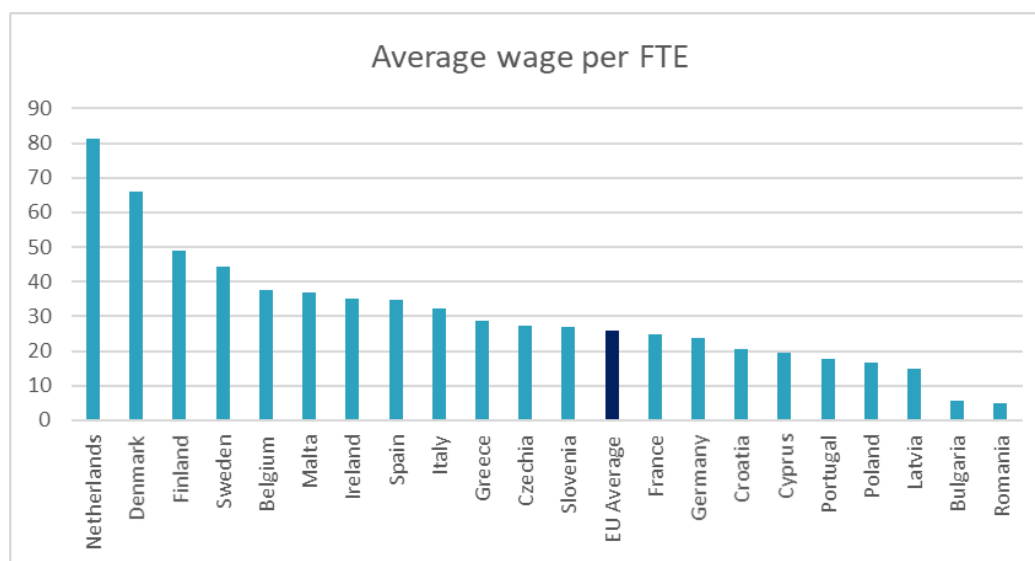


Source: Own elaboration from EU MS data submission and EWG estimations, 2024

Mean wages

The average wage is calculated as the gross average wage, and so 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 22 countries show that the average gross wage per FTE for the EU aquaculture sector in 2021 was about €25 170 per year, and in 2022 it increased by 2.5% to almost €25 800 (Figure 12).

Figure 12. Average wage (in thousand euro) in the EU Aquaculture sector per MS: 2022.



Source: Own elaboration from EU MS data submission, 2024

Gross Value Added

Gross value added (GVA) is an economic productivity metric that measures the input of a company to an economy. GVA informs about the contribution made by a particular product to the firm's profit. DCF data from 21 countries (some of the countries did not submit the necessary data for calculation of GVA) show that the EU aquaculture sector generated about €1 851.6 million in GVA in 2021 and €2 005 million in 2022, corresponding to an increase of 8% (Table 2).

Table 2. Economic performance Indicators for the EU aquaculture sector: 2022.

Country	GVA		EBIT		ROI		Labour productivity		Capital productivity		Average wage	
	million €		million €		%		thousand €		%		thousand €	
	2021	2022	2021	2022	2021	2022	2021	2022	2021	2022	2021	2022
Belgium	-	-	-	4.0 - 4.9	-17.5	-21.5	0.0	0.0	0.0	0.0	39.2	37.6
Bulgaria	12.6	0.3		4.1 - 9.9	7.9	-15.7	10.3	0.2	26.4	0.4	4.0	5.5
Croatia	51.7	50.5		24.3 23.0	4.5	4.0	41.6	39.9	10.6	9.3	17.8	20.6
Cyprus	6.4	20.2		0.1 14.6	0.0	28.8	28.5	98.4	13.0	39.9	22.1	19.5
Czechia	124.5	244.2		84.6 197.3	51.7	102.3	185.5	302.3	75.7	126.5	22.7	27.4
Denmark	33.0	41.9	-	3.6 2.3	-1.9	0.0	65.9	91.1	13.1	14.5	56.4	65.9
Finland	16.6	22.1	-	8.2 - 3.7	-7.8	-2.6	42.0	57.3	10.5	13.7	44.2	49.0
France	453.9	456.3		160.4 129.6	12.4	8.4	48.5	46.4	37.4	33.9	23.7	24.8
Germany	33.2	32.9	-	40.0 - 37.3	-8.6	-20.2	12.1	11.2	6.7	17.3	26.6	23.9
Greece	177.5	166.8		44.5 23.4	1.4	-0.1	45.3	42.1	10.6	9.4	28.0	28.7
Hungary	61.1			51.5		27.6	80.2		32.8		10.9	
Ireland	48.9	70.4		4.9 18.8	-1.4	6.7	43.3	60.2	19.4	25.2	31.8	35.0
Italy	266.5	267.1		190.5 191.0	51.5	57.1	135.3	132.4	72.6	80.6	32.7	32.4
Latvia	2.6	2.6		0.2 - 0.5	7.0	11.8	12.8	12.8	11.9	14.7	13.3	14.9
Malta	61.3	42.3		45.5 25.7	12.9	27.9	192.8	134.2	20.5	36.8	33.4	37.0
Netherlands	70.2	53.2		50.6 32.2	41.7	27.6	299.0	238.1	60.1	48.6	72.1	81.1
Poland	51.4	87.7	-	11.3 21.5	-1.8	3.8	13.4	22.6	9.2	15.5	15.2	16.7
Portugal	143.0	138.4		123.0 106.4	106.0	35.3	122.3	91.6	126.6	47.6	16.4	17.7
Romania	-	11.4 26.2	-	41.5 11.0	-14.7	9.7	-13.0	13.4	-4.0	22.1	19.7	4.9
Slovenia	-	0.6 - 0.1	-	1.7 - 1.3	-22.4	-16.2	-20.8	-3.6	-7.1	-1.1	26.1	27.0
Spain	216.7	249.3		7.2 19.6	-0.2	1.2	37.9	42.4	23.8	24.1	32.1	34.6
Sweden	32.5	32.9		19.0 16.6	19.9	13.5	103.3	111.0	34.3	23.9	32.9	44.2
Total DCF reported	1,851.6	2,005.0		700.0 775.5	8.1	9.5	50.1	51.9	23.8	26.2	25.2	25.8

Source: Own elaboration from EU MS data submission, 2024.

EBIT (Earnings Before Interest and Taxes or Operating Profit)

EBIT is used to analyse the performance of a firm's primary operations without the costs of the capital structure and tax expenses impacting profit. DCF countries data show that the EU aquaculture sector was more profitable in 2021 than in 2020 with a reported total EBIT of €700 million. In 2022 operating profit increased to €775.5 million.

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 countries data show an average ROI of the EU aquaculture sector of 9.5% in 2022, which is an increase from the 17% reported in 2021.

Labour productivity

The labour productivity is calculated as the Gross value added (GVA) divided by the total number of FTEs. DCF countries data show that the labour productivity for the EU aquaculture sector was about €50.1 thousand per FTE in 2021 and about €52 thousand in 2022. There is a large variation between member states in the estimated labour productivity. Some of this variation may be due to an over or under estimation from the number of persons employed to the number of FTEs in each country.

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 countries data show that the capital productivity for the EU aquaculture sector was 26.2% in 2022, which marked an increase of 10% from the 23.8% reported in 2021.

Average wage

The average gross wage is calculated as the total remuneration of the work force covering both paid and unpaid employees (wages and salaries + Imputed value of unpaid labour) divided by the total number of full time employed (FTE) again covering both paid and unpaid labour. The average gross wage in the EU was €25.8 in 2022, which was an increase of 2% compared to 2021 where the average wage was €25.2.

2.4 Main species in the EU aquaculture

In 2022, the main aquaculture species produced were sea mussels (without the species being fully specified, but mostly consisting of Mediterranean mussels) with 195 thousand tonnes (17% of total EU production), rainbow trout (169 thousand tonnes, 15%), blue mussels (135 thousand tonnes, 12%), Gilthead seabream (106 thousand tonnes, 10%), Pacific cupped oyster (100 thousand tonnes, 9%), European seabass (90 thousand tonnes, 8%), Mediterranean mussel (79 thousand tonnes, 7%), Common carp (63 thousand tonnes, 6%) and Atlantic bluefin tuna (32 thousand tonnes, 3%). These nine species account for 87% of the total EU aquaculture production in weight.

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

In 2022, the main aquaculture species produced in value were rainbow trout (€686.4 million, 14% of total EU value), European seabass (€668.8 million, 14%), Gilthead seabream (€628.9 million, 13%), Atlantic bluefin tuna (€569.5 million, 12%), Pacific cupped oysters (€479 million, 10%), Blue mussels (€259.3 million, 6%), Japanese carpet shell (€225.6 million, 5%) Common carp (€192.3 million, 4%) and Sea mussels nei (€158.8 million, 3%). These nine species accounted for 81% of the total EU-27 aquaculture production in value.

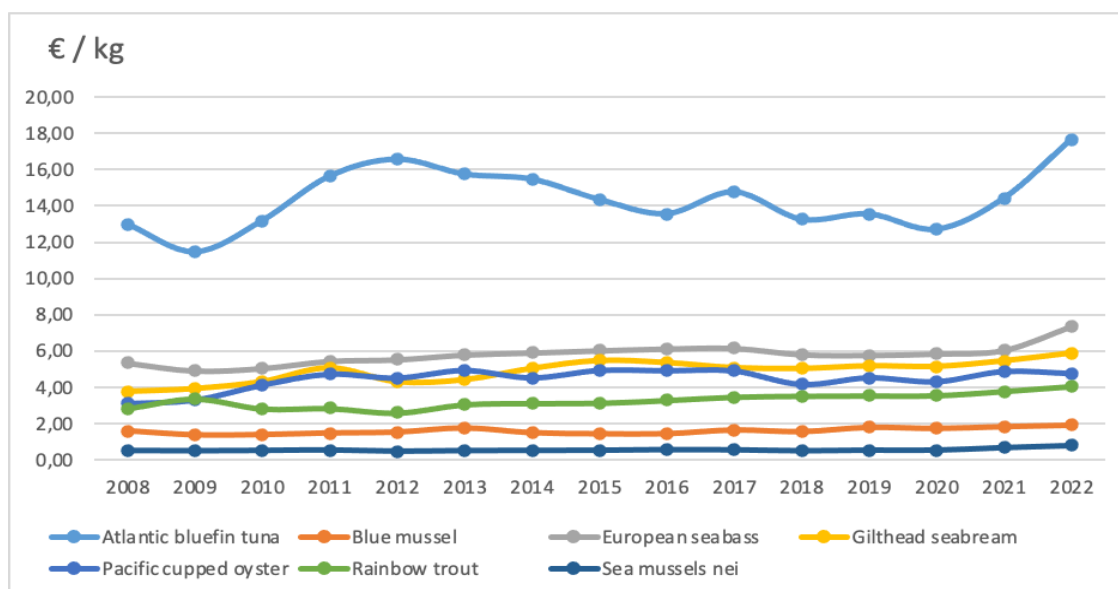
Figure 13. Main species produced in EU-27 aquaculture: 2022.



Source: Own elaboration from FAO (2024) data

In Figure 14, the average prices for the main species are shown. It can be seen that tuna is the most valuable species, however it is also the price that shows most variability over the period 2008 to 2022. For all other major species prices seems stable over the period 2008 to 2022, and a slight positive trend during 2021 and 2022, even though there are minor fluctuations.

Figure 14. Main species produced in EU-27 aquaculture: 2008-2022.



Source: Own elaboration from FAO (2024) data

3 THE STRUCTURE OF THE EU AQUACULTURE SECTOR

The EU aquaculture production accounted for 1.12 million tonnes in 2022, of which 27% was marine fish, 49% shellfish, and 24% freshwater fish (FAO, 2024). Aquatic plants represented less than 0.1% of the total EU aquaculture production, aquatic invertebrates represented less than 0.01% of the total, and crustaceans about 0.3%.

In value terms, marine fishes, freshwater fishes and shellfish accounted for 51%, 22% and 28% of the production value.

3.1 Marine finfish aquaculture

Marine finfish farming represents 25% of the EU aquaculture production, but contributes almost 50% of its value. According to DFC data and EWG estimations marine aquaculture represented 4% of the enterprises, 13% of employees and 40% of FTE in the EU aquaculture industry in 2022.

These data reflect that this industry produces higher-value species, using high-end technology and capital-intensive production systems, distributed on few but relative large companies. The greater industrial nature of these activities means that the demand for employment is lower than in other less capital-intensive productions; however, it is generally a more qualified and a full time workforce that are demanded for these type of enterprises.

Table 3. Economic indicators for the EU marine aquaculture: 2021-2022.

Country	Number of enterprises		Total sales volume		Turnover		Employment		FTE		Average wage	
	number		thousand tonnes		million €		number		number		thousand €	
	2021	2022	2021	2022	2021	2022	2021	2022	2021	2022	2021	2022
Croatia	28	26	22.9	22.0	156.3	164.6	908	908	795	791	21.7	26.5
Denmark	4	4	12.3	13.6	58.2	78.2	133	137	98	99	59.3	65.1
Finland	28	25	8.2	8.8	41.8	49.6	155	147	120	113	48.8	48.9
Greece	311	309	116.5	117.6	558.3	745.8	3657	3750	3321	3334	30.0	30.9
Ireland	26	23	13.4	12.0	109.5	105.1	266	272	245	232	52.0	68.2
Italy	43	43	15.3	12.9	126.9	95.7	475	533	139	150		
Malta	9	10	16.4	16.6	210.4	286.1	371	370	318	315	33.4	37.0
Portugal	33	51	7.4	8.3	59.4	80.4	578	874	557	811	19.9	22.0
Slovenia	1	1	0.1	0.1	0.3	0.9	12	13	11	12	31.2	29.4
Spain	47	43	53.1	64.1	434.1	588.8	1,858	2,025	1,749	1,931	35.4	36.9
Total DCF reported	530	535	265.5	276.0	1,755.1	2,195.2	8,413	9,029	7,353	7,788	32.4	33.9
Other none DCF	-	-	26.3	27.3	152.9	182.4	-	-	-	-		
Total EU	530	535	291.7	303.3	1,908.0	2,377.7	8,413	9,029	7,353	7,788	32.4	33.9

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

Source: Own elaboration from EU Member States DCF data submission and FAO (2024)

The total sales volume for the EU27 marine aquaculture sector is estimated to be 303.3 thousand tonnes generating €2 377 million of turnover in 2022. Compare to 2021 total weight of marine aquaculture increased by approximately 4%, whereas turnover increased significantly by 25%. Available data report 535 enterprises in the marine sector in 2022, showing a decrease of 1% compared to 2021. Employment reached 9 029 employees and 7 788 FTEs. Most employees in the marine sector were working full time. On average, the enterprises had 17 employees. The data show that as a whole, marine fish production has a stable structure, which during the years 2021 and 2022 increased its activity, both in employment and production and even more so its value. The analysis by country shows small differences. While

almost all countries have increased their production and its value, there are countries in which there are fewer companies in 2022, and employment levels have remained stable or even slightly decreased.

The average wage for the EU marine aquaculture sector was €33.9 thousand in 2022 increased significantly by 4% compared to 2021, with a significant variability across countries (e.g. from €22 thousand in Portugal to €68.2 thousand in Ireland). This variability can be explained by differences in labour productivity and the capital and production intensity of the different techniques.

The marine sector provided €549.2 million in GVA and €185.6 million in EBIT. Compare to 2021, GVA in the marine aquaculture showed a rise of 6% mainly due to the increased GVA in Spain. On the other hand, EBIT decreased by around 4% mainly, due to the lower profitability in Malta and Greece. ROI decreased to 3.8% in 2022 but labour productivity increased to €65.1 thousand. Despite the improvement in the value of production experienced in 2022, there was also an increase in the operating costs at the same level, which caused the economic performance indicators, although positive, to remain stable or even decrease slightly.

Table 4. Economic performance indicators for the EU marine aquaculture: 2021-2022.

Country	GVA		EBIT		ROI		Labour productivity		Capital productivity	
	million €		million €		%		thousand €		%	
	2021	2022	2021	2022	2021	2022	2021	2022	2021	2022
Croatia	40.5	43.8	16.0	19.0	3.8	4.6	50.9	55.4	10.9	11.2
Denmark	16.3	21.3	9.3	13.4	14.5	15.6	166.8	214.0	25.8	24.6
Finland	13.4	17.4	5.2	9.3	9.7	16.0	111.4	154.2	25.6	30.6
Greece	167.6	156.7	47.5	25.7	1.6	0.1	50.5	47.0	10.3	9.1
Ireland	4.3	12.2	12.3	9.4	-11.6	-7.0	17.6	52.7	3.9	8.7
Italy	56.3	52.7	39.3	38.4	29.6	36.3	404.9	352.1	42.3	50.0
Malta	61.3	42.3	45.5	25.7	12.9	27.9	192.8	134.2	20.5	36.8
Portugal	55.7	59.7	44.0	37.2	63.7	13.7	100.0	73.6	84.8	24.3
Slovenia	0.6	0.8	1.0	1.2	-45.5	-40.5	-51.0	-61.1	-25.1	-24.6
Spain	60.6	101.6	16.4	13.3	-3.5	0.9	34.7	52.6	8.7	11.8
Total DCF reported	475.4	507.0	177.1	171.4	4.0	3.8	64.7	65.1	13.9	13.6
Other none DCF	41.4	42.1	15.4	14.2						
Total EU	516.8	549.2	192.5	185.6	4.0	3.8	64.7	65.1	13.9	13.6

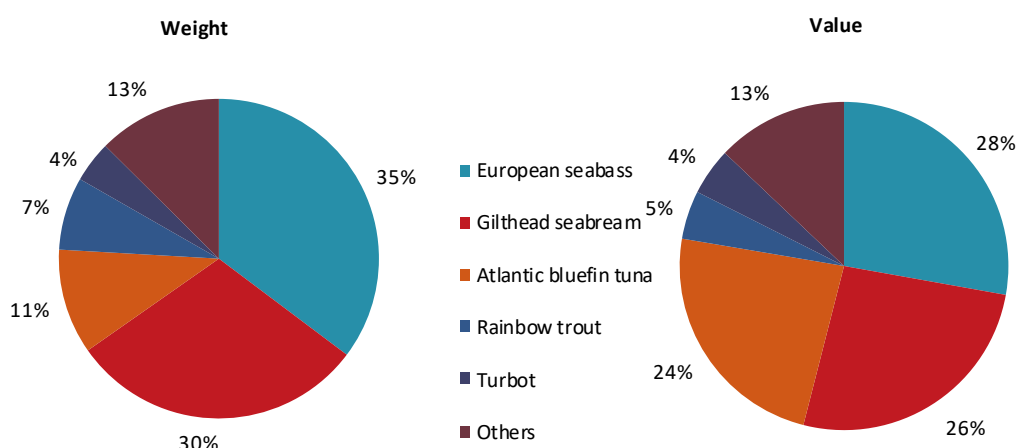
* Italian data on labour productivity are not reported as the EWG considers them to be unreliable.

Source: Own elaboration from EU Member States DCF data submission

The most produced marine species in terms of sales volume was European seabass representing 35% followed by gilthead seabream (30%) and Atlantic Bluefin Tuna (11%). In terms of total sales value, the same picture appears than the one of total production weight for the first two species, since the leader is the European seabass representing 28% due to higher prices, followed by gilthead seabream (26%). The third most important species in regards to value was Atlantic Bluefin Tuna corresponding to 24%, even though it only represented 11% in value. This is because Tuna receives much higher prices than European seabass and gilthead seabream at around €17 per kg.

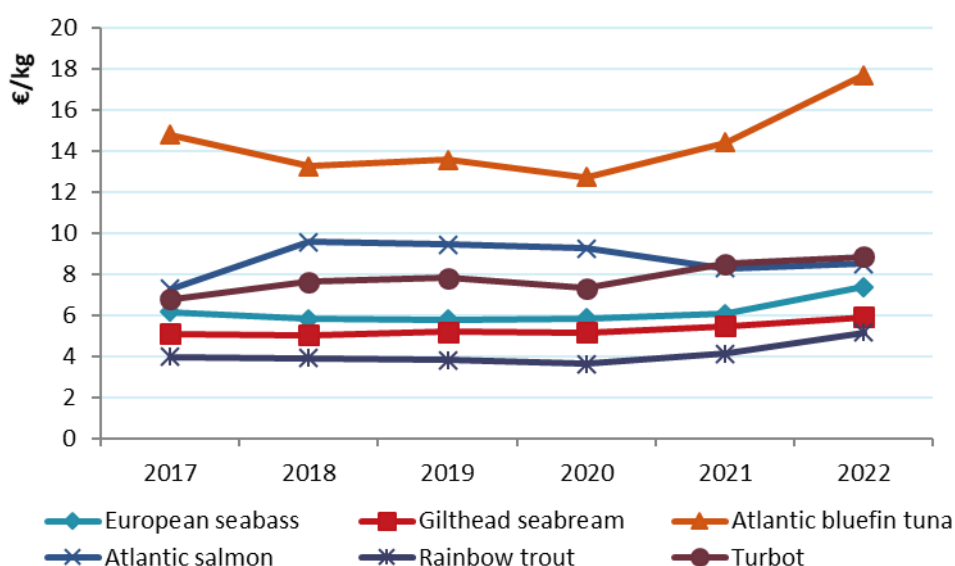
During the 2021-2022 there was a positive evolution in the average price compared to 2020 for all species except salmon. This price evolution helps to explain the greater proportional increase in the value of production than in the quantities produced. In addition, higher prices are one of the main reasons why companies have been able to cope with the increase in operating costs and reduce the higher costs negative impact on profitability indicators.

Figure 15. Main species in terms of weight and value in the EU marine aquaculture: 2022.



Source: Own elaboration from FAO (2024) data

Figure 16. Price (€/kg) evolution of the main species produced in the EU marine aquaculture: 2017-2022.



Source: Own elaboration from FAO (2024) data

3.1.1 Salmon

FAO statistics show that 2.86 million tonnes of Atlantic salmon, valued at €10.87 billion was produced globally in 2022. There were slight downturns recorded by several major players on 2021 output, reflecting a belief within certain companies that a peak global production level may be close to being reached. Norway led the 2022 output with 53%, followed by Chile, 26%, The UK, 6%, North America (Canada), 5% and The Faroe Islands, 4%. Various Pacific salmon species are produced also in minor quantities relative to Atlantic salmon worldwide and on occasion within the Block. The EU, since the departure of the UK, has become a minor producer of Atlantic salmon, contributing to 0.4% of global production in 2022.

According to EU-MAP marine finfish data, the EU produced 12 000 tonnes of consumer-ready Atlantic salmon product, valued at €105 million in 2022. Two EU countries are recorded as producers in EU-

MAP data, 2021 to 2022: Ireland with 23 enterprises, employing 272 (FTE 232) and Spain with 3 enterprises, employing 48 (FTE 14) in 2022. Marine production in 2022 above is recorded only for Ireland. According to the FAO finfish data set, there was an additional 1 165 tonnes of Atlantic salmon, valued at €5.8 million, produced by land-based enterprises in Denmark, using salt-water. Exclusions from EU-MAP reflect confidentiality obligations due to a limited number of enterprises.

The main production and employment data for EU marine Atlantic salmon aquaculture collated under the DCF are presented in Table 5. EU figures for 2022 mainly reflect the Irish marine caged industry. The average annual wage for EU production in 2022 is estimated as €68 200 per FTE, which is a significant increase, reflecting steep increases in labour costs generally in Ireland.

Table 5. Output and employment for EU salmon aquaculture, 2021 to 2022.

Country	Number of enterprises		Total sales volume		Turnover		Employment		FTE		Average wage	
	number		thousand tonnes		million €		number		number		thousand €	
	2021	2022	2021	2022	2021	2022	2021	2022	2021	2022	2021	2022
Ireland	26	23	13.4	12.0	109.5	105.1	266	272	245	232	52.0	68.2
Spain	5	3	0.0	0.0			62	48	21	14		
Total EU	31	26	13.4	12.0	109.5	105.1	328	320	265	246	52.0	68.2

Source: Own elaboration from EU Member States DCF data submission

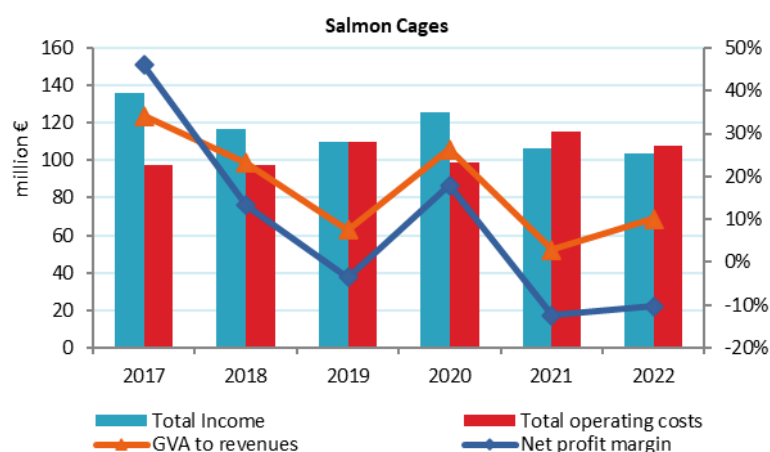
Falling output volumes and sales values, together with rising costs both at unit and total purchased level, have led to negative values for such economic indicators as EBIT, ROI and Net profit. Future expectation ratio would also reflect a negative and unsustainable trajectory for this EU segment. Increasing capacity at sea is unlikely in the face of stiff competition for the near-shore spaces required by current cage culture and also due in no small part to effective NGO opposition to this. New marketing initiatives, coupled with cost reducing measures or technologies are needed if the industry continues to be constrained within current licenced capacity at sea. A move to land-based production may be a future prospect, depending in part on to how successful the start-up units in Canada and Denmark and their business models, turn out to be in the near future.

Table 6. Economic performance indicators for EU salmon aquaculture: 2021 to 2022.

Country	GVA		EBIT		ROI		Labour productivity		Capital productivity	
	million €		million €		%		thousand €		%	
	2021	2022	2021	2022	2021	2022	2021	2022	2021	2022
Ireland	4.3	12.2	-12.3	-9.4	-11.6	-7.0	17.6	52.7	3.9	8.7
Total EU	4.3	12.2	-12.3	-9.4	-11.6	-7.0	17.6	52.7	3.9	8.7

Source: Own elaboration from EU Member States DCF data submission

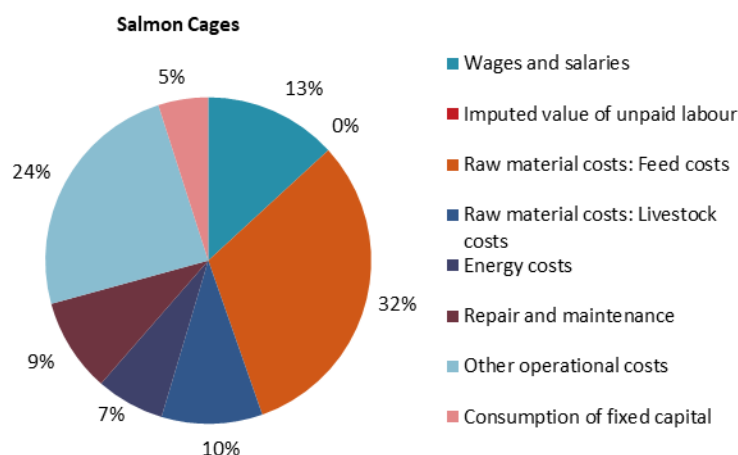
Figure 17. Economic performance indicators for salmon aquaculture: 2017 to 2022.



Source: Own elaboration from EU Member States DCF data submission

In the last two years, rising costs have outstripped Total income. Most categories such as total labour costs have risen, and others, such as feed purchase, have only decreased as a whole as purchase level was reduced. Unit feed cost rose on average by 11.5% per tonne. Feed and stock input together determine the profitability of the segment and in 2022 made up 42% of total costs. The next most important cost category for the EU salmon segment in 2022 is Other operating costs, representing 24% of the total. This variable covers a diverse range of goods and services not included within the other economic variables such as on site services, health management, office based professional, equipment rental and servicing, etc.

Figure 18. Costs breakdown for the EU salmon aquaculture: 2022.



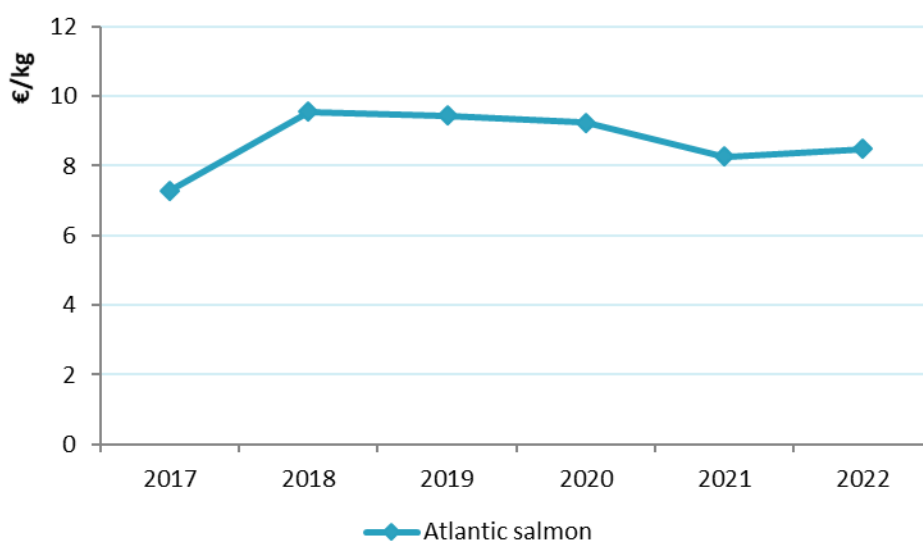
Source: Own elaboration from EU Member States DCF data submission

Wages and salaries was 13% of 2022 total costs. The relatively high average wage per FTE of €68 200 is a broad figure over a wide spectrum of differing industry skill sets but nevertheless reflects the full-time professional nature of employment sustained. Much of the equipment deployed by industry is hired and maintained by specialists, nevertheless a high degree of on-site and in-house maintenance is required from staff and this activity made 9% of 2022 total costs. Energy use is in the form of boat fuel and electricity used in plant and office. Its cost took up a significant 7% of total in 2022. Depreciation, at 5%, while a significant cost, indicates that the industry keeps a relatively healthy inventory of equipment.

The EU production is targeted at niche markets; Danish production is sold in EU and the US as an environmentally friendly and disease-free product as it is produced in closed indoor systems, used in the making of fresh sushi. All Irish production has been certified as organic for a number of years and this, with successful branding, has allowed products to command a high unit sales value, relative to more mass-producing competitors. Exports of 6 556 tonnes of organic salmon were sent principally to France (64%) Poland, Germany and The Netherlands (29%) and third countries such as Switzerland, North America and the UK (collectively 7%) in 2022. The main product formats are whole-round, head on gutted, fillets and other value-added categories.

Sales of organic product has generally made a significant margin above the global unit sales average and had climbed steadily to 2018, before hitting a ceiling of €9.4 per kg. A slight decline is observed from 2019 onwards. The segment was able to adapt to the 2020 market lockdown by shifting format toward frozen products, though this may have contributed to a farther depressed unit average sales value in 2021. The average sales value for EU product in 2022 was €8.56 per kg while that for Norwegian product was €6.31 per kg. The lack of production scale in the EU was somewhat mitigated by the greater sales unit value obtained by being the sole supplier to niche markets. This is changing as the UK moves into the organic space, requiring the EU to either find a new avenue to scale up production or to develop new selling strategies for its quality produce. A farther growing challenge is water quality and the impact of new organic certification rules relating to it that may complicate meeting certification requirements.

Figure 19. Price (€/kg) evolution of salmon: 2017-2022.



Source: Own elaboration from FAO (2024) data

3.1.2 Seabass & Seabream

According to FAO production data, the combined production of European seabass (*Dicentrarchus labrax*) and Gilthead seabream (*Sparus aurata*) more than doubled during the 2008 – 2022 period from 245.6 thousand tonnes valued 1 482 million USD in 2008 to 638 thousand tonnes valued 3 891 million USD in 2022. Twenty-seven countries were producing one or both species in 2022. Leading production countries are Turkey and Greece producing 48% and 18% of the total volume and 45% and 20% of the total value in 2022, respectively. The ten largest producing countries: Turkey, Greece, Egypt, Spain, Tunisia, Croatia, Italy, Saudi Arabia, Cyprus and Albania produced more than 95% of the total volume in 2022. Turkey, Egypt, Tunisia, Saudi Arabia 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 state, Greece, during the same period have increased production volume at a lower rate by 35%. Production volume has decreased in France by 72%, while in Italy and Spain remain relatively stable, with slight increase of 7% and 4% during the same period. Thus, the volume share of the EU producer countries has decreased from 60% in 2008 to 31% in 2022. Accordingly, the value share of the EU producer countries has decreased from 65% in 2008 to 35% in 2022 (FAO, 2024).

Global production of European seabass according to FAO production data, has more than doubled during the 2008 – 2022 period from 115 thousand tonnes valued 784 million USD in 2008 to 293.6 thousand tonnes valued 1 877 million USD in 2022. Turkey and Greece are the world seabass leading producers with 56% and 16% of the volume and 50% and 19% of the value produced in 2022, respectively. The EU member states produced 91 thousand tonnes, valued 704 million USD, in 2022. The main European producer is Greece with 47 thousand tonnes, followed by Spain and Croatia with 24 and 10 thousand tonnes, respectively. The volume share of the EU producer countries has decreased from 52% in 2008 to 31% in 2022. Accordingly, the value share of the EU producer countries has decreased from 61% in 2008 to 35% in 2022 (FAO, 2024).

Global production of Gilthead seabream according to FAO production data, increased during the 2008 – 2022 period from 130 thousand tonnes valued 698 million USD in 2008 to 344 thousand tonnes valued 2 014 million USD in 2022. Turkey and Greece are the world Gilthead seabream leading producers with 44% and 20% of the volume and 41% and 21% of the value produced, respectively. The EU member states produced 107 thousand tonnes, valued 662 million USD, in 2022. The main European producer is Greece with 70 thousand tonnes, followed by Spain, Italy and Croatia with 9, 7.9 and 7.5 thousand

tonnes, respectively. The volume share of the EU producer countries has decreased from 68% in 2008 to 31% in 2022. Accordingly, the value share of the EU producer countries has decreased from 70% in 2008 to 31% in 2022 (FAO, 2024).

The European seabass and gilthead seabream sector was undergoing a consolidation phase during the past decade. The vast majority of seabass and seabream is produced and consumed in Southern European and other Mediterranean countries. On the one hand, the presence of imported products in the EU markets is increasingly larger. On the other hand, new markets are steadily emerging and exports to North America and Middle East are nowadays becoming regular.

In the Mediterranean seabass and seabream aquaculture industry the effects of COVID-19 on the market during 2020 were less severe than expected by a boost to retail sales. During 2021 the industry experimented a great recovery in production promoted by a growing demand and market prices. However, also during 2021 the sector faced again with higher logistic and increasing operational cost that limited the improvement of the economic indicators. The positive evolution of production continued in 2022, but the whole seabream value chain was impacted by higher inflation rates in EU countries, affecting both operational cost structures and consumer behaviour. This resulted in lower economic indicator in for the industry in 2022.

In Italy, the sector has achieved stability in terms of annual production volumes. Over the past five years, the industry's structure has evolved due to consolidation and acquisitions by stronger groups. These entities have achieved significant vertical integration, encompassing all stages from broodstock reproduction to initial processing and transportation. This integration has fostered economies of scale and strengthened negotiation power with wholesalers. However, the sector has faced challenges due to rising feed and fuel costs, impacting overall production expenses. Most marine aquaculture products are sold through organized retail channels, which value the sector's reliability and control over each phase of supply, from raw material procurement to ensuring cold chain integrity. Approximately 10% of marine products reach the market in processed form, mainly as value-added items like fillets and marinated products. Larger-sized products, particularly those over 400-500 grams, are also sold through wholesale fish markets and are in demand within the food service sector (HoReCa).

The Croatian production continues to expand, but at a slower rate. The reference period was marked by inflation and a significant increase in production costs through record-high fish feed prices, energy and other input raw materials. Nevertheless, the sector managed to maintain a positive economic performance with the timely reaction of adjusting its market policies through selling prices, strengthening the market position and brand awareness, supported by marketing activities in all key markets. These actions are followed by investments in processing facilities to maintain profitability, enhance the efficiency of business procedures and reach a wide range of target customers through premiumization – providing high valued innovative products and constantly expanding the product portfolio. Also, new species reached the market in 2021 (Greater amberjack, Common dentex) and organic production is marked by steady growth in total volume of production and sales.

Between 2021 and 2022, the Greek seabass and seabream aquaculture industry encountered several domestic and international challenges. Although the sector's consolidation efforts, which began in 2018, slowed during this period, mergers, acquisitions, and the closure of some enterprises still took place. While restructuring efforts among large companies helped reduce financial burdens by lowering debt-related expenses, the sharp rise in production costs—driven by inflation and the energy crisis, which was further exacerbated by the war in Ukraine—hindered financial performance, despite a growth in total production volume. The larger aquaculture companies, having felt the impact of the COVID-19 pandemic, took steps to enhance their self-sufficiency and reduce costs. They expanded or initiated operations in related areas such as fry production, fish feed, cages, and equipment manufacturing. Although primarily export-oriented, these companies also supplied the Greek domestic market through large supermarket chains, offering their products at affordable prices. In the EU, traditionally, Italy, Spain and France absorb more than half of Greek production since almost 60% of Greek seabass – seabream production or 70% of exports were sold in these 3 countries. Turkey's emergence as the leading exporter of seabass and seabream to the European Union has intensified competition with Greece, which remains the largest producer and exporter of these fish within the EU. Turkish producers are able to

offer highly competitive prices. However, a price premium has been established for European seabass, reflecting its superior quality. Greek seabass typically arrives in EU markets about a day earlier than Turkish products, which results in better quality and higher prices. Despite this, Turkish producers have strategically used Greek logistics infrastructure to facilitate their exports to EU countries. Greece has now become the second-largest export destination for Turkish-origin seabass and seabream. Once cleared in Greece, Turkish products are processed and distributed throughout Europe, still marked as of Turkish origin.

In Spain, the seabream and seabass industry has continued to suffer the effects of the damage caused by Storm Gloria during 2021, as demonstrated by the increase in imports during that same year. Although the improvement in production in 2022, increased competition and an inflationary context with higher feed, fry and energy prices have meant that economic indicators have been unfavourable both during 2021 and 2022. The Spanish Mediterranean coast, where much of the production of these species is concentrated, is an area where extreme weather events are increasingly occurring, significantly increasing the operational risk of companies and the uncertainty of their results.

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. Several. Various labelling initiatives promoted by producers within the EU have recently emerged in countries such as Spain (Crianza de nuestros mares y rios de España) and Greece (Fish from Greece). These labels aim to identify and differentiate seabream and seabass produced in the country, from imported ones. In the Spanish case, this label has achieved a 10% increase in the value at the retail for the aquaculture species covered under this label, according to a study carried out in 2023 on behalf of APROMAR. With the slogan "Spanish fish, fresh fish", the label strengthens the association with the superior quality of the Spanish product.

The European industry in 2022, according to the DCF data consists of 443 enterprises, which is almost same as in 2021. A more detailed analysis shows that in most countries the number of companies has remained stable or even slightly decreased. The increase in companies reported by Portugal is the main reason for the increase experienced in the total number of companies in 2022. 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. The production of new species, such as meagre and pagrus is now common for European firms.

Table 7. Economic indicators for the EU seabass & seabream aquaculture: 2022.

Country	Number of enterprises		Total sales volume		Turnover		Employment		FTE		Average wage	
	number		thousand tonnes		million €		number		number		thousand €	
	2021	2022	2021	2022	2021	2022	2021	2022	2021	2022	2021	2022
Croatia	24	22	17.3	18.2	104.1	122.6	580	580	503	473	20.4	22.0
Greece	311	309	116.5	117.6	558.3	745.8	3657	3750	3321	3334	30.0	30.9
Italy	43	43	15.3	12.9	126.9	95.7	475	533	139	150	96.6	75.1
Malta	2	2	2.9	2.2	11.6	10.3	47	35	43	31	30.5	37.7
Portugal	28	42	3.7	5.1	24.4	42.3	304	411	293	365	19.0	20.2
Slovenia	1	1	0.1	0.1	0.3	0.9	12	13	11	12	31.2	29.4
Spain	27	24	28.3	30.4	184.5	220.8	770	809	730	774	32.8	33.2
Total DCF reported	436	443	184.0	186.6	1,010.1	1,238.5	5,845	6,131	5,040	5,139	30.6	31.0
Other none DCF	-	-	3.9	3.0	28.1	24.5	-	-	-	-		
Total EU	436	443	188.0	189.7	1,038.1	1,263.0	5,845	6,131	5,040	5,139	30.6	31.0

Source: Own elaboration from EU Member States DCF data submission and FAO (2024) data

After a decade in which the number of companies has been reduced due to a process of business concentration, it seems that the number of companies has stabilised. Strong competition in the sector

and reduced margins led companies to seek economies of scale to increase their competitiveness. Due to the difficulty in establishing new facilities, companies increased their production scale mainly through the acquisition of competitors in order to gain access to their production facilities. This business acquisitions took place even in other countries, such as the case of Greek capital obtaining the control of several Spanish firms and their facilities.

Based on DCF data, the seabass and seabream segment showed growth across all categories in 2022. Despite a slight decline in the number of enterprises in most countries, the overall number of companies increased due to a significant rise in Portugal. The total sales volume in the EU increased to 189.7 thousand tonnes in 2022, with only Italy and Malta experiencing a decline in sales volume. The total sales value of EU production grew to €1 263 million in 2022, up from €1 038 million in 2021. Most DCF countries saw an increase in turnover, with Slovenia, Portugal, and Greece reporting the highest growth rates of 195%, 74%, and 33.6%, respectively. Employment in the segment reached 6 131, equivalent to 5 139 in FTE terms, with Malta being the only country to show a decline in employee numbers. As for average wages, in most of the countries remained relatively stable.

Table 8 presents the performance indicators for seabass and seabream producers in the EU. In 2022, all countries but Portugal reported a decline in Gross Value Added (GVA). As for the EBIT indicator, Portugal and Croatia were the only countries to show an increase, while the total DCF reported value dropped significantly from €107.9 to €88.9 million. In terms of Return on Investment (ROI), Portugal and Italy recorded the strongest performance in 2022, with 36.3%, both of them. Italy, Croatia, Malta and Slovenia improved their ROI compared to 2021. Spain is the only country among the three main producers in the EU (along with Greece and Italy), in which the seabream and seabass industry, despite having increased production and its value during 2021 and 2022, has obtained negative economic performance indicators, GVA, EBIT and ROI.

Table 8. Economic Performance indicators for the EU seabass and seabream aquaculture: 2022.

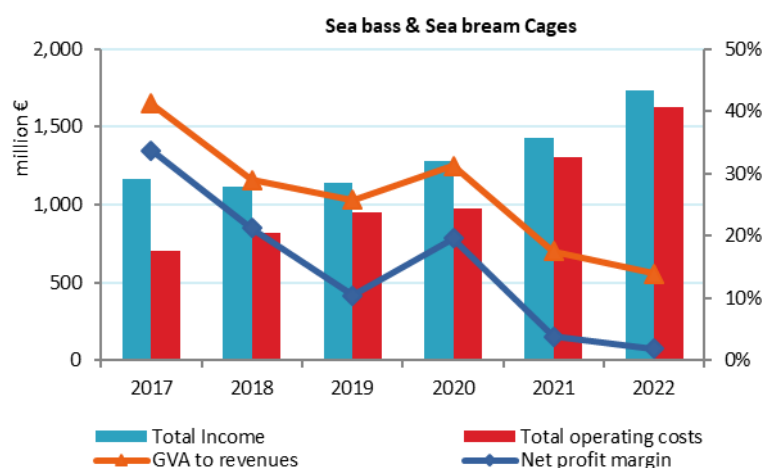
Country	GVA		EBIT		ROI		Labour productivity		Capital productivity	
	million €		million €		%		thousand €		%	
	2021	2022	2021	2022	2021	2022	2021	2022	2021	2022
Croatia	22.3	21.8	7.0	9.3	2.8	3.2	44.2	46.0	8.8	8.0
Greece	167.6	156.7	47.5	25.7	1.6	0.1	50.5	47.0	10.3	9.1
Italy	56.3	52.7	39.3	38.4	29.6	36.3	404.9	352.1	42.3	50.0
Malta	4.0	3.2	2.2	1.7	17.7	31.6	92.1	104.0	31.6	50.5
Portugal	28.4	41.7	22.3	33.2	44.8	36.3	96.8	114.3	58.9	47.5
Slovenia	-	0.6	-	1.0	-	1.2	-45.5	-40.5	-51.0	-61.1
Spain	17.4	8.2	-	9.4	-	18.2	-5.0	-6.4	23.8	10.6
Total DCF reported	295.2	283.6	107.9	88.9	3.4	2.2	58.6	55.2	12.5	11.0
Other none DCF	8.2	5.6	3.0	1.8						
Total EU	303.4	289.2	110.9	90.6	3.4	2.2	58.6	55.2	12.5	11.0

Source: Own elaboration from EU Member States DCF data submission

Additionally, only Croatia, Malta and Portugal saw improvements in labour productivity. Capital productivity also decreased across most countries, with Italy and Malta being exceptions, posting the highest values at 50.0 and 50.5, respectively. Lastly, regarding the average wage indicator, Malta experienced the largest increase, rising from €30.5 thousand in 2021 to €37.7 thousand in 2022. On the other hand, Italy reported a sharp decline of nearly €20 thousand in average wages, dropping from €96.6 thousand to €75.1 thousand. Italy and Slovenia were the only countries to report a decrease in average wages for 2022.

Figure 20, which presents the economic performance indicators for the EU seabass and seabream sector, shows a decline in the GVA-to-revenue ratio and net profit margins during the 2017-2022 period. In 2022, the net profit margin reached its lowest point, primarily due to operating costs rising at a faster rate than total income since 2018. Despite production growth in the sector, the lingering effects of the pandemic, rising inflation, and the energy crisis have negatively impacted the economic performance of EU seabass and seabream aquaculture. The stability of feed prices during 2023 and their decrease during 2024 due to greater availability of fishmeal and fish oil, could facilitate an improvement in the economic performance indicators of seabream and seabass companies during these two periods.

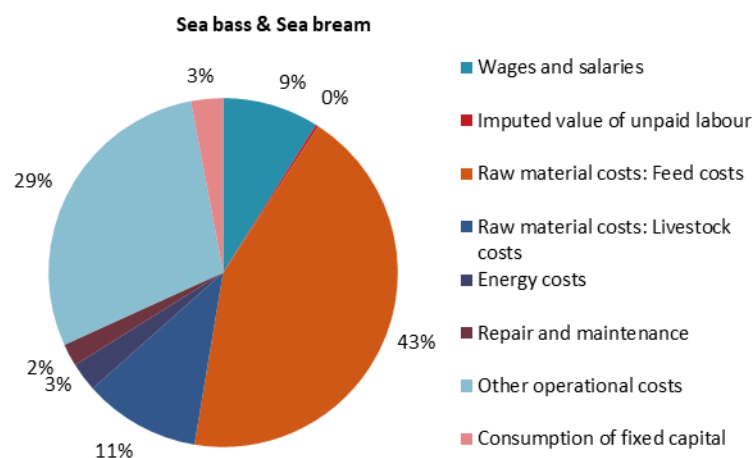
Figure 20. Economic performance indicators for seabass and seabream aquaculture: 2017-2022.



Source: Own elaboration from EU Member States DCF data submission

In Figure 21, the cost structure of the EU seabass & seabream aquaculture sector is presented for 2022. Raw material (feed costs and livestock) account for 54% of the total cost, while in 2021 the value was 60%. It must be pointed out that in 2020 the respective percentage was 33%, indicating the rise of the main production costs in the industry. Other operational costs rose from 21% in 2021 to 29% in 2022. Wages and salaries account for 12% in 2021, up from 9% of the total cost in 2022. The energy cost share rises from 2% in 2021 to 3% in 2022. Consumption of fixed capital and repair and maintenance follow at 3% and 2% respectively for 2022.

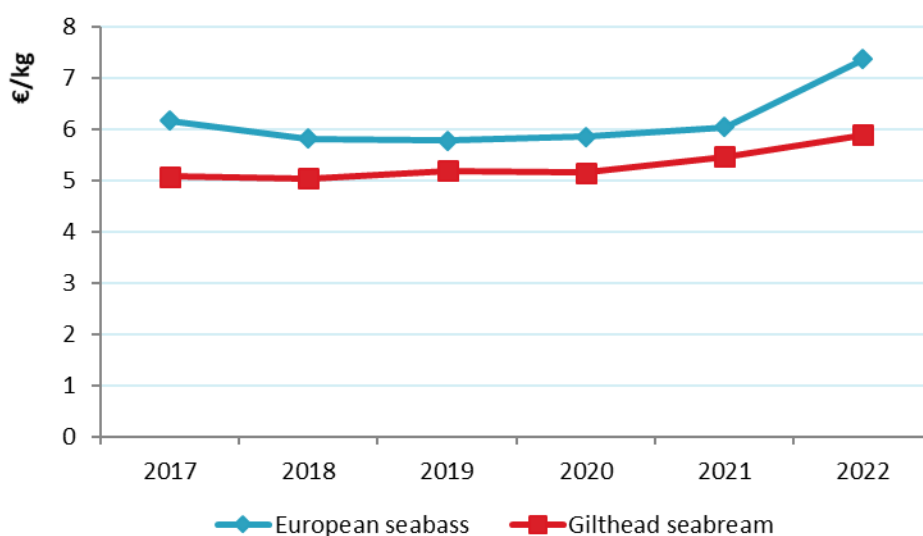
Figure 21. Costs breakdown for the EU seabass and seabream aquaculture: 2022.



Source: Own elaboration from EU Member States DCF data submission

In Figure 22, the price evolution of European seabass and seabream is presented. Demand for these species has grown significantly in the years since the pandemic, leading to a noticeable rise in prices. This increase has occurred despite both an expansion in EU production and a growth in imports, with Turkey accounting for nearly 98% of seabass and seabream imports into the EU. In 2022, both species reached their highest prices in the past six years, with seabass selling at €7.4 per kilogram and seabream at €5.9 per kilogram. A continued growth in EU production and imports is expected to help stabilize these prices, particularly if demand remains steady. Early estimates predict a slight decrease in the price of seabass, reflecting potential adjustments in supply and demand dynamics.

Figure 22. Price (€/kg) evolution of the main species of seabass and seabream group: 2017-2022.



Source: Own elaboration from EU Member States DCF data submission

3.1.3 Atlantic Bluefin Tuna

The current production status of Atlantic Bluefin tuna (*Thunnus thynnus*) farming for 2022 from DCF data shows that Croatia, Malta, Portugal, and Spain are the four EU member states involved in the production of the species. The EU tuna aquaculture industry continued to experience steady growth between 2021 and 2022. The total sales volume increased from 28.0 thousand tonnes in 2021 to 31.4 thousand tonnes in 2022, a notable rise of 12.1%. This growth was primarily driven by increased production in Malta and Spain, which accounted for the largest shares of total output.

Malta, already a leader in the sector, saw its production increase from 13.5 thousand tonnes to 14.4 thousand tonnes, reinforcing its position as the primary producer of farmed tuna within the EU. Spain also demonstrated a strong upward trend, growing from 8.8 thousand tonnes in 2021 to 13.1 thousand tonnes in 2022, reflecting a substantial 48.9% increase. In contrast, Croatia experienced a decline in production, dropping from 5.6 thousand tonnes to 3.8 thousand tonnes. Portugal's production remained marginal in comparison to the other players, with minimal growth from 0.1 thousand tonnes in both years, although there is an increasing trend in economic activity within its sector.

The turnover data further corroborates these findings, with the overall EU turnover for tuna aquaculture jumping from €387.8 million in 2021 to €539.6 million in 2022, an impressive 39.2% increase. Malta again led the way with a significant increase in its turnover from €198.7 million to €275.4 million, closely followed by Spain, whose turnover surged from €136.1 million to €219.7 million. Portugal, while small in terms of volume, saw its turnover triple from €0.8 million to €2.4 million, suggesting higher market prices or enhanced efficiency in production. On the other hand, Croatia saw a decline in turnover from €52.2 million to €42.0 million, aligning with its reduced production levels.

This rise in production and turnover is reflected in employment and FTE figures, both of which saw moderate increases. Total employment rose from 1 005 to 1 059 individuals, while the full-time equivalent (FTE) workforce grew from 917 to 991. This suggests a strong and resilient labour market within the tuna farming sector, with notable expansions in Malta and Portugal, where employment and FTE numbers rose in tandem with production increases. Croatia's employment remained unchanged at 328, while its FTE numbers saw a marginal rise from 292 to 318, reflecting potential improvements in operational efficiency. Spain's employment remained stable with only minor adjustments.

Average wages across the sector also saw a substantial increase, growing from an average of €29.8 thousand in 2021 to €35.0 thousand in 2022, indicating rising labour costs as a potential result of increased production and economic performance. Spain, Malta, and Croatia saw the largest jumps in wages, further underscoring the positive economic trajectory for the sector.

Table 9. Economic indicators for the EU tuna aquaculture: 2022.

Country	Number of enterprises		Total sales volume		Turnover		Employment		FTE		Average wage	
	number		thousand tonnes		million €		number		number		thousand €	
	2021	2022	2021	2022	2021	2022	2021	2022	2021	2022	2021	2022
Croatia	4	4	5.6	3.8	52.2	42.0	328	328	292	318	23.9	33.1
Malta	6	6	13.5	14.4	198.7	275.4	323	334	275	283	33.8	37.0
Portugal	1	2	0.1	0.1	0.8	2.4	43	82	42	76	20.0	24.9
Spain	3	3	8.8	13.1	136.1	219.7	311	315	308	314	33.0	37.8
Total DCF reported	14	15	28.0	31.4	387.8	539.6	1,005	1,059	917	991	29.8	35.0
Other none DCF	-	-	0.0	0.0	0.0	0.0	-	-	-	-		
Total EU	14	15	28.0	31.4	387.8	539.6	1,005	1,059	917	991	29.8	35.0

Source: Own elaboration from EU Member States DCF data submission and FAO (2024) data

The economic performance of the EU tuna aquaculture sector improved significantly from 2021 to 2022, with notable growth in key performance indicators such as Gross Value Added (GVA), Earnings Before Interest and Taxes (EBIT), Return on Investment (ROI), and productivity metrics. GVA for the sector rose from €100.2 million in 2021 to €132.8 million in 2022, marking a 32.5% increase. This growth was primarily driven by Spain, which saw a dramatic rise in GVA from €24.5 million to €66.2 million. In contrast, Croatia experienced a more moderate increase, growing from €18.2 million to €22.1 million, while Malta saw a decline from €57.3 million to €38.8 million. Despite this drop, Malta remains a key player in the sector, although the reduction in GVA might reflect changes in operational costs or shifts in revenue structure.

Earnings Before Interest and Taxes (EBIT) also increased, climbing from €63.6 million in 2021 to €88.9 million in 2022. Spain was a major contributor to this growth, with EBIT rising significantly from €11.9 million to €52.4 million, highlighting its strong performance in the sector. Conversely, Malta experienced a sharp decline in EBIT, dropping from €43.3 million in 2021 to €23.7 million in 2022. This discrepancy between the countries could stem from differences in cost structures, particularly operational and feed costs, which represent significant expenses in tuna farming. Meanwhile, Croatia saw a modest increase in EBIT, moving from €9.0 million to €9.6 million, demonstrating stable but slower progress.

The sector's Return on Investment (ROI) more than doubled, increasing from 11.5% in 2021 to 30.8% in 2022, indicating enhanced profitability across the industry. Spain, in particular, saw an impressive surge in ROI, rising from 16.1% to 73.5%, reflecting the country's exceptional financial efficiency and high returns on invested capital. Malta also reported a solid improvement, with ROI increasing from 12.7% to 27.4%, while Croatia's ROI saw a more modest rise from 5.9% to 7.8%. These figures underscore the overall improvement in profitability and operational efficiency within the sector, although there remain significant differences between member states.

Labour productivity also saw a notable increase across the EU, rising from €109.2 thousand per worker in 2021 to €134.0 thousand in 2022. Spain led this trend with a substantial jump in labour productivity, from €79.3 thousand to €210.8 thousand, a clear reflection of heightened operational efficiency and greater output per worker. Capital productivity similarly improved, increasing from 21.1% in 2021 to 42.2% in 2022, with Spain again displaying the largest gains (from 35.6% to 90.7%). Malta also showed a positive trend, with capital productivity rising from 20.0% to 35.8%, while Croatia's metrics grew more moderately.

Tuna cage operations across the EU also showed solid financial results, with total income increasing from €409.8 million in 2021 to €586.0 million in 2022. However, operating costs rose alongside income, from €335.3 million to €485.4 million, reflecting increased expenditures tied to growth in production and

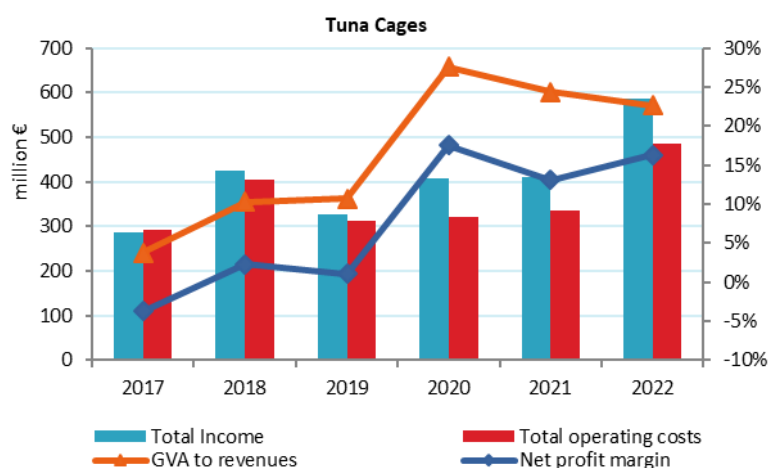
expansion efforts. Despite these rising costs, the GVA to revenues ratio remained stable at around 23%, indicating that the sector maintained its profitability. The net profit margin also improved, rising from 13% in 2021 to 16% in 2022, highlighting the industry's growing financial health and capacity to absorb higher costs while maintaining profitability.

Table 10. Economic performance indicators for EU tuna aquaculture: 2021-2022.

Country	GVA		EBIT		ROI		Labour productivity		Capital productivity	
	million €		million €		%		thousand €		%	
	2021	2022	2021	2022	2021	2022	2021	2022	2021	2022
Croatia	18.2	22.1	9.0	9.6	5.9	7.8	62.3	69.5	15.3	18.4
Malta	57.3	38.8	43.3	23.7	12.7	27.4	208.5	136.8	20.0	35.8
Portugal	0.2	5.8	-	0.6		33.9	5.3	76.1		63.5
Spain	24.5	66.2	11.9	52.4	16.1	73.5	79.3	210.8	35.6	90.7
Total DCF reported	100.2	132.8	63.6	88.9	11.5	30.8	109.2	134.0	21.1	42.2
Other none DCF	-	-	-	-						
Total EU	100.2	132.8	63.6	88.9	11.5	30.8	109.2	134.0	21.1	42.2

Source: Own elaboration from EU Member States DCF data submission

Figure 23. Economic performance in € million, indicators for the EU tuna aquaculture: 2017-2022.



Source: Own elaboration from EU Member States DCF data submission

The operational cost structure of the EU's tuna aquaculture sector reveals a clear breakdown of the major expenditures associated with tuna cage operations, showcasing how resource-intensive this industry is. The largest component of the cost structure is livestock costs, which amounted to €220.8 million, making it the most significant expense. This reflects the high cost of acquiring and maintaining tuna stock, particularly given the species' value and the complexities of ensuring a healthy and productive environment for the fish.

Following livestock costs, feed costs stand as the second-largest expense, accounting for €119.0 million. This highlights the significant input required to sustain and grow the tuna, as the species demands a considerable amount of feed during the farming process. Given the growing demand for feed-efficient operations and the rising cost of high-quality feed, this figure is expected to remain substantial in the coming years.

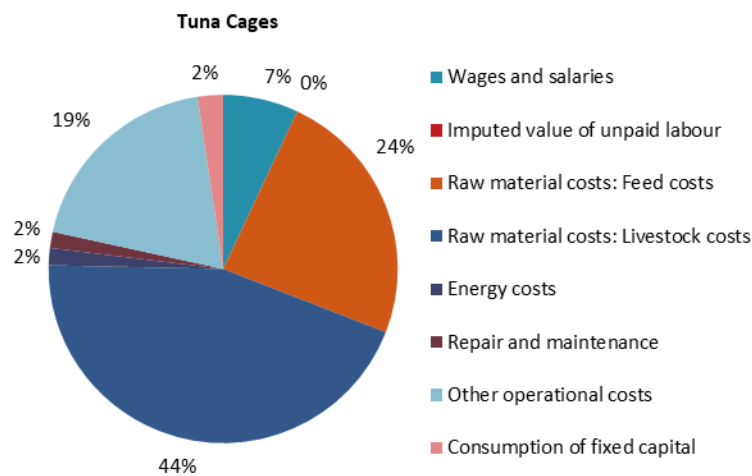
Wages and salaries are also a considerable component, totalling €34.7 million, reflecting the labour-intensive nature of tuna farming. Although not the largest expense, labour costs remain critical, particularly as aquaculture operations continue to scale and require more specialized and trained workers. The absence of any "imputed value of unpaid labour" suggests that the sector predominantly relies on formal employment structures, with a focus on paid labour in these operations.

Other operational costs amounted to €95.5 million, covering a range of necessary expenses required to keep the farms running efficiently, such as logistics, equipment, and overheads. Additionally, repair and maintenance costs of €7.4 million illustrate the ongoing need for infrastructure upkeep, essential for the maintenance of sea cages, equipment, and other facilities used in tuna farming.

Energy costs reached €7.9 million, a relatively moderate figure, but an area that is becoming more critical as energy prices fluctuate globally. Rising energy costs could influence future profit margins, particularly for operations that are heavily dependent on energy-intensive processes.

Finally, the consumption of fixed capital amounted to €11.7 million, representing the depreciation of capital assets such as infrastructure, equipment, and sea cages over time. This is a necessary part of the long-term sustainability of the industry, ensuring that assets are maintained and replaced when needed.

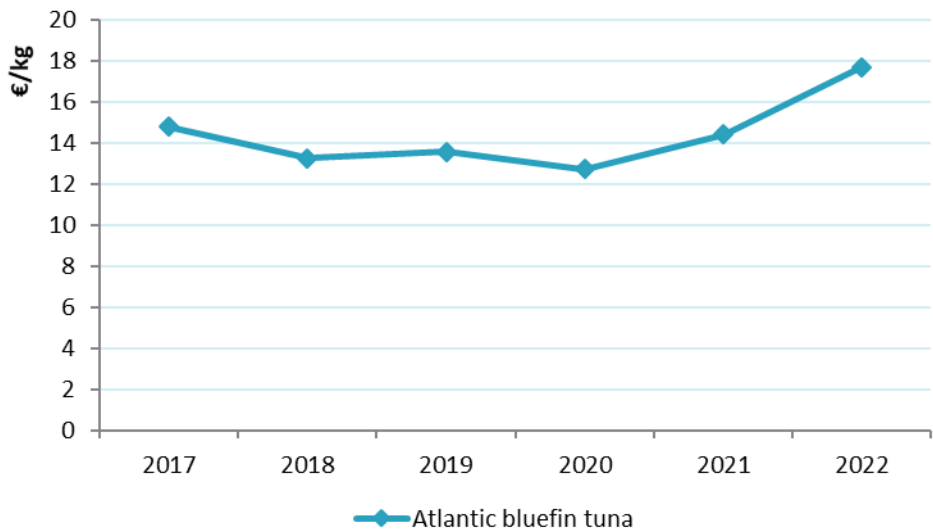
Figure 24. Costs breakdown for the EU tuna aquaculture: 2022.



Source: Own elaboration from EU Member States DCF data submission

Between 2021 and 2022, there was a sharp rise in the price of Atlantic bluefin tuna, increasing from €14.4/kg to €17.7/kg. This 23% increase can be attributed to a combination of factors.

Figure 25. Average price/kg of Atlantic Bluefin tuna: 2022.



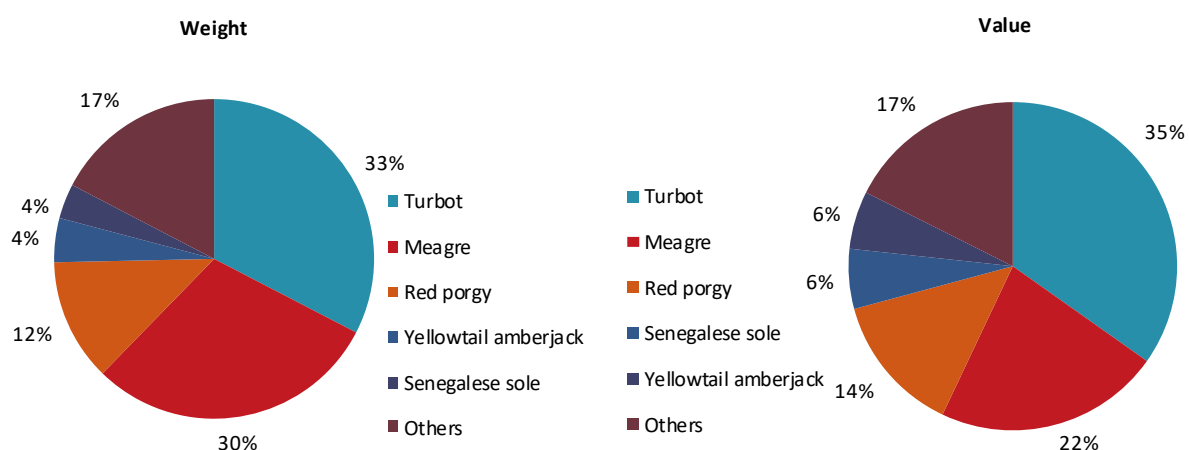
Source: Own elaboration from EU Member States DCF data submission

First, rising global demand played a critical role. After the economic disruptions caused by the COVID-19 pandemic in 2020, demand for high-value seafood, particularly in the restaurant sector, rebounded strongly in 2021 as global markets reopened. Japan, a key market for Atlantic bluefin tuna, saw a resurgence in demand for this specie. Additionally, the cost of production in the aquaculture sector saw notable increases. Rising feed costs and energy prices during 2022, largely due to global supply chain disruptions and inflationary pressures, further drove up operational expenses, which were reflected in the final market price for tuna. Aquaculture operations, particularly in Malta and Spain, were faced with higher input costs, prompting a pass-through effect on tuna prices.

3.1.4 Other marine fish species

Figure 26 shows the remaining marine fish species produced in the EU. According to FAO data, the total value of those species was about €320 million corresponding to almost 39 thousand tonnes in 2022. Turbot was the most important species in terms of value contributing with almost €112 million and over 12 thousand tonnes. Turbot was mainly produced in Spain and Portugal. The second most valuable species was meagre, contributing with €71 million and over 11 thousand tonnes. The main producers for meagre were Greece, Spain, and Croatia.

Figure 26. Other marine fish species produced in the EU: 2022.



Source: Own elaboration from FAO (2024) data

The other marine fish species segment produced about 23.5 thousand tonnes, valued almost €185 million, and employed more than 1 200 persons.

Table 11. Economic indicators for other marine fish species: 2021-2022.

Country	Number of enterprises		Total sales volume		Turnover		Employment		FTE		Average wage	
	number		thousand tonnes		million €		number		number		thousand €	
	2021	2022	2021	2022	2021	2022	2021	2022	2021	2022	2021	2022
Malta	1	2	0.0	0.0	0.1	0.4	1	1	0	1	36.6	37.4
Portugal	4	7	3.6	3.0	34.1	35.7	231	381	222	370	21.0	23.2
Spain	12	13	16.0	20.5	113.4	148.2	715	853	690	829	40.3	40.7
Total DCF reported	17	22	19.6	23.5	147.7	184.3	947	1,235	912	1,200	35.6	35.3

Source: Own elaboration from EU Member States DCF data submission

The GVA generated by the other marine fish species segment achieved almost €40 million; however, the EBIT went down to about €-20 million, resulting in a ROI of -5.3%. Average gross wage was slightly more than €35 thousand.

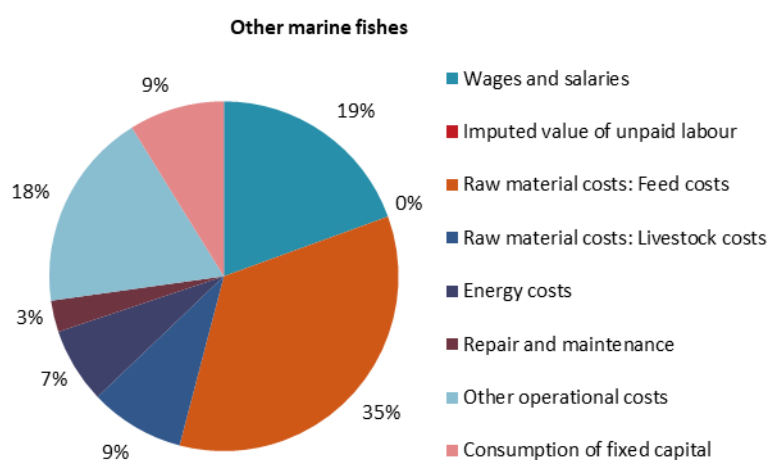
Table 12. Economic performance indicators for other marine fish species: 2021-2022.

Country	GVA		EBIT		ROI		Labour productivity		Capital productivity	
	million €		million €		%		thousand €		%	
	2021	2022	2021	2022	2021	2022	2021	2022	2021	2022
Malta	0.0	0.3	0.0	0.2	61.0	116.1	292.7	497.9	75.3	120.4
Portugal	27.1	12.2	22.3	0.9	118.8	-1.0	122.3	32.8	154.2	8.2
Spain	18.8	27.3	-18.9	-20.8	-6.2	-5.3	27.2	32.9	5.4	6.7
Total DCF reported	46.0	39.7	3.4	-19.7	-6.2	-5.3	50.4	33.1	5.4	6.7
Other none DCF	-	-	-	-	-	-	-	-	-	-
Total EU	46.0	39.7	3.4	-19.7	-6.2	-5.3	50.4	33.1	5.4	6.7

Source: Own elaboration from EU Member States DCF data submission

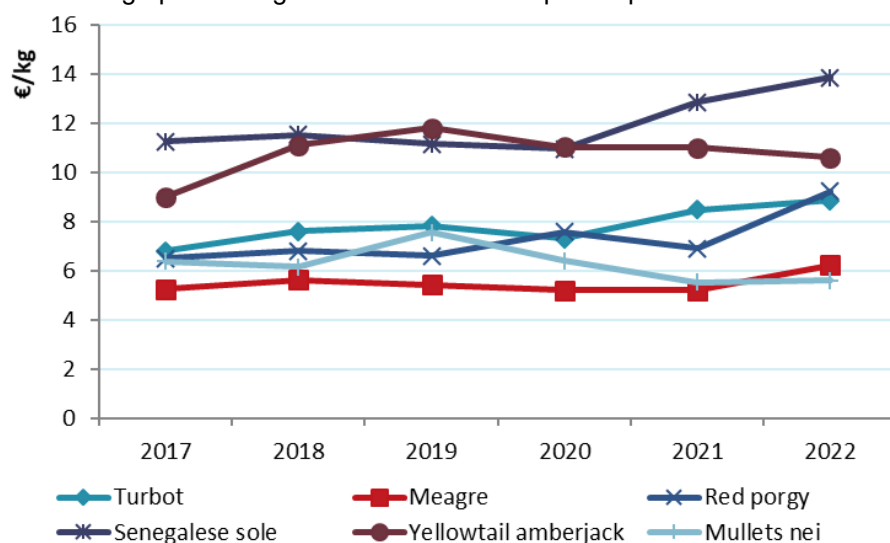
The main costs of the production of other marine fish species in 2022 were feed costs with 35% of the total production costs, wages and salaries were 19% and other operational costs were 18%.

Figure 27. Cost structure of other marine fish species produced in the EU: 2022.



Source: Own elaboration from EU Member States DCF data submission

Figure 28. Average prices €/kg of other marine fish species produced in the EU: 2017-2022.



Source: Own elaboration from FAO (2024) data

3.2 Shellfish aquaculture

Worldwide seafood demand for bivalves continues to grow. Taking into account the total production of aquatic animals in the world, molluscs represents 20% in overall production and 52.9% in marine production. The main species produced in the world are: oysters accounting for 37.4% of total production, clams, cockles and ark-shells (23.9%), scallops (10.7%) and mussels (10.2%) (FAO, 2024). The different species of shellfish produced in the EU aquaculture include (but are not limited to): Mediterranean mussel, blue mussel, Pacific cupped oyster, flat oyster, Venus clams, grooved carpet shell, cockle, and recently abalone.

The European blue growth agenda and the “farm to table” strategy set out the ambition of producing more sustainable and healthy food, which includes aquaculture. The Commission has adopted its guidelines for the development of aquaculture between 2021-2030, and the Parliament and Council have approved this proposal. Particular attention is paid to low-carbon species, such as shellfish and algae, with a view to mitigating climate change and strengthening the EU's food security and sovereignty. Despite the Commission's continued support over the past 20 years, the data show a different reality: annual shellfish production in Europe is declining, and less than 1% of the EU's coastal waters are occupied by shellfish concessions in 2022 within the public domain of member states.

In order to unlock the potential of this industry, social acceptance must improve:

- Support from citizens for the allowance of new concessions at sea, including offshore, maybe in coexistence with windfarms.
- Support from consumers for a more dynamic market where they are open to adjusting their eating habits depending on yearly production, and for a change of overall diet (a study released in 2020 shows that a diet rich in shellfish or algae can reduce greenhouse gas emissions similarly to a vegan diet).

Fostering this type of support could be achieved through collaborative actions with environmental and consumer NGOs, based on the scientifically proven benefits of shellfish (carbon neutral, various important ecosystem services provided, healthy diet). Setting up educational programs may help future generations make informed decisions. In addition, specific attention must be paid to restoring the quality of the European Union's coastal waters. This requires both major investments and a special effort in raising awareness through citizens education regarding their relationship to the coast and the ocean.

The data collection reports the principal 13 Member States that are involved in the EU shellfish sector in 2022. The reader should note that the dataset analysed below does contains declarations regarding some species with the generic “nei” (*Mytilus* mussels nei, Clams etc. nei, Venus clams nei, Cupped oysters nei). This is mainly the case for Spain in the FAO dataset and Portugal in DCF dataset for Sea mussel nei, that should thus be read as Mediterranean mussels, which does in fact correspond to the Spanish and Portuguese effective production in 2022.

Total production (for all participating EU members) decreased by 8.4% to 536.5 thousand tonnes in 2022 from 585.9 thousand tonnes in 2021. However, total value increased by 3.7% to €1.34 billion in 2022 from €1.29 billion in 2021. This same trend is observed in the three main shellfish-producing countries (Spain, France, and Italy).

Production volume mainly comes from small-scale farms (close to 95% of shellfish farms employed less than 10 people in 2022), with employment remaining stable overall. Therefore, this industry has a high socio-economic importance, especially with jobs that cannot be delocalized. In the countries with the most employment in the shellfish sector (France, Spain, Italy, Ireland, and Portugal), a positive trend is observed in the change of the number of FTEs from 2021 to 2022 (despite a decrease in overall employment in Spain and Italy).

This trend is also confirmed by the slight increase in the number of enterprises from 6 459 units in 2021 to 6 521 in 2022 (+1%). The total number of employees remained relatively stable with 38 175 in 2021 and 38 081 employees in 2022 (-0.25%).

Table 13. Socio-economic indicators for the EU shellfish aquaculture: 2021-2022.

Country	Number of enterprises		Total sales volume		Turnover		Employment		FTE		Average wage	
	number		thousand tonnes		million €		number		number		thousand €	
	2021	2022	2021	2022	2021	2022	2021	2022	2021	2022	2021	2022
Bulgaria	21	22	1.4	1.4	1.1	1.5	52	63	46	55	4.9	3.2
Croatia	81	86	0.9	1.1	1.6	2.5	136	168	103	123	7.4	9.1
Denmark	8	11	8.9	10.7	5.5	5.7	37	38	28	28	59.1	62.8
France	1999	2163	182.3	178.3	666.5	698.6	13404	15198	7803	8260	22.7	23.3
Germany	9	9	10.3	11.7	19.0	17.4	161	146	123	112	29.6	21.0
Greece	207	219	16.4	15.0	5.5	5.4	704	712	277	296	16.2	14.2
Ireland	264	249	28.7	31.6	66.7	76.1	1,715	1,747	848	902	26.0	27.0
Italy	398	398	85.0	81.5	208.3	215.4	6630	6199	1740	1794	20.6	23.0
Netherlands	80	79	33.4	0.0	76.1	63.0	235	224	235	224	72.1	81.1
Portugal	645	661	8.1	7.5	73.9	76.9	988	1080	598	647	13.1	12.2
Slovenia	5	5	0.5	0.5	0.5	0.6	18	17	15	13	22.3	24.8
Spain	2723	2606	206.5	194.9	162.8	173.9	14003	12420	2881	2957	32.8	35.5
Sweden	19	13	3.5	2.3	3.5	2.9	93	69	71	43	39.4	65.9
Total DCF reported	6,459	6,521	585.8	536.4	1,291.1	1,339.8	38,175	38,081	14,769	15,453	24.9	26.0
Other none DCF	1	0	0.1	0.0	1.4	0.8	4	2	2	1		
Total EU	6,460	6,521	585.9	536.5	1,292.5	1,340.6	38,179	38,083	14,771	15,454	24.9	26.0

Source: Own elaboration from EU Member States DCF data submission and FAO (2024) data

The most important countries in the shellfish sector in terms of employment are: France with 2 163 enterprises and 15 198 employees (8 260 FTE), Spain with 2 606 enterprises and 12 420 employees (2 957 FTE), Italy with 398 enterprises, 6 199 employees (1 794 FTE), Portugal with 661 enterprises, 1 080 employees (647 FTE), and Ireland with 249 enterprises and 1 747 employees (902 FTE).

Table 14. Main economic indicators for the EU shellfish aquaculture: 2021-2022.

Country	GVA		EBIT		ROI		Labour productivity		Capital productivity	
	million €		million €		%		thousand €		%	
	2021	2022	2021	2022	2021	2022	2021	2022	2021	2022
Bulgaria	1.1	1.4	0.0	0.3	-1.3	2.5	23.0	24.8	10.7	14.7
Croatia	1.5	2.1	0.9	0.6	19.6	7.7	14.5	17.0	30.2	34.8
Denmark	3.0	3.1	1.0	1.0	11.8	11.5	106.5	111.8	37.0	37.0
France	354.6	345.1	122.7	90.3	11.8	7.1	45.4	41.8	36.6	32.3
Germany	9.6	9.1	4.0	5.4	3.3	5.1	78.5	81.0	8.3	8.6
Greece	4.7	3.8	- 0.1	- 0.5	-3.3	-12.1	16.8	12.8	91.7	81.7
Ireland	44.3	56.7	18.3	27.9	10.6	21.5	52.3	62.8	34.0	43.1
Italy	167.7	173.4	128.0	128.2	148.5	134.7	96.4	96.7	195.1	183.0
Netherlands	51.6	28.2	32.1	7.2	25.9	4.8	220.0	126.3	44.2	25.8
Portugal	83.4	78.8	75.1	67.8	174.1	195.4	139.4	121.8	196.0	228.2
Slovenia	0.0	0.7	- 0.7	- 0.1	-12.9	-2.1	1.4	49.6	0.4	12.6
Spain	123.4	117.2	25.0	6.9	33.2	14.3	42.8	39.6	167.3	255.7
Sweden	4.0	3.9	0.5	0.6	2.7	3.5	56.2	92.6	14.1	27.2
Total DCF reported	848.8	823.5	406.7	335.6	24.4	19.4	57.5	53.3	53.1	50.2
Other none DCF	1	0	0	0						
Total EU	849.8	824.0	407.1	335.8	24.4	19.4	57.5	53.3	53.1	50.2

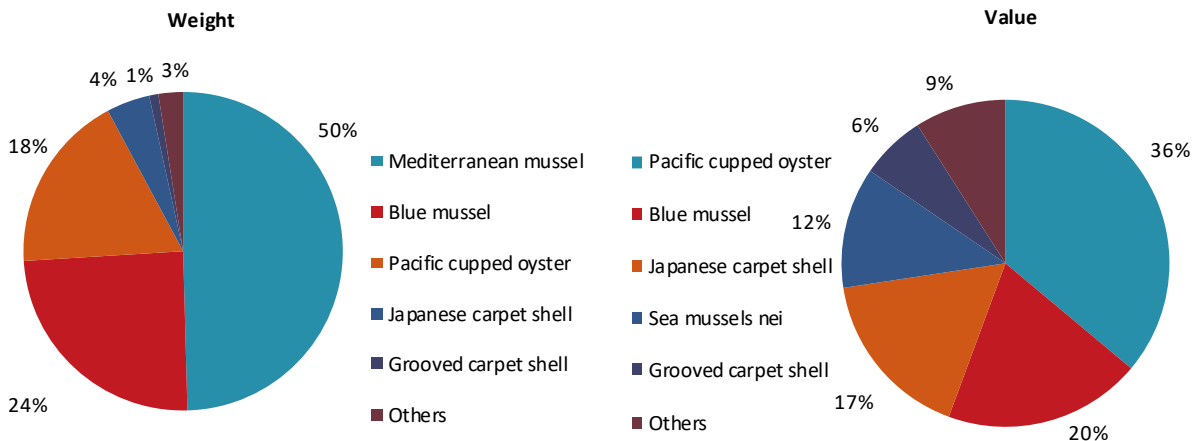
Source: Own elaboration from EU Member States DCF data submission

Data submitted by member states shows a decrease in GVA from €848.8 million in 2021 to €823.5 million in 2022, and an EBIT value of €335.6 million in 2022, decreasing from €406.7 million in 2021. The same trend is observed for ROI with a decrease of 20.5% from 2021 to 2022 (all countries). In general, operational costs, including salaries, are increasing with inflation, which is making it more difficult for some companies to reinvest back into their activities. However, certain countries, like Italy

and Portugal, are successful in keeping their ROI consistently above 100%, indicating some level of effectiveness in their reinvestment.

The main species produced in EU shellfish farming facilities (by volume) in 2022 were: Mediterranean mussels and Sea mussels (50%), blue mussels (24%), and Pacific cupped oyster (18%). In terms of value, the most important species are: Pacific cupped oyster (36%), blue mussel (20%), and Japanese carpet shell (17%).

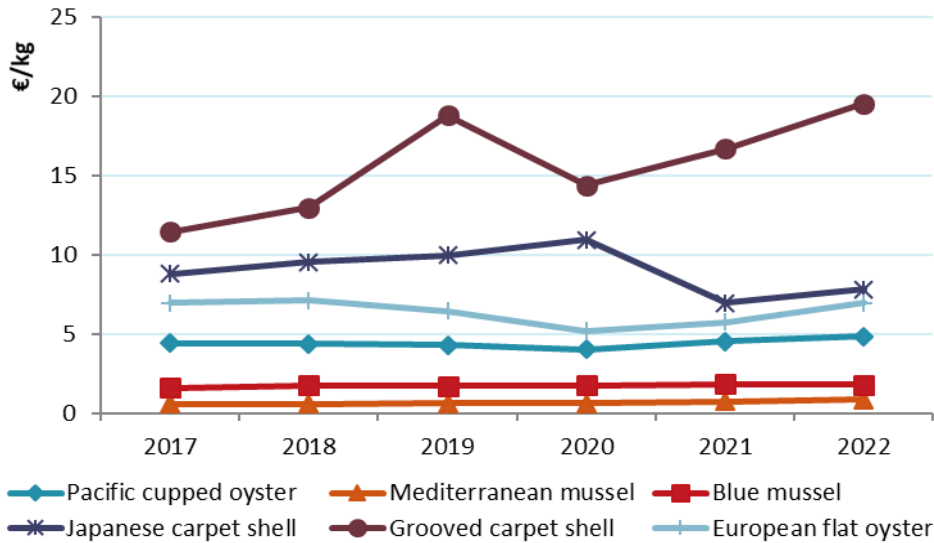
Figure 29. Composition in weight and value of the main shellfish species produced by the EU aquaculture sector: 2022.



Source: Own elaboration from EU Member States DCF data submission

The price evolution in the shellfish sector over the 2017-2022 period is shown in Figure 30 Pacific cupped oyster prices remain stable at around €4.59/kg (average over 2017-2022). It is possible that this will decrease in 2023 and 2024, due to a norovirus crisis in France at the end of 2023. Flat oysters’ prices are more subject to variation; after a dip in prices in 2020, it seems as if prices are once again increasing. Both Mediterranean and blue mussel prices, although lower-value products, are steadily increasing since 2017.

Figure 30. Average prices (€/kg) for the main shellfish species produced by the EU aquaculture sector: 2017-2022.



Source: Own elaboration from EU Member States DCF data submission

3.2.1 Mussel

World's total mussel production reached 1.9 million tonnes in 2022 (FAO, 2024). The main species of mussels farmed in the EU are blue mussel (*Mytilus edulis*) and Mediterranean mussel (*Mytilus galloprovincialis*).

In Table 15, economic indicators for the mussel sector in the EU are shown. According to data collected under DCF for the year 2022, the volume of mussels produced in the EU is 368 thousand tonnes, valued at €438 million. In comparison to 2021, this represents 12% decrease in volume and 5% decrease in value. This is in large part due to the 5% decrease of production in Spain. Despite this, Spain, the main EU producer of mussels, saw a 12% increase in turnover. The sales volume in Germany increased by 12% and the turnover decreased by 8%. Blue mussel prices have increased compared to 2017, the same is true for Mediterranean mussel prices. Two main species produced in EU in 2022 are Mediterranean mussel (275 thousand tonnes) and blue mussel (136 thousand tonnes).

About 93% of the companies reported under the DCF/EU-MAP area are concentrated in four countries: Spain (67%) France (10%), Italy (8%), Greece (8%). More than 87% of the sales volume is concentrated in the same countries, with a turnover representing 77% of the total segment (2022). Spain represents 52% of the sales volume and accounts for 36% of the total turnover. Although France only accounts for 14% of the sales volume, it also represents 28% of the total turnover. An analysis of employment data shows that the four Member States account for more than 91% of employment, which corresponds to around 87% FTE of the mussel segment in the EU.

Table 15. Economic indicators for the EU mussel aquaculture: 2022.

Country	Number of enterprises		Total sales volume		Turnover		Employment		FTE		Average wage	
	number		thousand tonnes		million €		number		number		thousand €	
	2021	2022	2021	2022	2021	2022	2021	2022	2021	2022	2021	2022
Bulgaria	21	22	1.4	1.4	1.1	1.5	52	63	46	55	4.9	3.2
Croatia	60	60	0.7	0.8	1.1	1.6	95	113	72	77	8.3	12.1
Denmark	8	11	8.9	10.7	5.5	5.7	37	38	28	28	59.1	62.8
France	273	275	57.5	51.3	130.2	122.2	1792	1754	1198	1201	25.2	26.5
Germany	9	9	10.3	11.7	19.0	17.4	161	146	123	112	29.6	21.0
Greece	207	219	16.4	15.0	5.5	5.4	704	712	277	296	16.2	14.2
Ireland	86	75	17.4	20.1	17.1	18.8	357	357	199	205	30.0	31.0
Italy	224	224	62.3	60.5	56.9	53.6	1238	1830	913	1073	14.7	12.0
Netherlands	42	41	33.4	-	65.9	50.6	179	168	179	168	77.6	86.6
Portugal	9	10	1.5	1.8	1.9	1.5	40	57	33	40	22.9	27.1
Slovenia	5	5	0.5	0.5	0.5	0.6	18	17	15	13	22.3	24.8
Spain	1925	1933	202.2	192.0	138.2	156.5	7822	6314	2444	2552	24.2	35.0
Sweden	12	10	3.5	2.3	3.5	2.9	86	65	71	43	39.4	65.9
Total DCF reported	2,881	2,894	416.0	368.0	446.5	438.2	12,581	11,633	5,598	5,862	24.5	28.7
Other none DCF	-	-	-	-	-	-	-	-	-	-		
Total EU	2,881	2,894	416.0	368.0	446.5	438.2	12,581	11,633	5,598	5,862	24.5	28.7

Source: Own elaboration from EU Member States DCF data submission and FAO (2024) data

Social importance of mussel sector

The mussel sector has strong correlations with local employees. It guarantees stable work to which is added temporary and seasonal work, concentrated above all in the vicinity of the harvest.

In Spain, mussels are mainly cultivated in Galicia, where it is a traditional and consolidated sector. This industry represents an important part of the Galician economy, as it is a high-volume production sector. The workers are often self-employed and there is a lot of part-time employment. For example, fishermen who work on the rafts when the fishing season is closed. A significant proportion of the workers are from the same family as the owner. It is important to underline that the sector is strongly linked to the canning industry, which is also located in the same areas, and where most of the inputs come from Galicia (95%).

In 2021, the Spanish region of Galicia accounted for 71.6% of the jobs in marine aquaculture. When we focus this analysis on the mussel sector, this percentage rises to over 90%. A total of 3 793 workers have been registered in 2021, which means that the average number of workers per *batea* (raft) is 2.02 people. Since production of this bivalve mollusc is declining due to wind shifts, rising water temperatures and seed supply problems, employment is dropping. A comparative analysis with 2019 shows that the number of employed has decreased by 6.08% (246 workers). A broader review of the data since 2011 (4 947 workers) reflects that the sector, in ten years, has lost 1 154 jobs.

A deeper analysis of the social importance of the sector shows that 79% of workers are men. Although historically employment in the *bateas* (rafts) has been mostly male, in the last decade this trend has intensified, as in 2011 men accounted for 60.4% of total employment. Regarding the nationality of the workers, in 2021, 98.5% of the workers had Spanish nationality. This data is due to the fact that the mussel sector in Galicia is an atomized and family industry, in which workers, for the most part, are local workers. Another trend is that 63.3% of employment corresponds to self-employed workers.

France is the second country where mussels are cultivated mainly using two production techniques. The first is a specific rearing system on poles, called "*bouchots*". This method has existed since the Irishman Patrick Walton fortuitously invented it in 1235, after a shipwreck in the Bay of Aiguillon. These poles are now part of the landscape of the Atlantic coast and the English Channel. The second is in the Mediterranean basin, where they use tables. These are mainly family businesses. Throughout the country, these companies are becoming more and more important, with many salaried jobs, which benefit the inhabitants of the coast. Some of these companies have also started to deploy offshore longlines in the Mediterranean and Charente Maritime. Investments are becoming much more important and the jobs much more specialized.

In Italy, the Mediterranean mussel (*Mytilus galloprovincialis*) is the main cultivated species. However, national production is declining due to rising temperatures, which prevent growth to market size, and a shortage of mussel seed. This shortage is linked to changing weather conditions and the presence of the blue crab, which preys on mussels. As a result, domestic production does not meet market demand, with per capita consumption at 1.89 kg in 2021, making Italy the second largest consumer after Spain. This shortfall means that Italy imports mussel, especially fresh ones, with imports valued at around €37.5 million in 2021. Italy also exports fresh, unprocessed mussels, mainly to Switzerland, France, the Netherlands and Germany, with export earnings of around €10.6 million in 2021 (EUMOFA, 2022). Mussels are sold either as rope ("*treccia*") with impurities or cleaned in bulk ("*sfuso*"). Efforts to improve the value of mussels include cooperation with farmers' associations and research projects on biodegradable nets and the recycling of PVC nets for a closed-loop farming system to foster the circular economy transition into this aquaculture segment.

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 mussel production is harvested in the Spanish Northwest 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 on the appropriate date maintaining a continued production along the whole year. Rafts require a minimum depth of around 8 to 10 metres 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 metres where vertical ropes or mussel bags are hanged. This fact results in larger needs of space which are not 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).

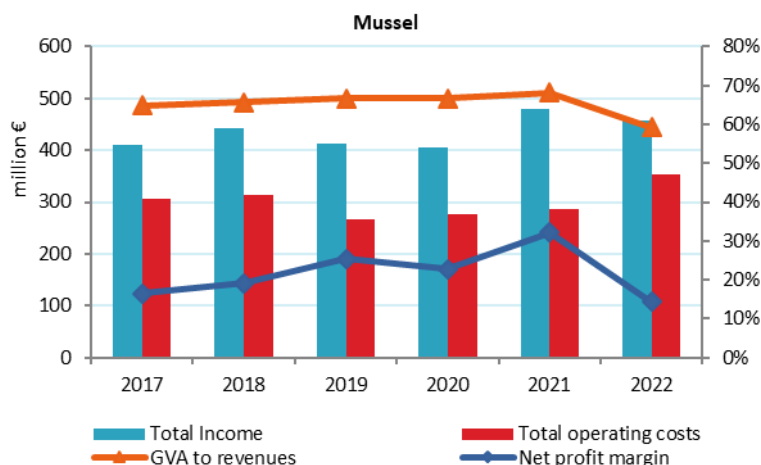
Bottom cultivation uses beds in the Netherlands and Ireland or poles (*bouchots*) and tables, very similar to rafts fixed in the seabed in France where the mussels are deposited or attached. This type of breeding “on bouchot” also makes it possible to benefit from the swaying of the tides, the mussels 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 time limited. In the case of *bouchot*, the excess seed is collected from the wild in Charente Maritime and Vendée 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 larger important quantities, the supermarket purchasing centres 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. About 80% of the production is sold to consumer into supermarkets, packaged in 1 to 2 kg trays.

Figure 31. Development of economic performance for the EU mussel aquaculture: 2017-2022.

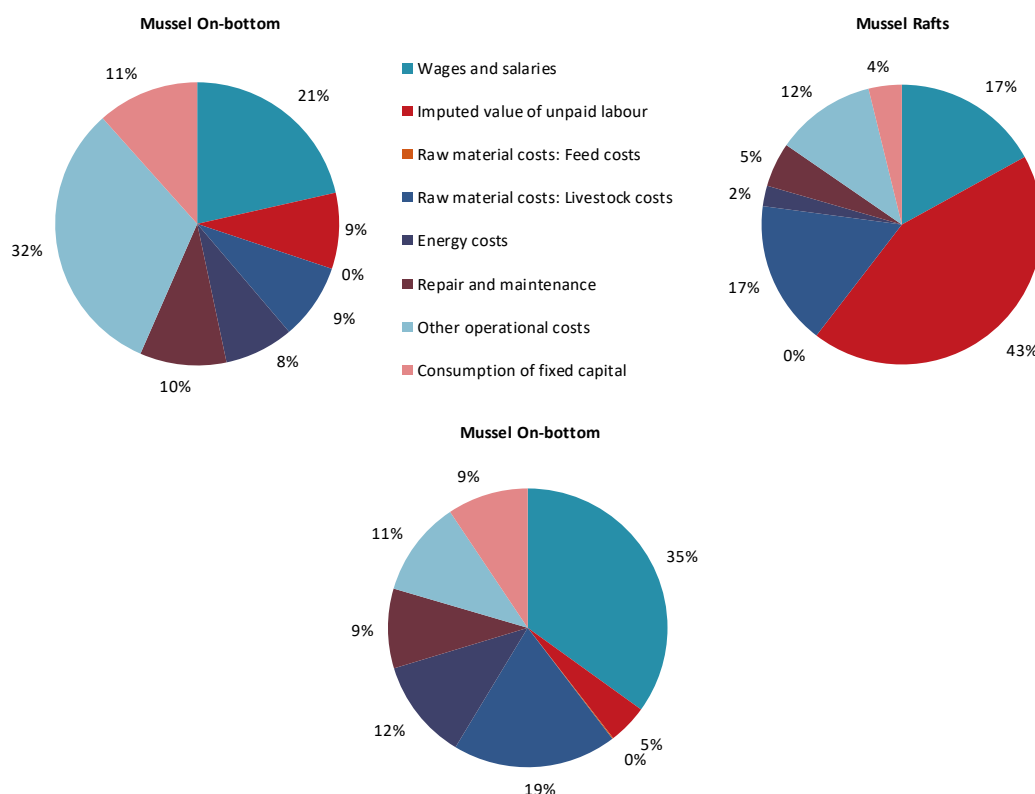


Source: Own elaboration from EU Member States DCF data submission

The evolution of economic performance in Figure 3.31 shows a positive trend in terms of incomes and operating cost, as well as in economic performance indicators (GVA and Net profit) on average for the entire European mussel sector, with a small decrease in 2022. The total income and operating costs for the mussel sector fluctuates over time but have remained relatively steady between 2017 and 2022. The net profit margin and GVA to revenues has been relatively stable over time but saw a minor decrease in 2022. Despite the reduction in total income, the increase in operational costs and the deterioration in GVA and Net profit in 2022, the industry remained profitable. A more detailed analysis by segments reveals that all of them obtain positive economic results in 2022 but with differences. Of all segments, the mussel long line has the highest profit margin of on average 24% in 2022, followed by mussel on-bottom (15%) and mussel rafts (85%).

As 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 32.

Figure 32. Costs breakdown for the EU mussel aquaculture: 2022.



Source: Own elaboration from EU Member States DCF data submission

One of the cost categories setting differences across techniques is the imputed value of unpaid labour. This has to do with the legal form of the enterprise. Raft and bottom culture record many employees 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 of cooperatives and consortia and such kind of informal labour is rarely present. Unpaid labour represented 43% in 2022 of the total raft costs and 9% in bottom culture, but only 5% in long line. This is also reflected in the importance of the formal wages and salaries which are 35% in long line, 21% in bottom culture and 17% in raft culture. The energy costs are significantly higher for mussel longline (12%) compared to 8% in the on-bottom segment and 2% for rafts. The on-bottom segment has the highest other operational costs of all segments (32%) compared to 12% for rafts and 11% for bottom culture.

As shown in Table 16, 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 Netherlands production is based on a high input of physical capital, while in other countries the production is more labour intensive. The highest average salary of all EU Member States is paid to workers in the Netherlands (about €86.6 thousand per year) followed by Swedish workers (about €66 thousand per year) and Danish workers (about €63 thousand per year). In Croatia, the average wage is about 58% lower than the average EU one. The average wages differ significantly between countries, which can be seen as an indicator of technological and organisational development in the various countries.

The EU mussel aquaculture gross value added reached more than €270 million, which is a decrease of 17% compared to 2021. EBIT reached almost €73 million, 55% lower than 2021. The ROI decreased

sharply to 9.7% from 21.7% in 2021. Labour productivity reached around €46 thousand per year, decreasing slowly compared to 2021. A capital productivity of 39.8% in 2022 compared to 45.9% in 2021.

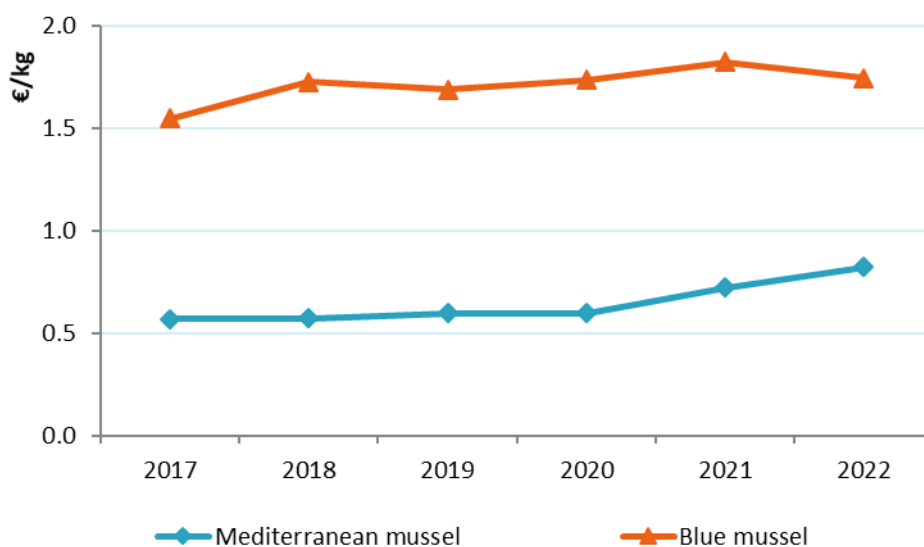
Table 16. Economic Performance indicators for the EU mussel aquaculture: 2021-2022.

Country	GVA		EBIT		ROI		Labour productivity		Capital productivity		
	million €		million €		%		thousand €		%		
	2021	2022	2021	2022	2021	2022	2021	2022	2021	2022	
Bulgaria	1.1	1.4	0.0	0.3	-1.3	2.5	23.0	24.8	10.7	14.7	
Croatia	1.0	1.8	0.5	0.8	12.6	12.3	13.7	23.8	23.6	33.0	
Denmark	3.0	3.1	1.0	1.0	11.8	11.5	106.5	111.8	37.0	37.0	
France	100.4	71.2	56.9	24.5	19.1	7.2	83.8	59.3	35.1	24.5	
Germany	9.6	9.1	4.0	5.4	3.3	5.1	78.5	81.0	8.3	8.6	
Greece	4.7	3.8	-	0.1	-	0.5	-3.3	-12.1	16.8	12.8	
Ireland	10.6	13.7	3.3	6.3	0.7	13.4	53.1	66.6	26.0	30.8	
Italy	36.7	31.9	20.8	16.6	55.1	37.0	40.1	29.8	98.3	72.4	
Netherlands	45.6	21.7	29.5	4.9	23.7	2.7	255.3	129.7	39.0	19.8	
Portugal	2.0	1.7	0.8	-	0.2	11.7	-2.4	61.5	42.4	31.8	16.7
Slovenia	0.0	0.7	-	0.7	-	0.1	-12.9	-2.1	1.4	49.6	
Spain	108.8	107.3	45.9	13.3	94.4	43.7	44.5	42.1	224.9	357.9	
Sweden	4.0	3.9	0.5	0.6	2.7	3.5	55.8	92.6	14.1	27.2	
Total DCF reported	327.4	271.3	162.4	72.7	21.7	9.7	58.5	46.3	45.9	39.8	
Other none DCF	0	0	0	0							
Total EU	327.8	271.5	162.6	72.8	21.7	9.7	58.5	46.3	45.9	39.8	

Source: Own elaboration from EU Member States DCF data submission

Figure 33 shows the market price for a kilo of blue mussels was €1 more expensive than for Mediterranean mussels in 2017. Since that date, the gap between the price of Mediterranean mussels and blue mussels is unchanged at €1 in 2022. Mediterranean mussels had an average price around €60 cents per kilo along the period observed and has increased 33% between 2017 and 2022. The price for blue mussel increased 16% per kilo from 2017. The average yearly growth from 2017 to 2022 was 3.6%.

Figure 33. Price (€/kg) evolution of the main species of mussel species: 2017-2022.



Source: Own elaboration from EU Member States DCF data submission, 2024

Outlook

Mussel production can be considered as an environmentally 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: Several recent publications describe the ecosystem services provided by both the natural beds of bivalves and by the aquaculture of molluscs. Clear level of carbon sequestration by shells is still in discussion in the scientific community on this service, but Joël Aubin 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. Recently the Aquaculture Advisory Council released in April 2022 a recommendation on the carbon sequestration by molluscs.

In some areas, like Spain, Ireland and France, the problem of red tides is very relevant. For instance, in Spain and Ireland, the problem of lacking seed mussels is an obstacle for stable and growing production. Spain has reported that the problem with finding a sufficient supply of mussel seed has grown in recent years and also created conflicts between the mussel and barnacle sector who compete for areas to harvest. The local government is trying to resolve the conflict but has so far been unsuccessful.

Bird and fish predation becomes significant in Greece, Italy, and France. Recently the specific predation by sea-spiders in the Channel becomes heavy (20% to 30% of loss reported in some French regions).

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.

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.

In 2021, there was an improvement in production, breaking the negative trend accumulated in previous years. However, in 2022, total mussel production in the EU has fallen again. Despite its low dependence on the evolution of energy costs, and the positive aspects of its production in social and environmental terms, it is the latter that expose producers to greater operational risk derived from environmental factors such as red tides, which produce great volatility in the quantities produced.

It is therefore complex to establish an Outlook for this sector since, although mussel production is aligned with EU sustainability policies, although producers invest in production and product development and marketing, and although there is strong demand in the main consumer countries for aquaculture products such as Italy, France or Spain, the sector's production is strongly conditioned by exogenous factors, such as environmental ones.

Demand for the product on EU markets means that the decrease in the value of production is proportionally much lower than that of the quantities produced, due to the increase in market prices. In the last three years, prices, although low compared to other species, have followed a positive trend that is likely to be repeated if production restrictions persist. Despite the increase in prices, profitability indicators, although positive in most countries, may continue to decline due to the increase in operating costs, especially those associated with seed supply, the availability of which is also affected by environmental aspects.

Regarding the impact of the COVID-19 pandemic, the European mussel farming sector has suffered relatively less than all other aquaculture sectors. As indicated in the previous report, the mussel industry was not only less affected by COVID-19 in 2020, but also performed better in 2021. The evolution of the sector in recent years shows that during 2020, 2021 and 2022 the economic results of the mussel industry in the EU has been marked, not so much by COVID-19, but mainly by environmental factors.

Recently the cost of the energy increased due to the war in Ukraine. Mussel farming is variably sensitive to this change: longline mussel is more sensitive than other segments. Starting in 2023, a few companies have started investing in valorising undersized mussels, which have previously been discarded. This

innovation has been increasing employment in the mussel sector, but the effect of this new product on the industry is not yet known. Any new development will be reported in the next edition (2026).

In recent years, it has become increasingly common to find processed products beyond traditional canned ones, which are increasingly popular and in demand among consumers. Although fresh and canned continue to be the main products, there are many examples of the increasing presence of ready-to-eat products in the retail. The desire of certain mussel growers to develop, within their own company, a transformation of their product, by extracting the flesh and using it as ready-made meals, should be given special attention. The integration of high added value processing activities will allow producers to access a greater proportion of the final value of the product, and not compete in prices with unprocessed imported mussels.

3.2.2 Clams

Global clam production is dominated by three main species: the Japanese carpet shell (*Ruditapes philippinarum*), the constricted tagelus (*Sinonovacula constricta*), and the blood cockle (*Anadara granosa*). In 2022, the combined global production volume of clams, cockles, and arkshells reached approximately 4 514 million tonnes in live weight, representing about 24% of the total output of species in this category. The Japanese carpet shell, also known as the Manila clam, plays a significant role in global aquaculture, especially in countries like China, Japan, and South Korea, where it is a primary species cultivated for both local markets and export.

In the European Union, the main species cultured are the Japanese carpet shell and the grooved carpet shell (*Ruditapes decussatus*). Italy stands as the leading producer within the EU, benefiting from extensive coastal areas suitable for clam farming. Portugal and Spain are also important players in European clam production, though they face distinct challenges.

The global market dynamics for clams are influenced by the high demand in Asian countries, especially China, which is the largest producer and consumer of *Ruditapes philippinarum*. The robust domestic demand, along with exports to other regions, drives global production. However, challenges like disease management, environmental changes, and fluctuating market prices continue to impact the sector's profitability and sustainability. As highlighted by FAO's 2024 SOFIA report, the industry must adapt through improved management practices and technological innovations to sustain growth.

Italy's number of enterprises remained stable at 174 in both years, despite a 7.5% decline in sales volume, from 22.7 thousand tonnes in 2021 to 21.0 thousand tonnes in 2022. Despite lower production, Italy's turnover increased by 6.8%, reaching €161.8 million in 2022, suggesting improved market prices and value-added sales strategies. However, employment dropped by around 1 000 jobs, and FTEs decreased by 12.8%, indicating cost-cutting measures in response to production challenges.

Portugal's production also declined, falling from 3.2 to 2.9 thousand tonnes (a 9.4% drop). However, turnover increased slightly by 4.5% to €51.3 million. Employment grew modestly, with job numbers rising from 720 to 761 and FTEs from 380 to 408, indicating a stable workforce despite reduced production.

Spain faced the most significant challenges, with its number of enterprises dropping from 738 to 617 (a 16% reduction) and production halving from 2.5 to 1.2 thousand tonnes, equal to a 52% decrease. This decline led to a 39.9% drop in turnover, from €19.3 million to €11.6 million. Employment remained steady, increasing slightly to 5 793 jobs, but FTEs fell from 317 to 294, suggesting more part-time roles.

The total European clam production also includes contributions from two other Member States, Slovenia and France. Their production is accounted for in the FAO data, categorized under "Other none DCF." This classification indicates that while their production is included in the overall figures, it falls outside the primary Data Collection Framework (DCF).

Overall, the European Union saw a 7.6% decline in the number of clam enterprises and a 5.6% decrease in production volume. Despite these drops, total EU turnover rose slightly, indicating better market prices. Employment and FTEs across the EU fell by 7.2%, reflecting efforts to optimize operations amid

lower production levels. The data suggest that while Italy and Portugal adapted through strategic adjustments, Spain faced severe difficulties. The EU's increase in turnover amidst declining production highlights the complex dynamics of price adjustments and market adaptation.

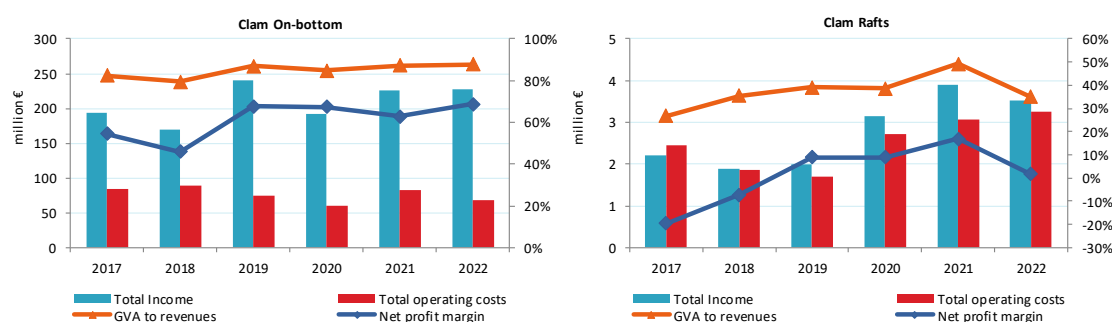
Table 17. Economic indicators for the EU clam aquaculture: 2021-2022.

Country	Number of enterprises		Total sales volume		Turnover		Employment		FTE		Average wage	
	number		thousand tonnes		million €		number		number		thousand €	
	2021	2022	2021	2022	2021	2022	2021	2022	2021	2022	2021	2022
Italy	174	174	22.7	21.0	151.5	161.8	5,391	4,370	827	721	27.1	39.4
Portugal	546	546	3.2	2.9	49.1	51.3	720	761	380	408	12.4	9.3
Spain	738	617	2.5	1.2	19.3	11.6	5,654	5,793	317	294	99.1	42.7
Total DCF reported	1,458	1,337	28.4	25.2	219.8	224.7	11,766	10,924	1,524	1,423	38.4	31.4
Other none DCF	111	100	2.2	1.9	12.3	13.5	892	819	116	107		
Total EU	1,569	1,437	30.6	27.0	232.2	238.3	12,658	11,742	1,640	1,529	38.4	31.4

Source: Own elaboration from EU Member States DCF data submission and FAO (2024) data

In the last two years, the economic performance of the different segments of the European clam industry, in specific the clam on-bottom segment, increased slightly from €226.7 million in 2021 to €228.1 million in 2022, reflecting the stability of the segment. Operating costs fell significantly from €82 million in 2021 to €68.9 million in 2022, a reduction of 16%. This reduction in costs contributed to an increase in net profit, which rose from €142.4 million in 2021 to €156.9 million in 2022, an improvement of 10.2%. GVA remained stable at around €199.9 million in both years, maintaining a high ratio of GVA to sales (around 85%). On the Clam Rafts side, total revenues decreased from €3.9 million in 2021 to €3.5 million in 2022, a reduction of around 10%. However, total operating costs increased from €3.06 million to €3.27 million, an increase of around 7%. The combination of lower revenues and higher costs led to a sharp decline in net profit, which fell from €662 249 in 2021 to €62 367 in 2022, a decrease of over 90%. The ratio of GVA to turnover also falls significantly over this period, indicating increased operational challenges. Meanwhile, the Clam Other segment continued to struggle with profitability. Revenues were insufficient to cover rising operating costs, resulting in a persistently negative net profit. In 2022, this segment's operating costs significantly exceeded the income generated, indicating serious financial challenges. As a result, the performance of this segment highlights the difficulties of maintaining profitable operations in more niche or less efficient production methods. These trends thus highlight the variability of economic results within the shellfish industry, where cost management and stable market demand are crucial for profitability, particularly in segments such as clam on-bottom, which benefit from economies of scale.

Figure 34. Economic indicators for the EU clam aquaculture: 2017-2022.



Source: Own elaboration from EU Member States DCF data submission

The economic performance of the clam segment in Europe focuses on key indicators such as gross value added (GVA), earnings before interest and tax (EBIT), return on investment (ROI), labour productivity, capital productivity and average wage levels. These indicators provide insights into the health, profitability and efficiency of the sector in each country.

Italy is the leading clam producer in Europe and its economic performance reflects this status. The country's GVA increased slightly from €131 million in 2021 to €141.5 million in 2022, suggesting a stable economic contribution despite wider sector challenges. EBIT and ROI remained virtually unchanged at around €110 million, and 220%, respectively. Labour productivity in Italy raised from €158.5 thousand to €196.2 thousand, indicating steady efficiency in the use of labour. In the meantime, capital productivity also raised from 269.1% to 279.4%, indicating a higher return on capital invested. Average wages rose significantly, from €27.1 thousand to €39.4 thousand, likely reflecting a focus on retaining skilled workers.

Portugal presented a robust economic performance in the clam segment, with a slight decrease in GVA from €56.4 million in 2021 to €53.4 million in 2022. Despite this decrease, the ROI increases significantly, reflecting improved efficiency in generating returns on investments. This suggests that Portugal has managed to optimise its production processes and benefit from more favourable market conditions. However, EBIT in Portugal declined from €51.8 million to €48 million, indicating a reduction in operating profitability. This decline may be linked to higher operating costs, even though market prices increased. Labour productivity declined from €148.3 thousand to €130.9 thousand, suggesting a fall in output per employee. In contrast, capital productivity improved, suggesting that capital investment was used more effectively to generate output. The average wage fell from €12.4 thousand to €9.3 thousand, reflecting downward pressure on labour costs, which could be a strategy to maintain competitiveness.

The Spanish clam segment faced significant challenges between 2021 and 2022. GVA fell from €12.6 million to €6.3 million, reflecting a decline in the sector's overall economic contribution. EBIT also fell sharply to negative numbers, indicating that this sector was not profitable in operational terms. This decline in results is in line with the challenges faced by the Spanish clam sector in terms of declining production volumes. The ROI also decreased significantly to negative returns on investment and suggesting difficulties in maintaining profitable operations. Labour productivity also fell, from €39.7 thousand to €21.4 thousand, reflecting lower efficiency in output per employee. Moreover, capital productivity went from 90.9% to 74.3%, suggesting that investments were managed in a less effective way in 2022, possibly in response to lower output. Average wages dropped sharply from €99.1 thousand to €42.7 thousand, possibly due to the exit of higher-paying businesses or efforts to reduce costs.

The economic performance of the clam sector in these countries shows a mix of stability and challenges. Italy, as the leading producer, managed to maintain stable GVA, EBIT, and ROI. Portugal showed improved ROI and capital productivity despite a decrease in GVA and EBIT, suggesting effective management of resources. Spain, on the other hand, suffered significant falls in GVA, EBIT and ROI, highlighting serious production and profitability problems. While some countries have adapted by improving investment management or maintaining labour stability, the sector is under pressure from fluctuating production levels, rising costs and market competition. The ability to address these challenges will be crucial for the long-term sustainability and growth of the European clam aquaculture sector.

Table 18. Economic performance indicators for the EU clam aquaculture: 2021-2022.

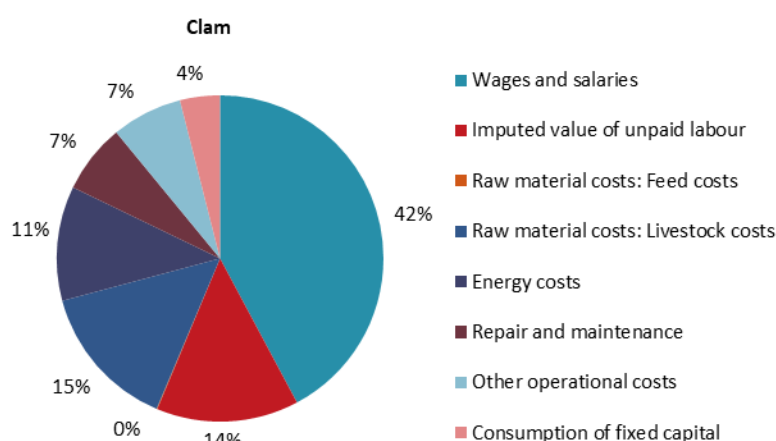
Country	GVA		EBIT		ROI		Labour productivity		Capital productivity	
	million €		million €		%		thousand €		%	
	2021	2022	2021	2022	2021	2022	2021	2022	2021	2022
Italy	131.0	141.5	107.2	111.6	220.0	220.0	158.5	196.2	269.1	279.4
Portugal	56.4	53.4	51.8	48.0	248.1	618.5	148.3	130.9	272.1	692.3
Spain	12.6	6.3	-19.1	-6.3	-139.3	-75.6	39.7	21.4	90.9	74.3
Total DCF reported	200.0	201.2	139.9	153.3	167.2	228.6	131.2	141.4	240.2	301.1
Other none DCF	11.2	12.1	7.9	9.2						
Total EU	211.2	213.3	147.8	162.6	167.2	228.6	131.2	141.4	240.2	301.1

Source: Own elaboration from EU Member States DCF data submission

The provided data illustrates (Figure 35) the breakdown of operational costs for clam farming. Key cost components such as seed, labour, and energy differ in importance depending on the production method. Labour is a predominant cost in all types of clam farming, with wages accounting for around 42% of total

costs. The significant allocation to wages reflects the labour-intensive nature of these aquaculture systems, which involve tasks such as manual seeding, maintenance and harvesting. In addition, the general category “Clam” shows a combination of paid labour (42%) and imputed unpaid labour (14%), indicating the presence of small-scale family farms that rely on both formal employment and unpaid contributions. Seed costs, which are often included under “raw material costs”: livestock costs’, represent a significant part of the cost structure for the “Clam on-bottom” and especially in the raft segment. This indicates that the purchase of clam seed or juvenile clams is a significant cost, especially in systems where high stocking densities are required to achieve optimum yields. For “other clams”, seed costs are less prominent, which could indicate the use of natural spat collection or other methods that reduce the dependence on external seed inputs. Energy costs are differentiated in the three segments, in fact “clam on-bottom”, energy costs account for approximately 12.4% of the total operating costs (€8.84 million out of €71.10 million). This higher proportion reflects the energy needs associated with managing large cultivation areas and maintaining environmental conditions. For “other clam”, energy costs represent about 1.3% of the total (€62 957 out of €4.90 million). This lower percentage suggests that this segment relies more on natural environmental factors and is less dependent on mechanical or energy-intensive processes. Finally, for “Rafting”, energy costs represent about 3.5% of the total (€119 724 out of €3.44 million). The moderate percentage indicates that although raft systems require energy for stability and water flow management, they are still less energy-dependent than large-scale on-bottom farming systems.

Figure 35. Costs breakdown for the EU clam aquaculture: 2022.



Source: Own elaboration from EU Member States DCF data submission

The data (Figure 36) highlights trends in production and market value for key species such as the Japanese carpet clam (*Ruditapes philippinarum*), grooved carpet clam (*Ruditapes decussatus*), and common edible cockle (*Cerastoderma edule*). Between 2017 and 2022, there was a general trend of decreasing production volumes for most species, while values tended to remain stable or even increase. This shift suggests that market dynamics have changed, possibly due to improved efficiency, changes in consumer preferences or post-pandemic supply chain adjustments. The Japanese carpet clam maintained a high market value until 2020, but experienced a decrease in 2021. Grooved carpet shells experienced more volatility but followed a positive trend. Focusing the analysis on the last two years, there is trend data suggesting that prices for the most valuable species of clams, such as Japanese and grooved carpet clams, are holding up, as detailed below.

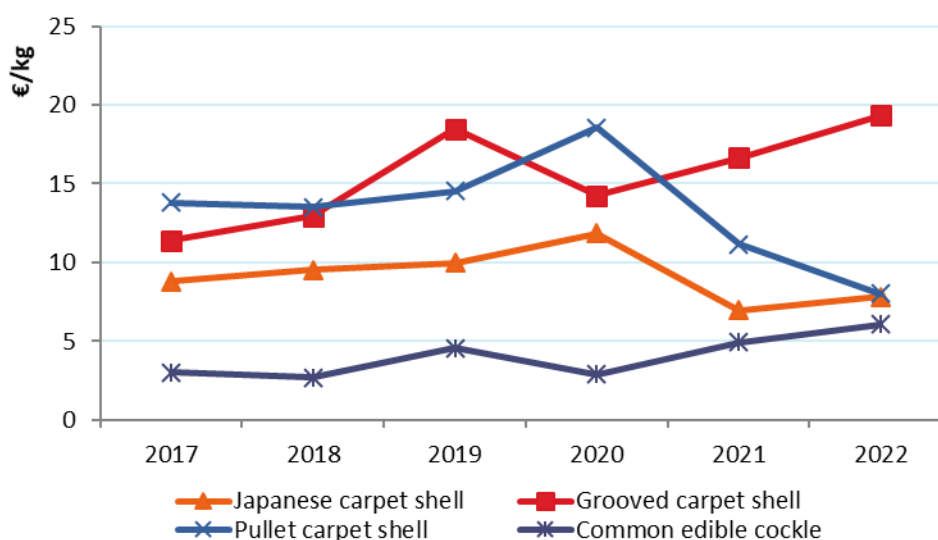
Japanese carpet clams are the dominant species in terms of both production volume and value. In 2022, production was around 24 403 tonnes, generating a value of around €225.6 million. This represents a decrease in volume from 35 526 tonnes in 2017, but the value in 2022 remained high compared to previous years. The price per tonne was stable in 2022, after a significant decrease in 2021. This could be due to higher market demand, which supported prices despite a reduction in supply.

Grooved carpet shells recorded more volatility in both volume and value. Production decreased from 6 895 tonnes in 2017 to 5 146 tonnes in 2022. However, the value remained more stable, increasing from €56.6 million in 2017 to around €85.5 million in 2022. This species showed remarkable price resilience in 2021 and 2022, with a positive evolution. Despite a reduction in production, the market value remained buoyant, suggesting that higher prices could be achieved due to stable demand or limited supply.

Common edible cockle showed a sharp decline in production volume, falling from over 2 061 tonnes in 2017 to just 1 214 tonnes in 2022. Its market value followed a similar trend, falling from around €7.99 million in 2017 to €4.47 million in 2022. This species did not maintain price stability as effectively as Japanese and grooved carpet shells. However, prices resumed the positive trend in 2021 and 2022.

The corrugated venus clam displays a relatively smaller share of production in the European clam market compared to species like the Japanese carpet shell. The data shows fluctuations in both production volume and market value between 2017 and 2022. The data shows fluctuations in both production volume and market value between 2017 and 2022.

Figure 36. Price (€/kg) evolution of the main species of clam group: 2017-2022.



Source: Own elaboration from EU Member States DCF data submission

From a market perspective (EUMOFA 2023²), the European clam sector experienced significant price dynamics and shifts in value throughout 2021. This increase was driven by rising ex-farm prices, particularly in Italy, the dominant player in the market. The ex-farm price reached €/kg 6.70, marking an almost 15% rise from the previous year (DCF data ref.2020). This shift reflects a combination of increased demand and constrained supply, which allowed producers to achieve higher market prices. Portugal also plays important roles in the EU clam market. In Portugal, the average market price for clams rose by 22% to €15.59 per kilogram in 2021 (EUMOFA, 2023), likely due to the higher value of the grooved carpet shell, which is the predominant species cultivated there.

Outlook

The European clam farming sector has seen significant strategic investments and management actions aimed at improving sustainability and resilience, particularly in 2021-2022. In Italy, where the clam industry has a long history and maturity, the focus has been on improving resource management and market stability. The creation of producer organisations (O.P.s) has strengthened coordination among clam farmers, enabling better market access and resource sharing. These efforts are complemented by

² EUMOFA. 2023. The EU fish market. doi: 10.2771/38507. https://eumofa.eu/documents/20124/35668/EFM2023_EN.pdf.

regional initiatives, such as those in the Po Delta, to address challenges such as invasive species and climate change impacts, including blue crab invasion and high-water temperatures. Spain and Portugal have also made significant investments in their aquaculture sectors through the European Maritime, Fisheries and Aquaculture Fund (EMFAF) for 2021-2027. Spain has dedicated part of its €1.57 billion budget to sustainable aquaculture, focusing on competitiveness, decarbonisation and biodiversity. Portugal's approach includes funding for spatial planning and technological innovation, supported by the MAR 2030 programme, with €22.8 million allocated to promote low-impact aquaculture practices. These coordinated efforts across Southern Europe reflect a broader alignment with the European Green Deal, which emphasises sustainable growth and climate resilience in the aquaculture industry.

3.2.3 Oyster

The oyster species produced in European aquaculture include Pacific cupped oyster, cupped oysters *nei* (declared by Portugal), and European flat oyster. European countries who reported oyster production include: Croatia, France, Ireland, Netherlands, Portugal, and Spain. Oyster production in Italy remains quite low and is not reported in the tables, but it appears that the sector is experiencing a revival after a long period of decline.

Pacific oysters represent the majority of European production in terms of volume and value. France and Ireland are the two main European producers, accounting for over 90% of production. The other main species of oyster is the European flat oysters, with some countries, such as Croatia, producing only this species.

The two main segments of oyster production are: oyster rafts (seg11.9) and oyster on-bottom (seg11.11). In 2022, reported data for the EU shows a total oyster sales volume of 143 000 tonnes valued €675 million, what represented an increase of 1% and 8% compared to 2021, respectively.

Pacific oyster production is predominant (over 95% of total oyster production by volume and value). As France accounts for more than 85% of the total volume and value of oyster production in Europe, prices and cost shares are entirely influenced by French production and the French market. The second largest European producer is Ireland, far behind France, which accounts for around 8% of production by volume and value, followed by Portugal.

In 2022, the number of oyster farms in the EU is estimated at 2 274. Most of these are in France (83%), followed by Ireland (8%) and Portugal (4%). The number of farms in 2022 will be the same as in 2020. Oyster farming businesses employ 8 148 FTEs, an increase since 2020, including non-salaried labour.

Table 19. Economic indicators for the EU oyster aquaculture: 2021-2022.

Country	Number of enterprises		Total sales volume		Turnover		Employment		FTE		Average wage	
	number		thousand tonnes		million €		number		number		thousand €	
	2021	2022	2021	2022	2021	2022	2021	2022	2021	2022	2021	2022
Croatia	21	26	0.2	0.3	0.5	0.9	41	55	31	46	5.3	4.2
France	1726	1888	124.8	127.0	536.3	576.5	11612	13444	6605	7059	22.3	22.7
Ireland	178	174	11.3	11.5	49.6	57.3	1358	1390	649	697	24.7	25.8
Netherlands	38	38	-	-	10.1	12.4	56	56	56	56	54.8	64.7
Portugal	82	99	3.1	2.6	21.8	22.4	213	251	175	190	13.1	15.5
Spain	48	49	1.8	1.6	4.8	5.3	393	215	98	100	25.8	29.5
Total DCF reported	2,093	2,274	141.2	143.0	623.1	674.8	13,673	15,411	7,615	8,148	22.5	23.1
Other none DCF	6	6	0.4	0.4	3.2	3.2	39	43	22	23		
Total EU	2,099	2,280	141.6	143.4	626.3	678.0	13,712	15,454	7,636	8,171	22.5	23.1

Source: Own elaboration from EU Member States DCF data submission and FAO (2024) data

The different strategies put in place by oyster companies to deal with the various risks they face may explain the changes in economic indicators over the years (mortality, closures of production areas for health reasons, maintenance of consumer confidence, etc.). The following Table 20 shows the economic performance indicators for European oyster farming in 2022. Compared with 2021, France, the main

contributor to the oyster industry, has recorded an increase in GVA (up 8%) and a stable EBIT. Ireland, for its part, will be much more profitable in 2022, with a 27% increase in GVA and a 43% rise in EBIT, well above the indicators for 2019 and 2020. The average wage indicator should be analysed with caution and by country, as it varies greatly from one country to another (i.e., the difference between the average wage in Portugal and the Netherlands) which is explained by the typology of the workforce (paid vs. unpaid labour in particular).

Table 20. Economic Performance indicators for the EU oyster aquaculture: 2021-2022.

Country	GVA		EBIT		ROI		Labour productivity		Capital productivity	
	million €		million €		%		thousand €		%	
	2021	2022	2021	2022	2021	2022	2021	2022	2021	2022
Croatia	0.5	0.3	0.4	-0.1	57.0	-43.5	16.2	5.9	65.7	55.5
France	254.2	273.9	65.8	65.9	8.8	7.1	38.5	38.8	37.2	35.2
Ireland	33.8	43.0	15.0	21.6	15.2	25.7	52.0	61.7	37.7	49.4
Netherlands	6.0	6.5	2.5	2.3			107.5	116.1		
Portugal	23.7	17.2	21.2	13.6	135.7	81.1	135.4	90.3	155.5	103.0
Spain	2.4	3.3	-0.3	-0.2	-5.2	-3.0	24.2	33.4	43.6	46.7
Total DCF reported	320.5	344.2	104.7	103.0	12.2	10.4	42.1	42.2	40.3	38.7
Other none DCF	0.4	0.2	0.1	0.1						
Total EU	320.9	344.4	104.8	103.1	12.2	10.4	42.1	42.2	40.3	38.7

Source: Own elaboration from EU Member States DCF data submission

In 2022, for all segments, total operating costs will have risen significantly compared with the average for the last five years (+12%), with a marked increase in the last year (+8% compared with 2021). The increase in these costs has, however, been accompanied by a rise in total income of the same proportion, enabling the profitability indicators to be maintained compared with the average for the previous five years.

Figure 37. Development of economic performance for the EU oyster aquaculture: 2017-2022.



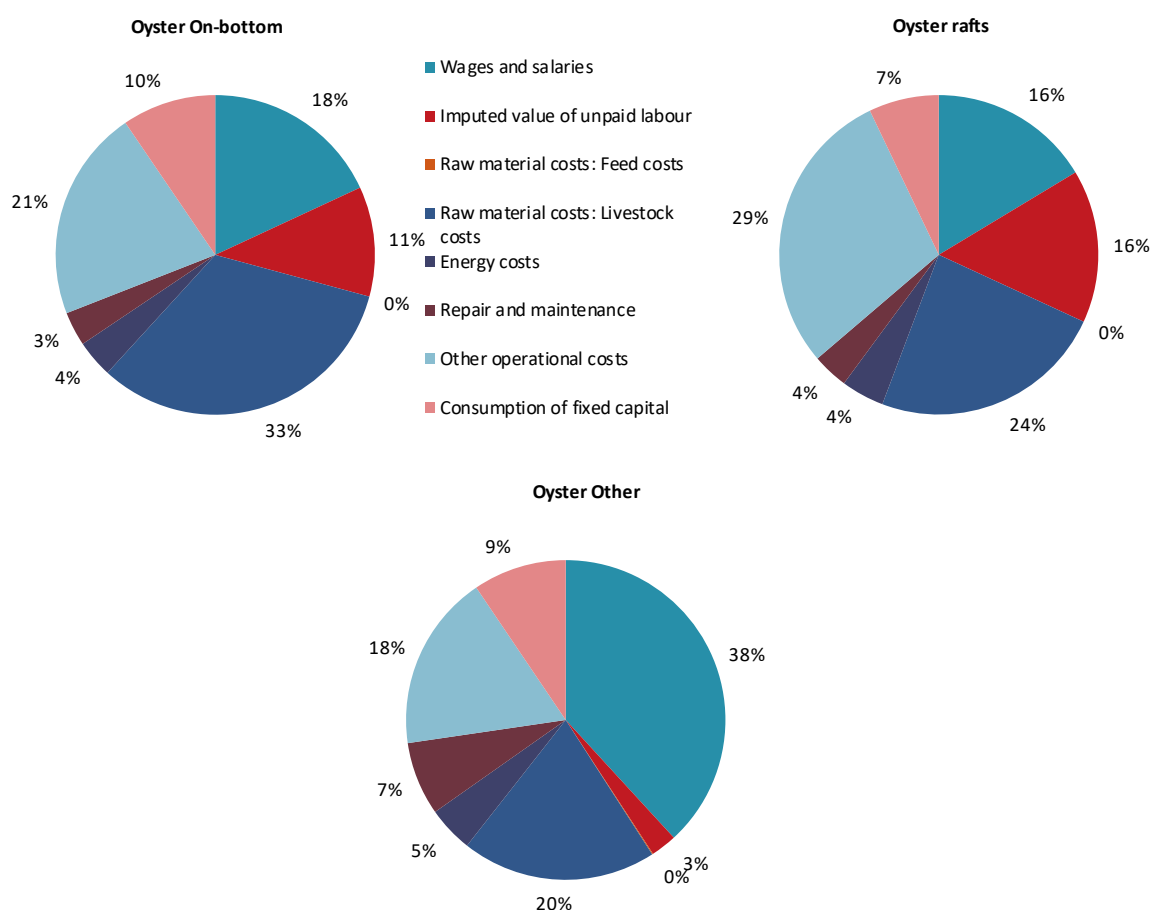
Source: Own elaboration from EU Member States DCF data submission

The breakdown of costs may differ from one segment to another. This is due to the different techniques used by oyster farmers and the different types of equipment used to grow oysters. The distances to be covered (at sea, on the foreshore, in the marshes) by different types of vehicles (tractors, boats of different sizes with different engines) can also explain the variability of different costs according to the different segments. Livestock costs are on the rise, particularly in the on-bottom segment, with the weight of this expense item rising from 25% of total costs in 2020 to 33% as a result of the general rise in raw material prices.

The type of workforce is also very different from one country to another, with a significant use of unsalaried or part-time and seasonal labour in oyster farming in some countries, as shown by the differences in employment and FTE numbers (13 444 employees in France for 7 059 FTE, for example).

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.).

Figure 38. Costs breakdown for the EU oyster aquaculture: 2022.

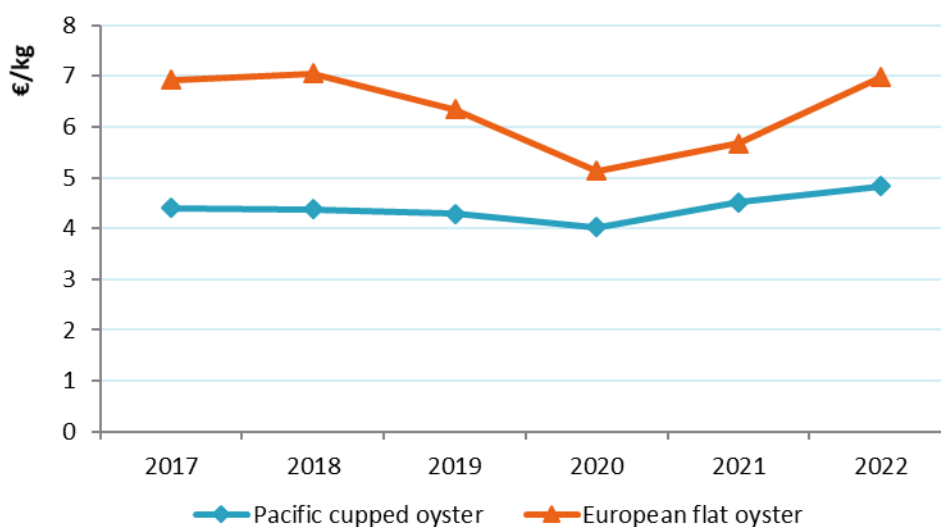


Source: Own elaboration from EU Member States DCF data submission

In Europe, the Pacific oyster has maintained its value for the last five years with an average price in 2022 of €4.8/kg almost at the same level as 2017 after lower average prices in 2017 and 2020 (€4/kg at a low in 2020). The flat oyster is the highest valued species with an average price of €7/kg in 2022 at the same level as in 2017 and 2018 but with a significant drop in 2020 where the average price had

fallen by more than €2/kg. While the average price of flat oysters is more than €2/kg higher than that of Pacific cupped oysters, this depends heavily on product scarcity and environmental and health factors.

Figure 39. Price evolution of the main species of oyster group: 2017-2022.



Source: Own elaboration from EU Member States DCF data submission

Outlook

Even though this past year has shown good production levels in terms of volume and value for oysters, oyster companies are continually facing many challenges that they will have to overcome in the years to come in order to maintain their profitability.

In France in 2023 for example, many production areas were closed for health reasons at the time of peak marketing, having a double impact, both on immediate marketing but also on the long-term image of the product among consumers. These phytoplankton blooms causing administrative closures could intensify in the years to come, just as climate change poses risks such as a shortage of phytoplankton, which is essential for oyster growth.

On the consumer side, general inflation and the financial crisis are impacting citizens and end-consumer budgets, limiting overall consumption. The work of promoting the product and its image, by promoting the local aspect, will be important keys in attracting and retaining consumers.

3.3 Freshwater aquaculture

In 2022, the EU's freshwater aquaculture sector produced about 266.3 thousand tonnes, generating a value of €1.12 billion (see Table 21). This marked an 11% decline in sales volume compared to 2021, while the value of sales increased by 8%.

The leading producers in EU freshwater aquaculture segment in terms of volume were Poland (17%), France (13%), and Italy (12%), according to data from the FAO and DCF. In terms of value, Poland also led with a 16% share, while France and Italy each contributed 12%.

For economic and employment indicators, 18 out of the 27 EU Member States reported EU-MAP data, but it was decided not to include Romanian data in the analysis because of data quality concerns. Estimates were made for the remaining countries to represent the EU total. Some Member States do not report freshwater aquaculture data to EU-MAP due to production thresholds.

Table 21. Economic indicators for the EU aquaculture freshwater subsector: 2021-2022.

Country	Number of enterprises		Total sales volume		Turnover		Employment		FTE		Average wage	
	number		thousand tonnes		million €		number		number		thousand €	
	2021	2022	2021	2022	2021	2022	2021	2022	2021	2022	2021	2022
Belgium	17	17	-	-	-	-	101	120	72	81	39.2	37.6
Bulgaria	735	692	10.3	8.0	32.2	31.1	1,451	1,455	1,173	1,181	4.0	5.6
Croatia	29	32	4.2	4.2	9.5	11.1	465	523	344	353	11.9	11.5
Czechia	480	440	23.5	24.1	47.5	66.3	2,180	2,463	671	808	22.7	27.4
Denmark	72	64	36.7	32.0	128.5	129.2	473	427	374	332	55.5	66.5
Finland	145	136	4.4	5.2	37.6	44.6	420	436	275	272	42.2	49.2
France	291	315	37.2	34.4	160.5	166.7	1,763	1,506	1,124	1,146	23.8	22.4
Germany	2,373	2,274	15.7	15.7	66.0	76.3	4,676	4,834	2,622	2,820	26.4	24.0
Greece	130	129	3.5	4.5	14.5	18.6	542	545	320	328	17.6	19.9
Hungary	189		11.3		25.2		1,245		763		10.9	
Ireland	8	9	0.5	0.4	1.8	2.2	21	26	18	19	30.1	37.9
Italy	141	141	41.0	29.0	123.9	93.0	695	550				
Latvia	75	69	1.1	0.9	5.7	6.2	307	310	206	202	13.3	14.9
Poland	1,012	1,012	45.4	46.9	119.8	191.9	5,148	5,206	3,844	3,888	15.2	16.7
Portugal	2	3	0.6	0.3	1.6	0.9	13	27		24		19.1
Spain	110	108	21.0	20.7	80.4	82.8	917	936	703	705	24.6	25.8
Sweden	86	78	12.7	10.3	58.6	65.9	438	364	166	226	48.9	40.1
Total DCF reported	5,895	5,519	269.1	236.6	913.4	986.9	20,855	19,728	12,674	12,385	20.8	21.6
Other non-DCF	676	694	30.9	29.7	127.3	132.1	2,393	2,481	1,887	1,912		
Total EU	6,571	6,213	299.9	266.3	1,040.8	1,119.0	23,248	22,209	14,561	14,297	20.8	21.6

Source: Own elaboration from EU Member States DCF data submission and FAO (2024) data

EU-MAP data and estimations for 2022 show that there were 6 213 enterprises in the freshwater sector and compared to 2021 this is a decreased of 5%. The sector employed 22 209 people, equivalent to approximately 14 297 full-time equivalents (FTEs). The average gross wage was around €21.6 thousand, though this varied significantly across member states. Salaries depended on the techniques used and the species produced, with the highest wages reported in Italy and Denmark, where intensive trout aquaculture is prevalent. Conversely, the lowest wages were in Bulgaria, dominated by extensive carp production. The variability in wages and employment conditions across member states highlights the diverse nature of the EU freshwater aquaculture sector. Compared to 2021, average wages increased by about 6%.

The EU freshwater aquaculture industry generated about €398 million in gross value added (GVA) in 2022, a 12% increase from 2021. Profitability showed an upward trend, with earnings before interest

and taxes (EBIT) rising to €40 million in 2022 from about €4 million in 2021. Labour productivity in the sector increased by 11% to €24 thousand, while capital productivity improved by 23%, with the highest capital productivity observed in France.

Table 22. Economic Performance indicators for the EU aquaculture freshwater subsector: 2021-2022.

Country	GVA		EBIT		ROI		Labour productivity		Capital productivity	
	million €		million €		%		thousand €		%	
	2021	2022	2021	2022	2021	2022	2021	2022	2021	2022
Bulgaria	11.5	- 1.1	4.1	- 10.2	10.2	-18.5	9.8	-0.9	30.5	-1.7
Croatia	9.8	4.6	7.4	3.4	6.1	2.0	28.4	13.0	8.6	3.2
Denmark	13.6	17.5	- 13.9	- 12.1	-8.3	-7.5	36.5	52.7	7.5	9.0
Finland	3.2	4.7	- 13.4	- 13.0	-16.5	-12.7	11.7	17.3	3.0	4.5
France	65.3	70.7	30.1	36.3	19.5	21.3	58.1	61.7	42.8	43.0
Germany	23.6	23.8	- 44.0	- 42.7	-12.3	-51.6	9.0	8.4	6.3	28.1
Greece	5.3	6.3	- 2.8	- 1.8	-8.3	-5.5	16.6	19.1	14.6	16.6
Ireland	- 0.1	1.3	- 0.8	0.4	-20.3	8.3	-4.6	71.2	-2.1	27.0
Italy	42.5	40.9	23.1	24.5	14.9	17.8			28.7	31.2
Latvia	2.6	2.6	0.2	- 0.5	7.0	11.8	12.8	12.8	11.9	14.7
Poland	51.4	87.7	- 11.3	21.5	-1.8	3.8	13.4	22.6	9.2	15.5
Portugal		- 0.3		- 0.7				-11.3		
Spain	25.1	25.5	4.9	5.7	5.4	6.9	35.7	36.1	30.2	33.6
Sweden	29.9	32.5	19.7	20.9	27.2	19.4	180.8	143.6	42.0	27.5
Total DCF reported	283.8	316.7	3.2	31.7	-0.5	1.3	21.6	24.0	14.9	18.3
Other non-DCF	70.4	81.0	0.8	8.1						
Total EU	354.2	397.7	4.0	39.8	- 0.5	1.3	21.6	24.0	14.9	18.3

Source: Own elaboration from EU Member States DCF data submission

Figure 40. Main species produced in the EU freshwater farming facilities: 2022.

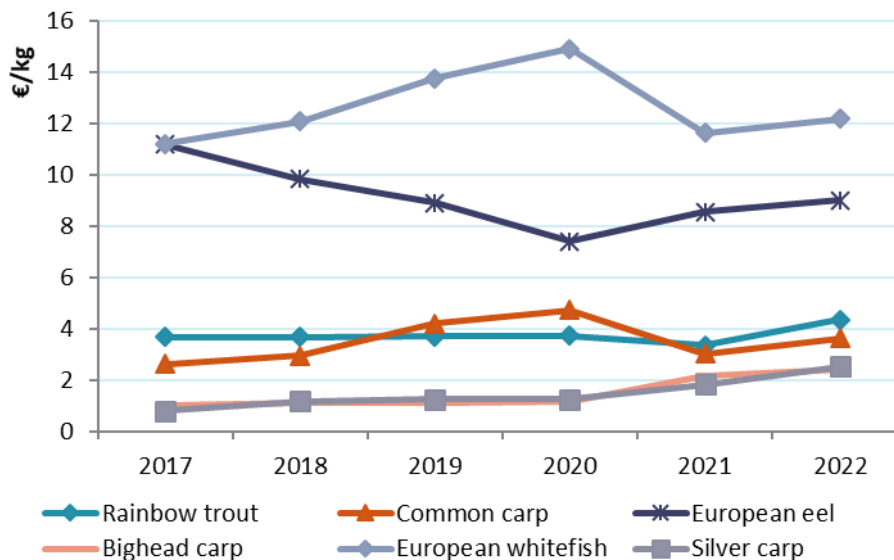


Source: Own elaboration from FAO (2024) data

Rainbow trout is the leading species in the EU freshwater aquaculture sector, accounting for 55% of the total production volume and 56% of the total production value. The common carp follows as the second most significant species, contributing 24% to the volume and 19% to the value of total EU production. European eel, while less dominant, still generates 4% of the total production value (see Figure 40). The farming methods for these species differ significantly. Rainbow trout aquaculture primarily relies on intensive technologies, which involve higher stocking densities, controlled environments, and often more

sophisticated feeding and management practices. In contrast, common carp farming is generally more extensive. This means it uses lower stocking densities and relies more on natural food sources and larger, less controlled environments like ponds. This method is less capital-intensive but can be more susceptible to environmental variations.

Figure 41. Price (€/kg) evolution of the main freshwater species farmed in the EU: 2017-2022.



Source: Own elaboration from EU Member States DCF data submission

3.3.1 Trout

The EU production of rainbow trout reached 190 thousand tonnes in 2021 but decreased to 171 thousand tonnes in 2022. However, production value increased from €717 million in 2021 to €758 million in 2022. The leading EU producers are France and Italy, accounting for 20% and 17% of the total volume and 22% and 12% of the total value, respectively. Denmark, Poland and Spain also hold significant shares of total production, with 16%, 14%, and 12% of the production volume and 14%, 12% and 10% of the sales value. Together, these five countries produce 79% of the total trout volume and 70% of the total production value.

In Europe, most rainbow trout are produced in freshwater and grown to a size between 300-500 grams. The flesh is white, allowing it to compete in the large European whitefish markets. Denmark and Finland also produce rainbow trout in marine cages in the Baltic Sea. Trout raised at sea have red flesh, competing at the salmon market. The sea cage farming of trout is covered under the marine chapter.

Economic performance

In 2022, the number of enterprises engaged in trout production within the EU is estimated to be almost 2100 companies, which was a decline from 2021 of 1%. These enterprises collectively employed almost 8 000 persons, despite a reduction of approximately 400 employees compared to the previous year. Full-time equivalent (FTE) employment in the sector amounted to about 6 171, marking a 2% increase relative to 2021. The freshwater trout sector has a significant component of part-time workers (0.74 ratio between FTE and employment). Significant variation exists in the average wages across countries involved in trout production. Denmark and Finland are leading as the production in these two countries also include sea cage farming. Member states with smaller production volumes tend to exhibit substantial fluctuations in average salaries. In 2022, average wages ranged from €6.5 thousand in Bulgaria to €66.2 thousand in Denmark.

Table 23. Economic indicators for the EU trout aquaculture: 2021-2022.

Country	Number of enterprises		Total sales volume		Turnover		Employment		FTE		Average wage	
	number		thousand tonnes		million €		number		number		thousand €	
	2021	2022	2021	2022	2021	2022	2021	2022	2021	2022	2021	2022
Bulgaria	89	90	4.2	4.1	17.2	19.4	424	439	376	409	5.1	6.5
Croatia	17	19	0.4	0.5	1.5	2.1	90	95	74	72	12.7	15.7
Denmark	62	56	31.0	27.8	105.7	103.1	382	339	302	265	55.5	66.2
Finland	50	49	3.7	4.9	29.7	41.1	269	316	202	263	46.3	47.1
France	291	315	37.2	34.4	160.5	166.7	1763	1506	1124	1146	23.8	22.4
Germany	877	849	10.3	11.0	49.8	60.4	1842	1820	1345	1328	34.9	34.3
Greece	69	70	2.0	2.6	5.9	7.0	201	201	147	148	16.3	18.7
Ireland	8	9	0.5	0.4	1.8	2.2	21	26	18	19	30.1	37.9
Italy	141	141	41.0	29.0	123.9	93.0	695	550				
Poland	118	118	22.7	23.9	59.4	89.6	848	883	649	689	16.2	17.4
Portugal	2	3	0.6	0.3	1.6	0.9	13	27	-	24		19.1
Romania	152	137	2.7	3.1	13.7	15.5	400	419	400	419	15.7	7.6
Spain	82	78	20.5	20.3	74.7	76.5	731	739	600	589	25.0	26.3
Total DCF reported	1,958	1,934	176.8	162.3	645.5	677.6	7,679	7,360	5,236	5,370	26.2	26.0
Other non-DCF	186	164	16.8	13.8	71.0	80.5	728	624	919	801		
Total EU	2,144	2,098	193.5	176.0	716.5	758.0	8,407	7,984	6,155	6,171	26.2	26.0

Source: Own elaboration from EU Member States DCF data submission and FAO (2024) data

The economic performance indicators suggest that the trout sector has improved in terms of gross value added, return on investment, and capital productivity. In 2022, gross value added (GVA) in the sector reached €229 million, reflecting a 1% increase from 2021. However, EBIT declined by 12% to €15.4 million. The increase in return on investment (ROI) to 0.9% signifies a positive shift in capital efficiency, potentially due to optimized resource allocation and asset utilization, despite decreased operating profit.

The decrease in labour productivity (-1%) and average wages (-2%) may be linked to several factors, including the integration of automation and new technologies, which often requires an adjustment period, and the rising costs of raw materials, energy, and transportation. Additionally, inflationary pressures and fiscal policy adjustments have likely impacted real wages, particularly when nominal wage growth has not kept pace with the rising cost of living.

Economic performance across EU Member States varies significantly due to differing sector sizes and the adoption of diverse production techniques, resulting in a broad range of economic performance indicators. An analysis of the economic performance of trout aquaculture from 2017 to 2022 reveals moderate fluctuations in total income, with a notable upward trend beginning in 2020. Total operating costs mirrored this pattern. The ratio of gross value added (GVA) to revenue showed a steady decline from 2017 through 2021, however, increasing in 2022 when it rose to nearly 30%. Net profit followed a similar trajectory, declining by approximately 10 percentage points from 2017 to 2021 before recovering slightly in 2022. This pattern indicates a recovery in sectoral profitability and productivity despite previous challenges.

The cost structure analysis for trout production indicates that feed costs are the most significant expenditure, representing approximately 36% of the total costs. This high proportion means that any fluctuations in feed prices can have a substantial impact on profit margins. Operational expenses account for 15% of the total costs, while wages and salaries constitute 14%. Raw material costs, including livestock expenses, make up 12% of the costs. The overall share of raw materials costs is 48% for trout farms, highlighting the dependency of these inputs. Consequently, price volatility in raw materials can greatly affect overall production costs. To mitigate these risks, strategies such as diversifying suppliers and securing long-term contracts could be beneficial. Furthermore, the imputed value of unpaid labour and the consumption of fixed capital each account for 6% of the total costs. Energy expenses contribute 7%, reflecting the energy-intensive nature of certain production methods.

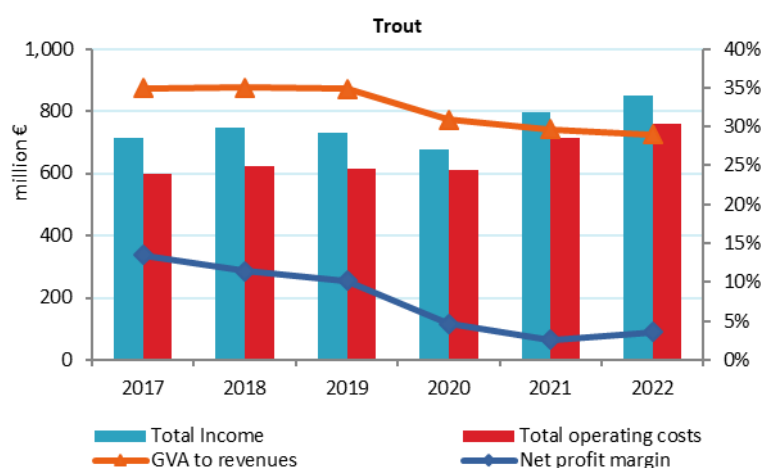
Repair and maintenance costs are relatively low, accounting for 4% of the total costs. The analysis underscores the importance of efficient resource management and cost control in maintaining sustainable and profitable trout production operations.

Table 24. Economic performance indicators for the EU trout aquaculture: 2021-2022.

Country	GVA		EBIT		ROI		Labour productivity		Capital productivity	
	million €		million €		%		thousand €		%	
	2021	2022	2021	2022	2021	2022	2021	2022	2021	2022
Bulgaria	4.1	1.9	0.9	- 2.1	2.8	-7.9	10.8	4.8	25.7	7.0
Croatia	0.1	- 3.5	- 1.5	- 5.4	-11.6	-48.9	1.7	-49.1	1.2	-31.0
Denmark	13.0	14.1	- 8.0	- 8.3	-7.2	-8.3	43.0	53.4	11.0	12.6
Finland	- 0.4	3.3	-13.8	-12.9	-18.4	-13.3	-2.0	12.6	-0.4	3.4
France	65.3	70.7	30.1	36.3	19.5	21.3	58.1	61.7	42.8	43.0
Germany	14.8	14.6	-31.3	-33.4	-11.2	-125.8	11.0	11.0	5.0	53.8
Greece	1.2	1.0	- 2.6	- 2.4	-15.1	-13.7	8.2	6.7	6.6	5.4
Ireland	- 0.1	1.3	- 0.8	0.4	-20.3	8.3	-4.6	71.2	-2.1	27.0
Italy	42.5	40.9	23.1	24.5	14.9	17.8			28.7	31.2
Poland	22.4	36.3	0.3	13.8	0.1	12.6	34.5	52.7	22.0	34.8
Portugal	-	- 0.3	-	- 0.7				-11.3		
Romania	20.4	5.4	14.3	- 0.5	28.9	-1.9	50.9	13.0	42.3	11.7
Spain	22.8	21.8	5.1	4.7	6.5	6.8	38.0	37.0	31.4	34.1
Total DCF reported	206.1	207.6	15.9	14.0	0.6	0.9	31.2	31.0	19.1	25.6
Other non-DCF	21.4	21.3	1.7	1.4						
Total EU	227.6	229.0	17.5	15.4	0.6	0.9	31.2	31.0	19.1	25.6

Source: Own elaboration from EU Member States DCF data submission

Figure 42. Economic performance indicators for trout aquaculture, 2017-2022.

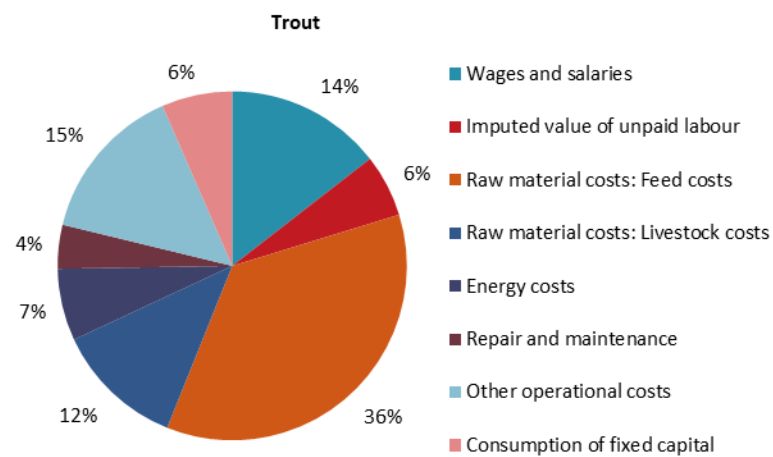


Source: Own elaboration from EU Member States DCF data submission

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 39% of the total costs in the ponds segment, 49% in tanks and race-ways, 42% in recirculation systems and 60% in the cages segment. Other major costs items are wages and salaries and other operational costs. The imputed value of unpaid labour is high for the pond segment with 24% of the total. The highest shares of energy costs are in tanks and raceways and in recirculation systems covering 7% and 8% of total costs. Consumption of fixed capital is quite evenly distributed on all

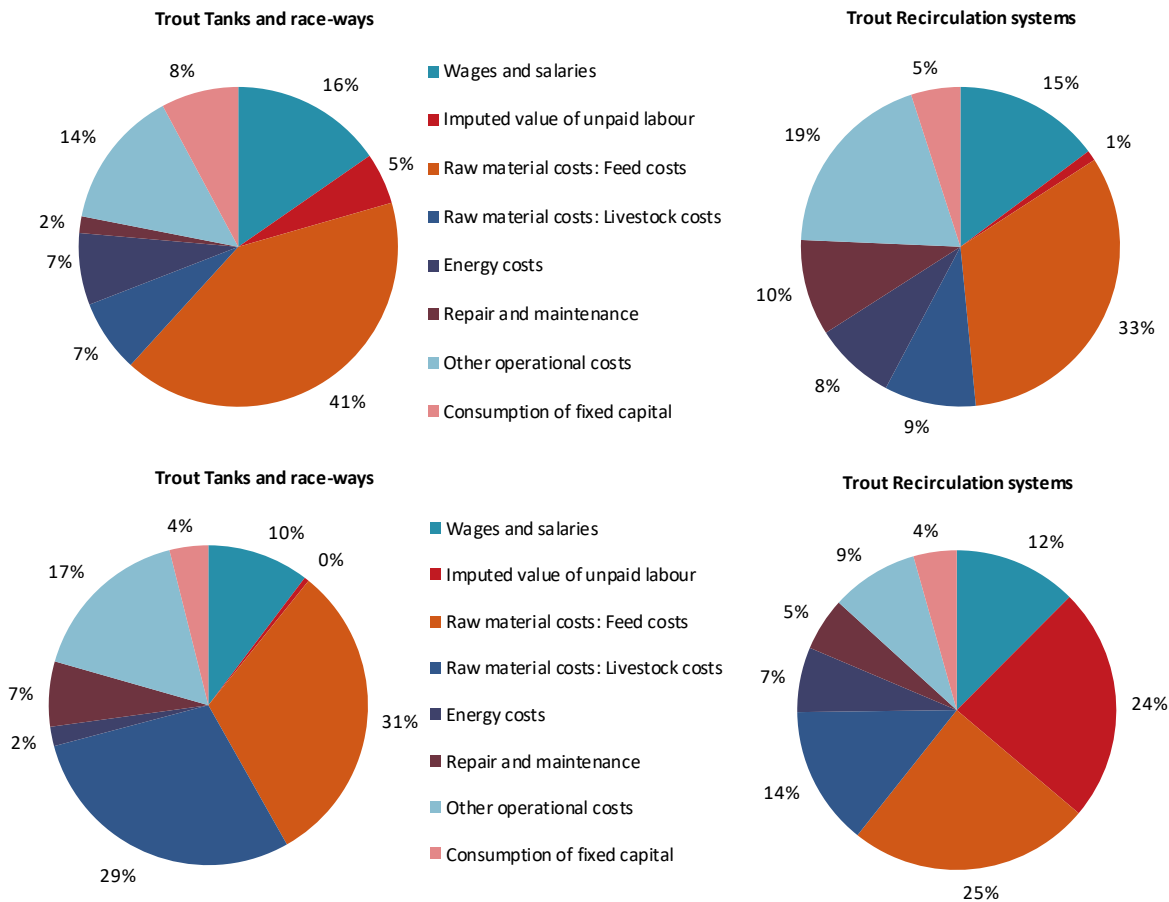
segments, representing 4% to 8% of the total costs. Repair and maintenance costs are higher in recirculating systems, covering 10% of total costs. The share of other operational costs is lowest in the ponds segment with 9% and the highest in trout recirculation systems with 19%. Each segment has its unique challenges and costs that affect the overall cost structure of trout production.

Figure 43. Costs breakdown for the EU trout aquaculture: 2022.



Source: Own elaboration from EU Member States DCF data submission

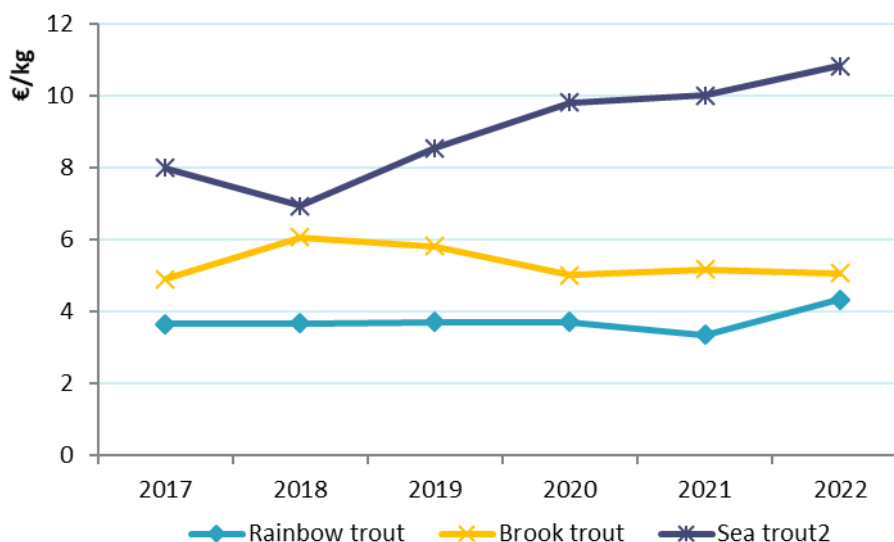
Figure 44. Costs breakdown for the EU trout aquaculture segments: 2022.



Source: Own elaboration from EU Member States DCF data submission

The average price of the main trout species has shown an upward trend from 2017 to 2022. Rainbow trout prices increased by 18% over this period, reaching €4.2 per kg in 2022. Market prices for sea trout have been higher and more volatile than for rainbow trout, starting out around €8 per kilo in 2017 and increasing to almost €11 per kilo in 2022. In most years, Brook trout prices have been quite stable around €5 per kg.

Figure 45. Price evolution of the main species of trout group: 2017-2022.



Source: Own elaboration from EU Member States DCF data submission

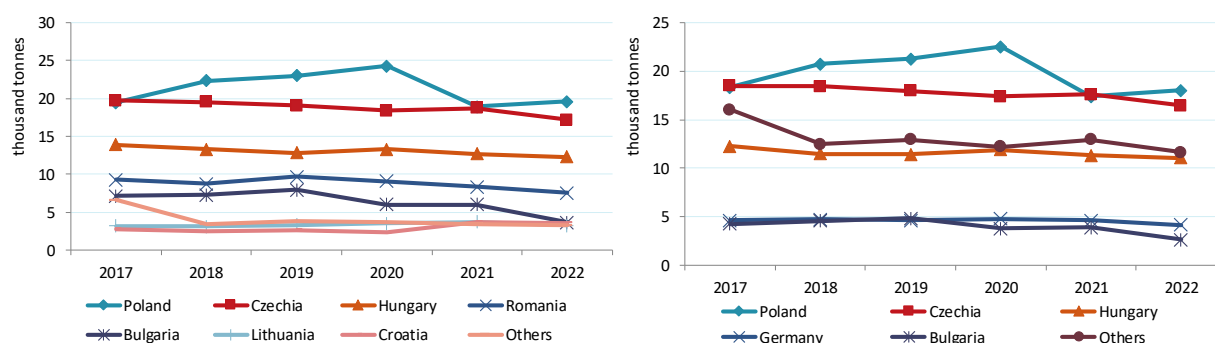
3.3.2 Carp

The common carp (*Cyprinus carpio*) is the most important cyprinid species in the EU by volume and value, representing about 85% of all the EU carp production. A long-term (2008-2022) analysis of production volumes indicates that average annual production has stabilised in Europe at around 65 000 tonnes (FAO 2024). Trends in carp production vary from country to country. In some countries (France and Germany) production is declining, while others have a stable production (Poland, the Czech Republic, Hungary and others).

In 2022, the production of common carp amounted to 63.8 thousand tonnes. Ten EU countries produced more than 500 tonnes of carp annually, and six production more than 2 000 tonnes. The two countries with the highest production volume, Poland and the Czech Republic, account for 54% of the EU's carp production. In Poland and the Czech Republic, the average production for the years 2021-2022 was 5% lower than the average of the previous decade. Hungary, Bulgaria, Lithuania, and Croatia recorded increases compared to the previous decade (ranging from 4% to 14%), while a significant decline were observed in Germany and Romania (20% and 17%, respectively).

Carp production is low-intensity and is predominantly carried out in earthen ponds. A significant portion of carp production takes place in polyculture systems (this is typically multi-trophic production simultaneously farming different herbivorous species, such as grass carp, omnivorous species, such as common carp, and predatory fish, such as pike-perch). The different species have a diverse natural food base, which is utilised in the multi-trophic system. Earthen ponds are usually multifunctional, serving not only a production role but also providing important social and environmental functions (in the latter case, these include water retention, hydrodynamic regulation, influencing the local microclimate, and maintaining biodiversity). A significant portion of carp pond areas is located in protected zones, including the Natura 2000 network.

Figure 46. Quantities of car species (left) and common carp (right) by main producers in EU: 2017-2022.



Source: Own elaboration from FAO (2024) data

The relative stability of carp markets in Central Europe is linked to the specific role of carp as a traditional Christmas Eve dish, particularly in Catholic countries. However, carp producers face numerous challenges, primarily related to market issues (increasing competition from other global species, which hampers new positioning of carp as a fish for year-round consumption; reluctance from some younger consumers towards this fish; and consumer convenience due to numerous bones). There are also production challenges, such as limited water resources in spring due to droughts; excessively high temperatures in summer leading to oxygen deficits; the lack of winter ice cover, which results in higher carp metabolism during winter and weight loss; and high pressure from fish-eating animals, especially the overgrown cormorant population. In many EU countries, the response to market challenges has been to focus processing efforts on higher value-added carp products that are more convenient (e.g. carp fillets and cuts, packaged in MAP). In some countries (such as Poland), recognised producer organisations take on the responsibility of market creation by running promotional campaigns in mass media.

Despite the market problems, the carp sector has high capacity reserves thanks to the fact that current production is low-intensity. This results in the possibility to increase production without significant investment while maintaining environmental values. However, the condition for maintaining the aquaculture potential of this sector is the economic health of the farms.

Economic Performance

Under the EU-MAP data collection, more member states have provided data for the freshwater aquaculture sector, which have improved the data coverage especially for landlocked countries, which are also the main carp producing countries. Based on the submitted information, it is possible to analyse 8 countries, which are included in Table 25. In 2022, the total EU aquaculture sector consisted of 4 100 registered enterprises, with a total sales volume of 110 thousand tonnes according to the reported EU-MAP and FAO data.

The majority of the enterprises were situated in Germany, Poland and Bulgaria. In 2022, the carp segment employed 14 783 people corresponding to 9 223 FTEs (Table 25). Total turnover was almost €260 million.

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. Therefore, the situation for the EU carp production is presented as one aggregated segment. According to the data reported the average wage in the segment was €13.8 thousand in 2022, which is decreased of 9% compared to 2021 (€15.1 thousand).

In terms of economic indicators, the GVA, EBIT, and Labour productivity generated by the EU carp aquaculture sector in 2022 was €116.7 million, €16.9 million, and €12.2 thousand, respectively. ROI and Capital productivity achieved 1.7% and 11.6% in the same year. All of the indicators increased in 2022

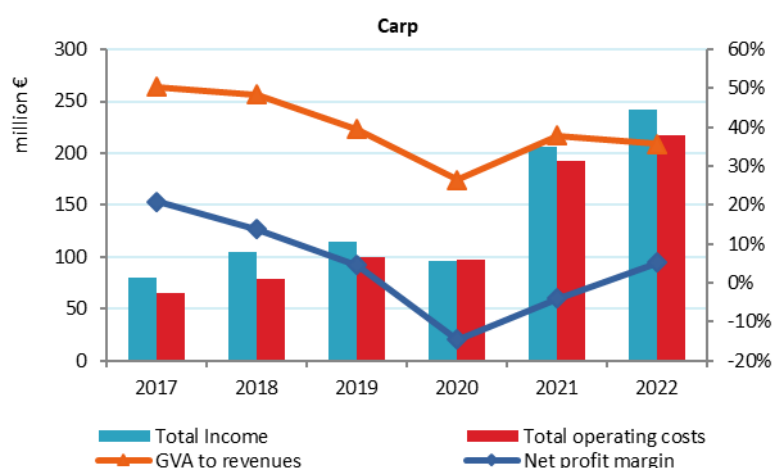
compared to 2021, with the exception of labour productivity. Labour productivity increased from €9.1 in 2021 to €12.2 in 2022, which correspond to a 34% increase.

Table 25. Economic indicators for the EU cyprinids aquaculture: 2021-2022.

Country	Number of enterprises		Total sales volume		Turnover		Employment		FTE		Average wage	
	number		thousand tonnes		million €		number		number		thousand €	
	2021	2022	2021	2022	2021	2022	2021	2022	2021	2022	2021	2022
Bulgaria	611	558	5.7	3.6	12.2	9.5	882	872	660	639	3.3	5.3
Croatia	12	13	3.8	3.8	8.0	9.0	375	428	270	281	11.7	10.5
Czechia	480	440	23.5	24.1	47.5	66.3	2,180	2,463	671	808	22.7	27.4
Germany	1,496	1,425	5.5	4.7	16.2	15.9	2,834	3,014	1,277	1,493	17.6	14.8
Hungary	189		11.3		25.2		1,245		763		10.9	
Poland	894	894	22.7	23.0	60.4	102.3	4,300	4,323	3,195	3,199	15.0	16.5
Romania	325	319	8.3	44.6	31.4	32.6	1,800	1,465	400	1,465	25.9	4.2
Spain	21	22	0.1	0.1	0.1	0.1	108	108	35	37	0.5	2.5
Total DCF reported	4,028	3,671	80.9	103.8	201.2	235.8	13,724	12,673	7,271	7,921	15.1	13.8
Other none DCF	355	429	7.1	6.4	22.3	23.7	1,211	2,109	642	1,302		
Total EU	4,383	4,100	88.1	110.3	223.5	259.6	14,935	14,783	7,913	9,223	15.1	13.8

Source: Own elaboration from EU Member States DCF data submission and FAO (2024) data

Figure 47. Economic performance indicators for carp aquaculture: 2017-2022.



Source: Own elaboration from EU Member States DCF data submission

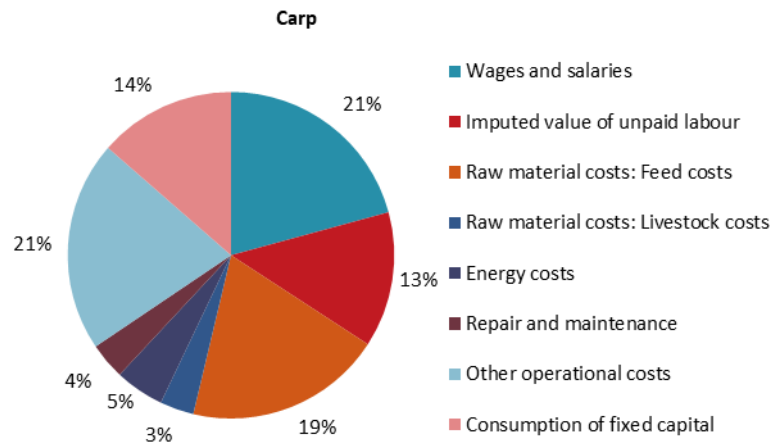
Table 26. Economic performance indicators for the EU cyprinids aquaculture: 2021-2022.

Country	GVA		EBIT		ROI		Labour productivity		Capital productivity	
	million €		million €		%		thousand €		%	
	2021	2022	2021	2022	2021	2022	2021	2022	2021	2022
Bulgaria	6.5	1.8	3.7	5.7	33.7	-26.7	9.8	-2.8	57.3	-7.3
Croatia	9.6	8.1	8.9	8.8	7.9	6.4	35.7	28.9	9.3	6.1
Czechia	8.7	9.2	-12.8	-9.2	-16.3	-16.6	6.8	6.1	11.0	15.9
Poland	29.0	51.4	-11.6	7.7	-2.3	1.8	9.1	16.1	6.4	11.1
Romania	24.0	19.6	1.8	11.0	1.4	17.0	60.1	13.4	11.4	28.2
Spain	0.0	0.1	0.0	0.0			0.8	1.9		
Total DCF reported	77.9	86.6	-10.0	12.5	-1.0	1.7	13.3	12.2	9.1	11.6
Other non-DCF	33.1	30.1	-4.3	4.3						
Total EU	111.0	116.7	-14.3	16.9	-1.0	1.7	13.3	12.2	9.1	11.6

Source: Own elaboration from EU Member States DCF data submission

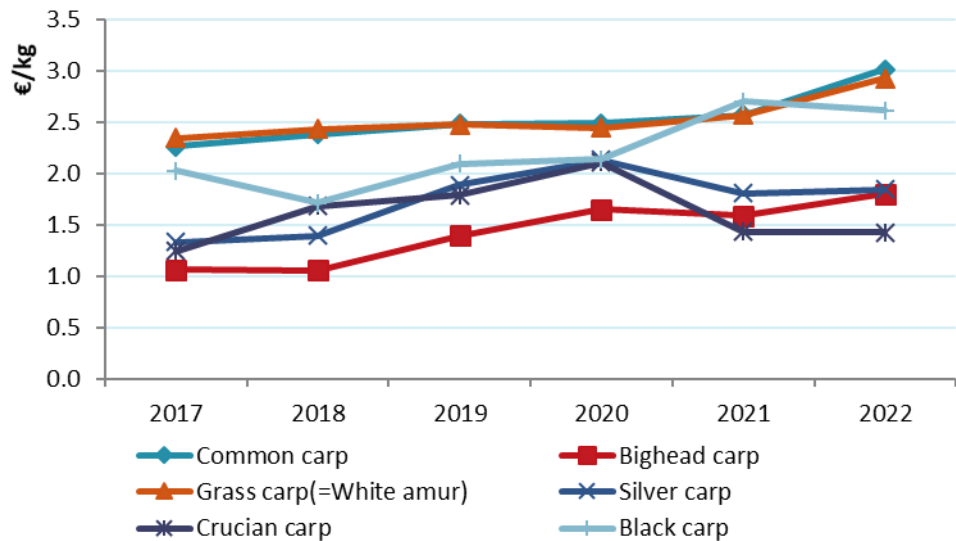
The cost breakdown for carp production reveals that wages and salaries represent 21% and imputed value of unpaid labour accounted for 13% of the total costs. Other operational costs covered 21%, whereas feed costs made up 19%. Consumption of fixed capital covered 14%, energy costs contributed with 5%, and repair and maintenance costs stand at 4%. Livestock-related expenses represent the smallest share, at 3%. This indicates that labour costs, other operational expenses and feed, dominate the cost structure in carp production.

Figure 48. Costs breakdown for the EU carp aquaculture: 2022.



Source: Own elaboration from EU Member States DCF data submission

Figure 49. Price evolution of the main species of carp group: 2017-2022.



Source: Own elaboration from FAO (2024) data

From 2017 to 2022, the price evolution of various carp species in euros per kilogram shows distinct patterns (Figure 49). Common carp experienced a steady increase, rising from €2.3 in 2017 to €3.0 in 2022, reflecting gradual price growth. Bighead carp, which started at €1.1, saw a more pronounced rise, especially between 2018 and 2020, reaching €1.8 by 2022. Grass carp followed a similar trajectory, growing from €2.3 to €2.9, with only a slight dip in 2020. Silver carp's prices increased significantly between 2017 and 2019, from €1.3 to €2.1, but remained stable at €1.8 from 2020 onwards. Crucian carp showed volatility, rising sharply from €1.2 in 2017 to €2.1 in 2020, and then dropping to €1.4 by 2022. The category "Silver, bighead carps nei" showed modest fluctuations, with prices stabilizing around €1.1 by 2022. Black carp exhibited a somewhat erratic pattern, with prices increasing from €2.0

to €2.7 by 2021 before settling slightly lower at €2.6 in 2022. Overall, the trends indicate growth in prices for most species of carp.

In 2022, the global price for common carp was around €2.0/kg according to FAO data. This aligns with trends in Europe, where prices have been consistently higher, largely due to differences in consumer income and demand between Europe and Asia. European consumers typically pay significantly more for common carp, reflecting not just purchasing power but also the higher costs associated with farming practices, regulations, and market preferences. Asian markets often include lower-value species such as bighead and silver carp in their broader carp pricing, contributing to the price gap.

3.3.3 European eel

Worldwide China is the largest producer of cultivated Japanese eel. For the European eel (*Anguilla Anguilla*) there is hardly any production outside the EU. Only in Morocco with a production of 350 tonnes in 2022 (FAO, 2024). Most of the production of European eel comes from aquaculture, as only around 3 100 tonnes were originating from captured fisheries in 2022 (FAO, 2024).

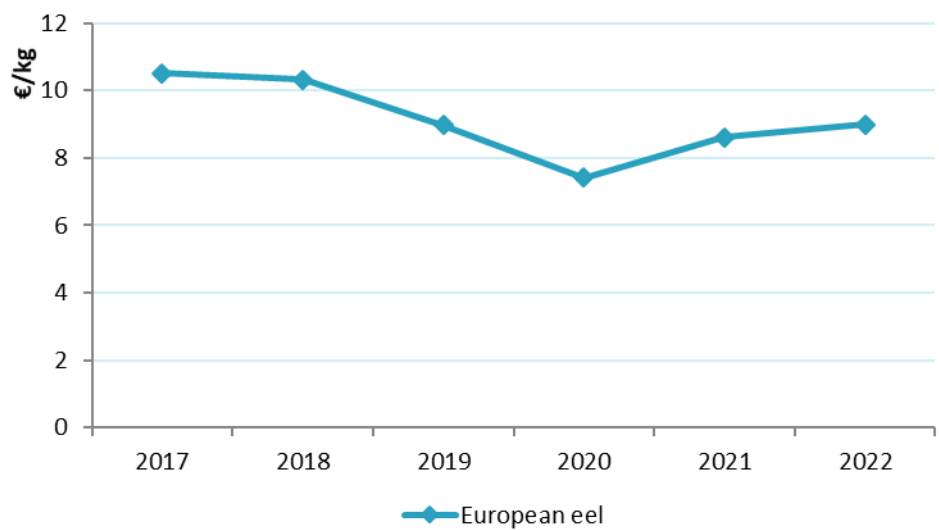
Eel is subject to recovery measures due to the vulnerable state of the stock. At EU level, this is defined in Council Regulation (EC) No 1100/2007, which state that EU countries should elaborate Eel Management Plans in order to allow 40% of adult eels to escape from inland waters to the sea, where they can spawn. There are also temporary fishing closures set at EU level. According to the scientific advice, the status of the European eel remains critical (EUMOFA, 2021). Despite extensive lab experiments, the eel cannot be breed in captivity yet. It remains a mystery how European eel reproduce and how to control the entire life cycle from breeding egg to mature eel.

The European eel is a catadromous and carnivorous species. Young eels live in freshwater, where they stay for a period of 6-12 years for males and 9-18 years for females. As the eels become sexually mature, they migrate to the sea, where they move to the spawning grounds in the Sargasso Sea. During migration, the eels do not feed. Once in the Sargasso Sea the eels spawn in late winter and spring. Adult eels do not leave the Sargasso Sea but their progeny, the leaf-shaped larvae (leptocephali) are brought to the continental shelf of Europe by the Gulf Stream, a journey that takes 200-300 days.

Before entering coastal zones and estuaries, the larvae metamorphose into transparent eels (glass eels). European eel production is based on the import of glass eels from France, Portugal, Spain and the United Kingdom. Eels are normally sold at two size ranges for smoking; either at 120-180 g, which is the normal Dutch smoking size, or at 300-600 g (large smoking size) in Germany. A smaller amount is fried or jellied or stewed. More specialised processed products include the Japanese specialty "kabayaki" [a style of serving, in which eels of around 150-200 g are butterflied, placed on skewers, basted and marinated in a thick soy-based sauce, and steamed or grilled; over 90 percent of all global production of eels (all *Anguilla spp.*) is destined for this form of consumption (FAO, 2009).

European eel is produced in RAS (Recirculated Aquaculture Systems), tanks or raceways. The EU production has varied between 4 800 tonnes in 2022 and 6 800 tonnes in 2008 (FAO, 2024). The largest producer countries were Netherlands (42%) and Germany (24%) in terms of produced live weight in 2022. Remaining countries producing eel were Denmark (9%), Italy (9%), Greece (8%) and Spain (7%) of the total live weight produced. From 2021 to 2022, the production decreased with 13% (live weight). In terms of sales value the six EU MS are similar but with a different ranking: Germany (35%), Netherlands (34%), Italy (11%), Denmark (8%), Spain (8%) and Greece (5%) in 2022. Germany has the highest sales value due to a higher sales price per kilogram. Total sales value was differing within this period (2008-2022) between €50.2 million (2022) and €62.0 million (2017). The average sales price per kilogram of eel was on average €10.1 for 2018-2022 (Figure 50). The average price increased on average last 15 years from €7.55 in 2008 to €10.51 in 2022. Higher prices are not explained by decreased production volumes, but rather by higher costs with a higher willingness to pay by consumers. It should be mentioned that eel is perceived as a luxury product by consumers with a higher sales price per kilogram than most other fresh water aquaculture species.

Figure 50. Average sales price (in €/Kg) of farmed European eel in the EU: 2022.

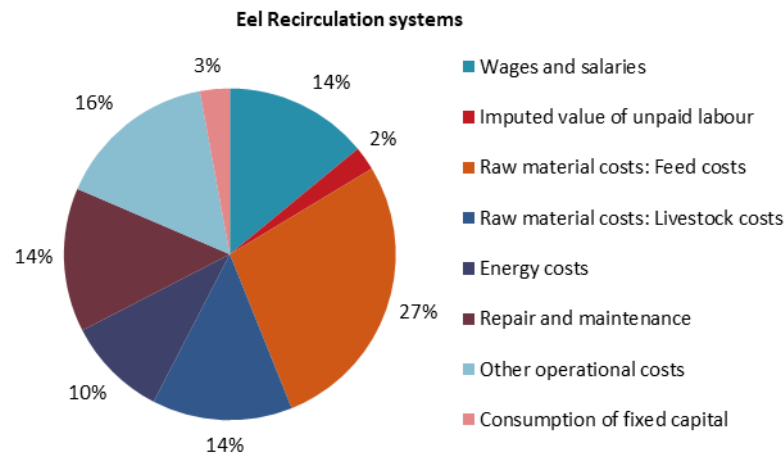


Source: own elaboration from FAO (2024) data.

Under the EU-map data collection, only data for Denmark was provided. Thus, no tables or figures concerning economic indicators can be provided. The data submitted to EU-MAP by Denmark illustrates the division of costs for RAS production of European eel (Figure 51). Precaution is needed with this division of costs as only Danish data was collected. Furthermore, the costs are based on recirculation system (RAS), but not for tank or raceways. Therefore, the numbers should not be automatically be applied to other MS or other land based aquaculture systems.

The highest costs share in percentage are for feed (37%) in 2022. Most other costs are equally important: Other operational costs (16%), wages and salaries (14%), livestock costs (14%), repair and maintenance (14%) and energy costs (10%). Energy costs increased by 78% in 2022 compared to 2021 due higher energy prices to the Ukraine war.

Figure 51. Costs for recirculation systems of European eel in Denmark: 2022.



Source: Own elaboration from EU Member States DCF data submission

3.4 Algae aquaculture

3.4.1 General overview

In coastal European countries, there has been a well-established and long-lasting utilisation of macroalgae resources mainly derived from wild harvesting activities in the intertidal and sub-tidal zones. These macroalga resources have been utilised by coastal communities and enterprises for food, feed, and fertilisers for centuries.

Predominately the greatest number of macroalgae enterprises in Europe are involved in the wild harvesting activities and processing of which accounts for 68% of all 153 enterprises. The remaining 32% are involved directly in the production of macroalgae species through aquaculture (Vazquez Calderon & Sanchez Lopez 2022; Araújo et. al., 2021)

Aquaculture production of macroalgae can be carried out in land-based tank systems (20%), coastal and offshore environments (68%) utilising substrates and culture materials such as nets, ropes, and rafts. 12% of enterprises identified the aquaculture production model was not fully described (Vazquez Calderon & Sanchez Lopez 2022, Camarena-Gómez et al., 2022). The main countries involved in aquaculture production of macroalgae within Europe and including the EEA are France, Denmark, Ireland, Norway, Iceland and Germany. The total production contribution is estimated at 1% of the total European macroalgal biomass, the remaining 99% of the biomass is derived from wild harvesting (Camarena-Gómez et al., 2022, Araújo et. al., 2021).

The current value chain of production for macroalgae is varied and diverse and the number of biobased value-added products is extensive. The majority of wild harvested and aquaculture production species provide valorised products and compounds to the food, feed and fertiliser sectors. There is also a large emphasis on circularity and the further valorisation of side streams and extraction of novel bioactive compounds for the pharmaceutical and nutraceutical industries. Research projects are ongoing throughout Europe linking the green and blue economies with the development of bio-stimulant production from macroalgae for the agricultural and horticultural sectors, thus reducing the need for high cost chemically derived fertilisers.

The macroalgae industry is a growing and expanding industry in Europe with significant advances being made by research projects (AquaVitae H2020, SeaSoil BlueBio, and SeaMark Horizon Europe) with key exploitable results being implemented by companies. The EU4Algae forum has been developed as a resource for producers and researchers to utilise an EU wide platform to allow for rapid transfer of innovation to implementation.

Macroalgae is defined as a low trophic extractive species (Slater & James, 2023) and its cultivation is providing positive ecosystem services that promotes and sustains employment in rural and peripheral areas. There are opportunities for the integration of macroalgae cultivation into already existing aquaculture production models (monoculture, polyculture and integrated multitrophic aquaculture (IMTA)).

As opposed to the majority of macroalgae production, microalgae and Spirulina production methods are land-based, including photobioreactors (71%), ponds (19%) and fermenters (10%) (Kuech et al., 2023).

3.4.2 EU algae aquaculture production overview

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, lacking consistent reporting per segment and of low quality for most of the MS.

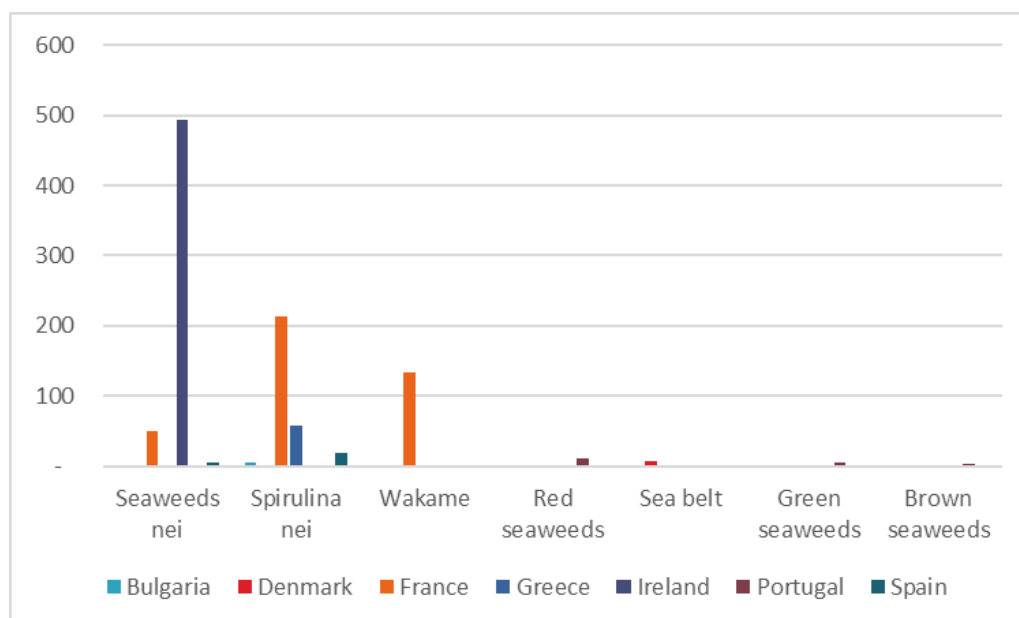
According to the FAO data 2022, a total of 1 000 tonnes of macro- and microalgae are reported at the EU level with Ireland and France leading the production and accounting for 49% and 40% of the total biomass produced, respectively (Figure 52 & Figure 53).

Figure 52. Main microalgae and macroalgae species produced by weight and value: 2022.



Source: Own elaboration from FAO (2024) data

Figure 53. Main microalgae and macroalgae EU producing countries: 2022.

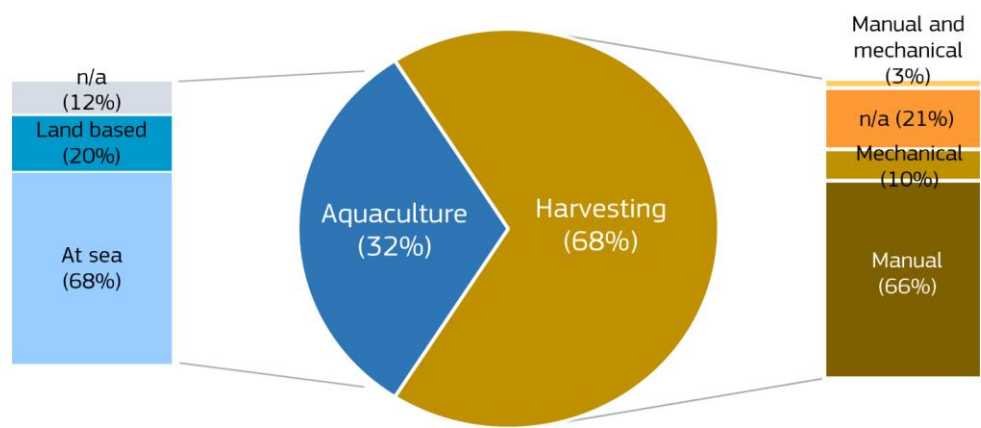


Source: Own elaboration from FAO (2024) data

The majority of macroalgae produced is derived from wild harvesting (68%). The remaining biomass is derived from aquaculture, of which 68% of that material is produced at sea.

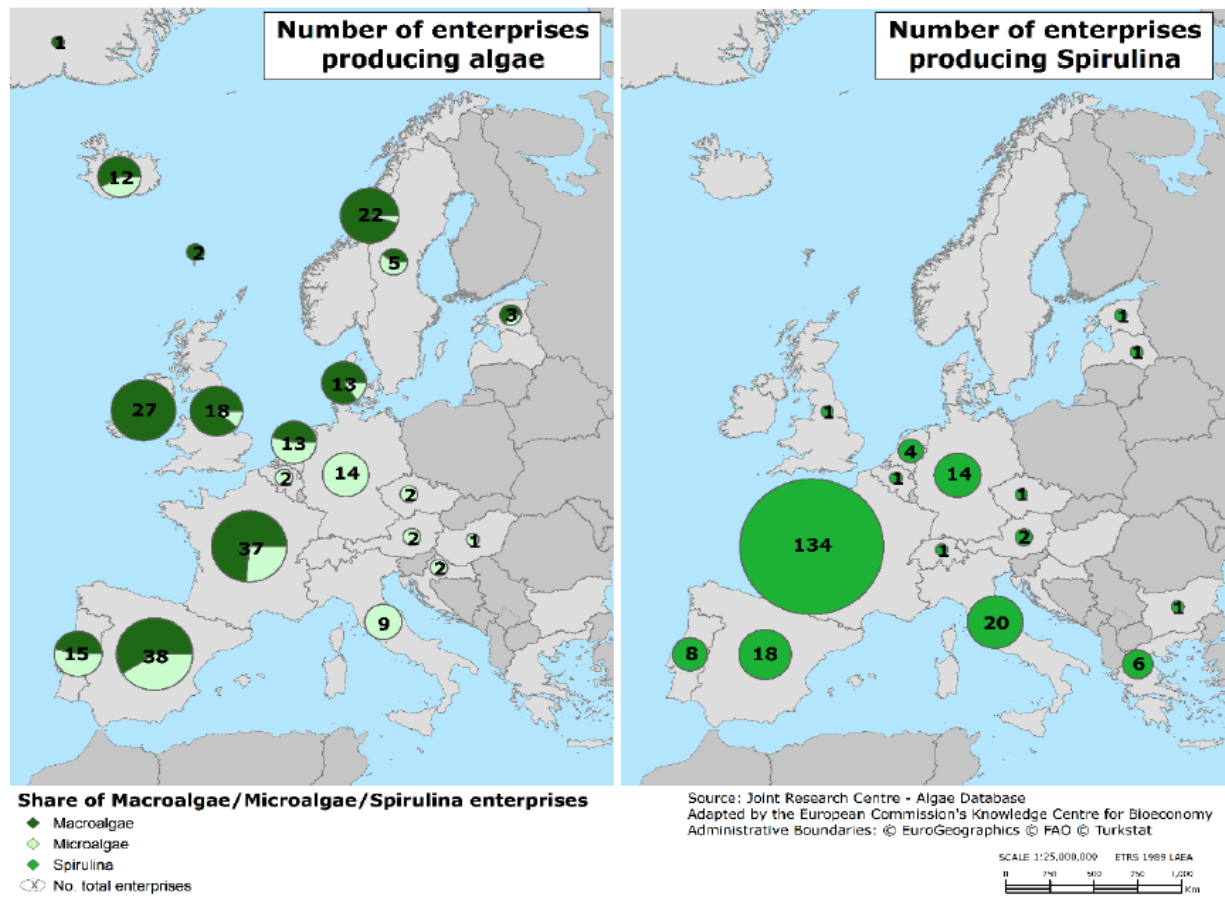
A mapping exercise carried out by Vazquez Calderon & Sanchez Lopez (2022) gives an overview by country (23 countries & 19 member states). The number of companies that produce microalgae, or *Spirulina* Spp. far outweighs the number producing or processing macroalgae. France is the country with the largest number of enterprises (171) involved in algae production, mainly due to the large number of *Spirulina* producing enterprises. The countries that follow with more than 20 macroalgae producing enterprises are Spain, Ireland, Norway, and Italy (Figure 55). Macroalgae cultivation in Spain, the valorisation of macroalgae to obtain high-value phycocolloids (alginates, agar and carrageenans) and as an agricultural fertilizer is a traditional practice on the northern coast. Although most macroalgae are harvested naturally, there are initiatives for their cultivation. These aquaculture initiatives produce high value-added species, such as *Saccharina latissima*, *Ulva* spp., and *Gracilaria* spp.

Figure 54. Breakdown of production of macroalgae by production system.



Source: Vazquez Calderon & Sanchez Lopez (2022)

Figure 55. Number and type of macroalgae and microalgae production along with the Spirulina Spp. production in relation to the country of operation. It does not consider shellfish hatcheries that produce microalgae for feeding shellfish.



Source: Vazquez Calderon & Sanchez Lopez (2022)

3.4.3 Structure of the EU macroalgae supply chain

The macroalgae value chain is evolving rapidly, driven by environmental sustainability goals, policies promoting the blue economy, and the growing demand for bio-based and natural products. Europe has a long history of utilising macroalgae; however, the EU is currently seeking to scale up macroalgae production and innovation, positioning EU enterprises in global sustainable industries. The key areas of advancement along the value chain are as follows:

Cultivation and harvesting: begins at the hatchery where seedlings and juveniles are cultured for further on-growing at land-based nurseries or on-growing units that rely on vegetative growth to increase the biomass yield. Seeded line can be produced in the hatchery for transfer and on-growing at inshore and offshore farm sites.

Post-harvest and handling: Strict safety regulations for post-harvest handling of macroalgae, particularly in food and pharmaceutical sectors. Macroalgae is thoroughly washed, dried, and certified organic, attracting European producers. Processing hubs like Brittany, Galicia, and Western Ireland transport, dry, and process fresh macroalgae into various products.

Primary processing: Enterprises within the EU are major producers of hydrocolloids, primarily extracted from red and brown macroalgae, are important components in the food, cosmetics, and pharmaceutical industries. Spain, along with France and Portugal, exports these hydrocolloids. European companies also extract high-value bioactive compounds, including antioxidants, proteins, and minerals, for use in nutraceuticals and healthcare products.

Secondary processing: Food Industries are experiencing increasing demand for seaweed as a food-first products, particularly in functional foods, dietary supplements, and plant-based proteins, pharmaceuticals and healthcare macroalgae-derived substances like fucoidan and laminarin are increasingly used in European health supplements and pharmaceuticals. Macroalgae-based fertilisers, soil enhancers, soil amendments and bio-stimulants are widely used in European agriculture. These products help improve soil quality and soil health, increase plant resilience, and contribute to organic farming practices. Countries like Ireland are leading the development of macroalgae-based animal feed.

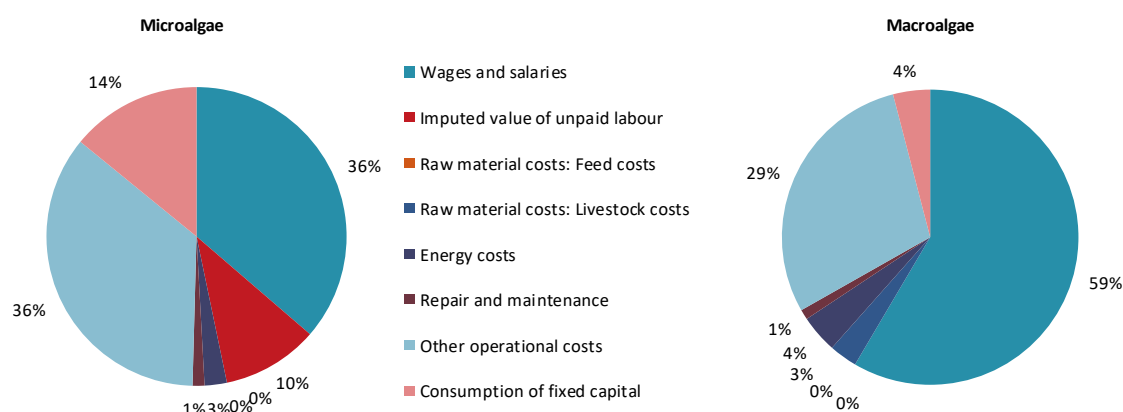
Distribution and Marketing: European Blue Economy Strategy, promotes sustainable marine resource use and macroalgae products are introduced into the market under the new Novel Food Regulation ((EC) 2015/2283), ensuring food safety and compliance with European standards. The EU has established logistics and distribution networks for seaweed products, facilitating movement from cultivation to processing facilities. European seaweed products often carry organic certifications promoting sustainability in markets (Lähteenmäki-Uutela et al., 2021).

3.4.4 Socio-economic data reported under DCF

The fragmented nature of the data provided under the data call makes it difficult to defining the current production of algal biomass in Europe. Vazquez Calderon & Sanchez Lopez (2022) have identified 413 enterprises located in 24 European countries including 20 MS from the EU-27, but also includes the Faroe Islands, Greenland, Iceland, Norway, Switzerland and the UK. Taking this into account, the largest number of enterprises per country are France (169), Spain (47), Ireland (27), Norway (22) and Italy (21). Algae production (both micro and macro algae) has the potential to be a significant employment driver in rural and peripheral areas along with the creation of employment along the value chain in primary and secondary processing.

Wages and salaries are the main operational costs for both micro and macroalgae production at 36% and 59%, respectively.

Figure 56. Overview of the microalgae and macroalgae production cost in 2022.



Source: Own elaboration from EU Member States DCF data submission

3.4.5 Microalgae overview

The scale and extent of enterprises producing microalgae (mainly *Spirulina spp.*) are well documented across member states and the value chain is well defined. In Spain there are companies dedicated to the commercial production of microalgae, with facilities with a high level of digitalisation and a strong focus on research, development and innovation. The microalgae cultured are destined for human nutrition, animal feed, biofuels and cosmetics. In 2022, Andalusia produced approximately 1.2 tonnes of microalgae, mainly *Nannochloropsis gaditana*, *Tetraselmis chuii*, *Isochrysis galbana* and *Phaeodactylum tricornutum* species. In addition, microalgae cultivation is common in fish, mollusk and crustacean hatcheries to feed the larval stages.

The Italian microalgae culture sector is growing, with a strong focus on *Spirulina*. The Unione Spirulina Biologica Italiana (USBi) organises producers with a focus on product quality and innovation. The microalgae are grown in six facilities using greenhouse tanks and are carefully monitored. Harvested at optimum cell concentration, they are dried at low temperatures to preserve nutrients and avoid the denaturing of important components. Daily production cycle minimises spoilage and uses renewable energy for an environmentally friendly process. Italian *Spirulina* is available in a variety of forms, particularly nutrient-rich filaments.

A feasibility analysis³ of *Spirulina* cultivation in Italy highlights key economic indicators:

- Turnover:
 - Small-scale farm (100 kg/year): €10 000 - €20 000.
 - Medium-scale farm (500 kg/year): €50 000 - €100 000.
 - Large-scale farm (1 000+ kg/year): €200 000+.
- Profitability:
 - Net profit margin ranges from 30% to 50%, depending on efficient management of energy, labour, and nutrient costs.
- Market Price:
 - Dried *Spirulina* sells for €100 - €200 per kg, varying by quality and market.

The profitability of a *Spirulina* farm is influenced by production costs, sales prices, and operational efficiency. Typically, the net profit margin ranges between 30% and 50%, depending on effective management of operational costs, such as energy, labour, and cultivation materials (e.g., nutrients). The selling price of dried *Spirulina* generally ranges from €100 to €200 per kg, depending on quality and

³ <https://www.bsness.com/bp-blog/quanto-guadagna-una-coltivazione-spirulina/> (Last accessed: 23/10/2024).

market demand. These figures provide a basis for understanding the economic potential of *Spirulina* cultivation in Italy and the EU.

3.4.6 Outlook

Challenges along the EU macroalgae value chain are seen at a policy, regulatory and industry level. There are still regulatory hurdles despite progress, related to the approval of seaweed products as novel foods or pharmaceuticals. Enterprises must navigate complex EU regulations to introduce new seaweed-based products. The EU's macroalgae industry is fragmented, with some regions lacking infrastructure for large-scale cultivation, processing, and distribution. However, co-location of sites and facilities may resolve these issues. Cultivation costs of macroalgae can be expensive particularly in Nordic regions, and high labour costs can limit the competitiveness of EU producers compared to other markets.

Within Europe, there are significant opportunities for the industry and producers due to the extensive policy driven supports, such as the EU's Green Deal and Biodiversity Strategy, which provide a significant opportunity for the macroalgae industry. Macroalgae cultivation aligns with the EU's goals of developing sustainable food systems, reducing reliance on fossil fuels, and protecting marine environments. The EU is investing in the blue bioeconomy, which includes macroalgae as a key sustainable resource. Thus, Horizon Europe provide funding for research and innovation, cultivation and bioproducts development. Macroalgae farming in the EU is being explored as a solution for carbon capture and sequestration, contributing to the region's climate goals by removing CO₂ from the atmosphere and oceans as part of a broader movement towards a sustainable and bio-based economy. With increasing investment in research, regulatory alignment, and demand for sustainable products, macroalgae is poised to become an essential resource for multiple industries in Europe.

With the expansion of aquaculture production into the offshore environment and the co-location of macroalgae farms and offshore wind (North Sea Farms Project) brings macroalgae farming into new and challenging and dynamic environments. The land based and the inshore production part of the value chain is well defined from the hatchery with the commercial production of seedlings that along with the inshore production model on longlines. The industry has been the leading innovator in this sector through the application of research and innovation activities independently or through different EU programmes.

A recent study by Macias et al. (2025) reveals that the EU Atlantic regions are the most suitable areas for macroalgae cultivation, particularly for cold and intermediate-water seaweed species. The potential cultivation area is extensive, spanning over 1 million km², and even taking a precautionary approach of only occupying 1% of that area, it could yield a yearly production of over 30 million tonnes dry weight. Adding further technical and logistical constraints (e.g. water depth and distance to coast) would limit the estimates of the potential macroalgae production to 5 million tonnes per year in EU member states' waters.

4 NATIONAL CHAPTERS

4.1 Austria

Overview of Austrian aquaculture

Austria's aquaculture sector is relatively small but diverse, focusing primarily on freshwater species. The main types of fish produced include rainbow trout, brook trout, brown trout, Arctic char, and common carp. The production methods used are pond farming, flow-through systems, and recirculating aquaculture systems (RAS). The sector consists of around 542 farms, many of which focus on direct marketing to local restaurants and hotels. There is also a growing trend towards producing convenience products, such as filleted fish⁴.

Austria utilizes various farming methods, including pond farming (covering 1 804 hectares), flow-through systems (296 601 cubic meters), and recirculating aquaculture systems (3 900 square meters)⁵.

Total Production and sales

Between 2017 and 2021, Austria experienced a steady increase in aquaculture production and sales. However, in 2022, this trend reversed, with production declining. Projections indicate that this downward trend may persist in the coming years.

In 2022, Austria produced approximately 4 718 tonnes of fish for human consumption, resulting in an estimated production value of €32.8 million. In contrast, the production volume in 2021 reached about 4 920 tonnes, with a market value of approximately €34.3 million.

The production of fish eggs was around 17.27 million pieces, and juvenile fish production reached about 30.59 million pieces in 2022⁶.

Table 27. Production and sales for Austria: 2017-2022.

Variable	2017	2018	2019	2020	2021	2022	Change 2021-22	Develop. 2022/(17-21)
Production weight (thousand tonnes)	3.9	4.0	4.3	4.5	4.9	4.7	-4%	9%
Marine	0	0	0	0	0	0		
Shellfish	0.0	0.0	0.0	0.0	0.0	0.0	-49%	72%
Freshwater	3.9	4.0	4.3	4.5	4.9	4.7	-4%	9%
Production value (million €)	25.3	26.4	29.8	30.7	34.3	32.8	-4%	12%
Marine	0	0	0	0	0	0		
Shellfish	0.0	0.0	0.1	0.4	1.3	0.6	-50%	71%
Freshwater	25.3	26.4	29.6	30.3	33.0	32.1	-3%	11%

Source: FAO (2024)

Main species produced

The main species produced in Austria include salmonids (such as trout and char), cyprinids (such as carp), and other freshwater species.

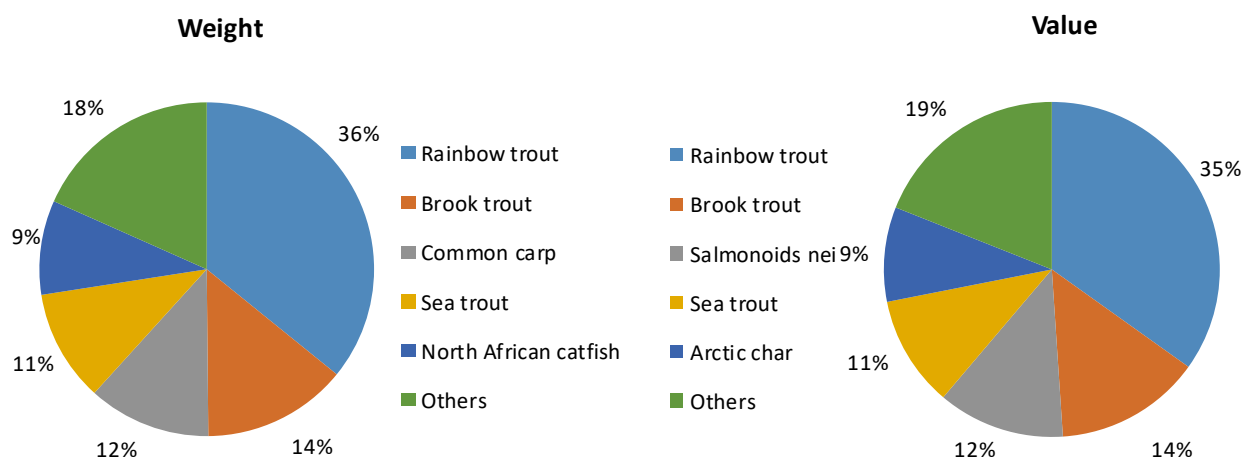
⁴ EU Aquaculture Assistance Mechanism - Europa. <https://aquaculture.ec.europa.eu/country-information/austria>.

⁵ https://oceans-and-fisheries.ec.europa.eu/system/files/2016-09/op-austria-fact-sheet_en.pdf.

⁶ <https://www.statistik.at/en/statistics/agriculture-and-forestry/animals-animal-production/aquaculture>.

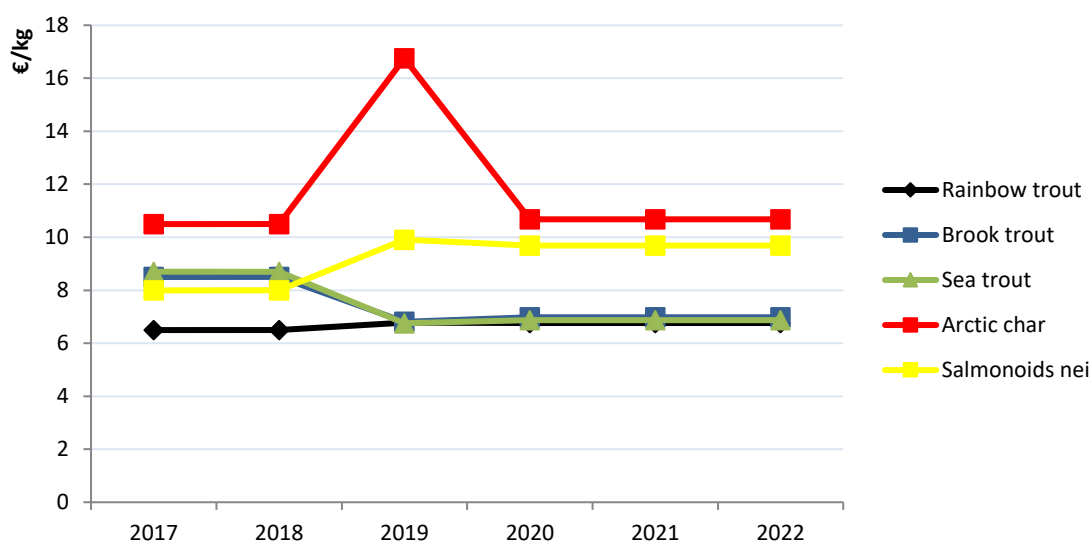
Rainbow trout continues to dominate the Austrian aquaculture sector, accounting for 36% of the total production weight and 35% of the total production value in 2022. Other notable species include brook trout, which represents 14% of both the total weight and value, and sea trout (also known as brown trout), comprising 11% of the weight and value. Additionally, common carp contributes 12% to both the weight and value of production.

Figure 57. Main species in terms of weight and value in Austrian production: 2022.



Source: FAO (2024)

Figure 58. Average prices for the main species produced in Austria: 2017-2022.



Source: FAO (2024)

Throughout the period from 2017 to 2022, aquaculture prices exhibited a generally consistent trend, with notable spikes in 2019. Arctic char emerged as the most valuable species, experiencing a significant price increase in 2019; however, prices subsequently fell back to levels comparable to those observed earlier in the analysed period, costing €10.70 per kg in 2022.

Conversely, both sea trout and brook trout experienced substantial price declines in 2019, stabilizing thereafter between 2020 and 2022 at approximately €7.00 per kg. Common carp maintained the lowest price among the species, at €4.20 per kg.

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.

Challenges for the industry include increasing production volumes, promoting new species, and improving the quality and competitiveness of domestic products. There is also a push towards sustainable and organic aquaculture practices ⁷.

Data Coverage and Data Quality

The share of the Austrian aquaculture is under 2.5% of total EU production and value, so the reporting is not mandatory under the DCF.

⁷ <https://aquaculture.ec.europa.eu/country-information/austria>.

4.2 Belgium

Overview of Belgian aquaculture

Although Belgium is not a landlocked country, its aquaculture production is almost entirely freshwater finfish from inland farms. As data collection for freshwater aquaculture is not mandatory under the DCF, this chapter is based on a compilation of partial sources (see 'Data coverage and data quality'). The available data points to a freshwater finfish sector that is growing, while the country also looks to develop shellfish aquaculture in coastal waters.

Production volume and value

According to FAO production data, aquaculture volume and value continue to increase in Belgium. In 2022, the freshwater aquaculture sector produced 243 tonnes valued at €1.7 million.

The total number of persons employed in 2022 was 120, corresponding to 81 FTE. This marks an increase from 72 FTE in 2021.

Table 28. Production and sales for Belgium: 2017-2022.

Variable	2017	2018	2019	2020	2021	2022	Change 2021-22	Develop. 2022/(17-21)
Sales weight (thousand tonnes)	0.1	0.1	0.1	0.2	0.2	0.2	▲ 9%	▲ 73%
Sales value (million €)	0.7	0.8	0.5	1.4	1.4	1.7	▲ 20%	▲ 77%
Number of enterprises			7	7	17	17	▲ 0%	▲ 65%
Employment					101	120	▲ 19%	▲ 19%
FTE			36	31	72	81	▲ 13%	▲ 76%

Source: Own elaboration from EU Member States DCF data submission and FAO (2024) data

Industry structure

The Belgian freshwater aquaculture sector consists of 17 main enterprises. These businesses are characterised by small-scale, extensive production units with limited labour input. In the northern part of Belgium (Flanders), the companies can be identified; in the southern part of Belgium (Wallonia), the situation is more complicated.

Most of the aquaculture production is situated in Wallonia, where 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 operations that often have no further personnel on the payroll and subsequently do not have significant alternative employment opportunities. As such, producers are prepared to accept incomes that would not be acceptable in an employer-employee business structure and continue to operate under unprofitable conditions. Pausing and restarting a business is relatively easy because the infrastructure is not expensive to maintain. Larger producers of trout import large size trout (typically from Italy, Greece and Turkey) and keep them in outdoor ponds until there is demand in local markets. To our knowledge there is no full cycle production (from broodstock via eggs to market sized product) of trout or other finfish in Belgium.

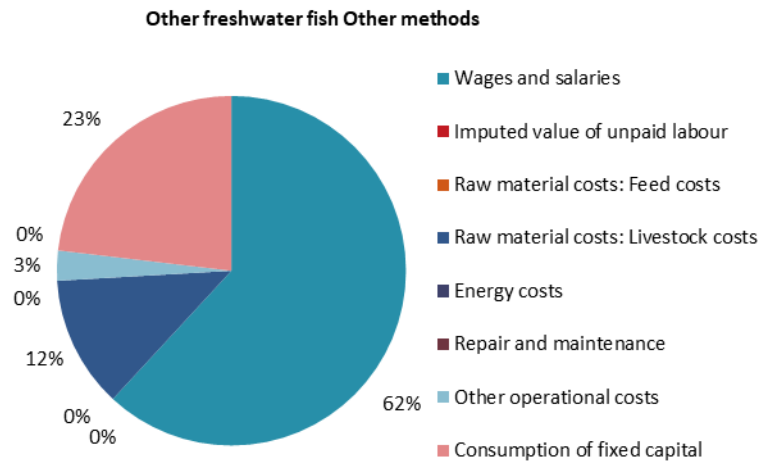
In Flanders, several fish farms are active in the production of ornamental fish (koi, goldfish, shubunkins, sarasa's), game fish (e.g. bream, carp, catfish, ide, minnow, pike, tench) and consumption fish (carp and tilapia) in fishponds.

Mariculture is rare in Belgium and is limited to the production of oyster, blue mussel and tropical shrimps. In 2020, a national supermarket chain (Colruyt group) was permitted to cultivate mussels in the Westdiep area after the Marine Spatial Plan enabled commercial activities in the North Sea. This operation is expected to cultivate and harvest between 10 and 15 tonnes of mussels using longline/suspended culture technology. In the longer term, production is expected to increase in scale and diversify to include oysters and seaweed.

Overall economic performance and total employment

Belgium collected expenditure data for 2021-2022, which is reported here as national totals. The main expenditure of the sector is wages and salaries (62%), followed by consumption of fixed capital (23%), and raw material costs (12%).

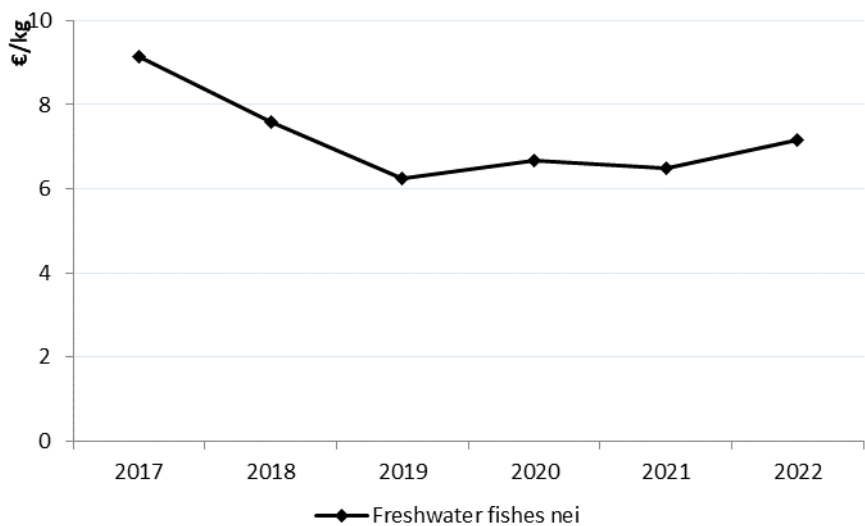
Figure 59. National Total Expenditures in Belgium: 2022.



Source: Own elaboration from EU Member States DCF data submission

Prices for freshwater fish (the only ‘species’ data available) have been relatively stable over the past few years at around 7 €/kg.

Figure 60. Average prices for the main species produced in Belgium: 2017-2022.



Source: Own elaboration from FAO (2024) data

Outlook

The Belgian Strategic Plan Aquaculture 2021-2030, which has a focus on sustainability and production with high added value, is now being implemented. Regional differences are apparent. In Flanders, the focus is on starting up and refining 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

Since the share of the Belgian aquaculture is under 2.5% of total EU production and value, the reporting is not mandatory under the DCF. Partial expenditure data was submitted, and this was supplemented by FAO production data to document economic performance in this chapter. As the expenditure data did not appear to align with the production data, only the composition of expenditure was included in this chapter rather than the level of expenditure and no economic indicators were calculated. Additionally, as the expenditure data covered a larger number of enterprises than the 2019-2020 period, neither the level of expenditure nor the composition of expenditure should be compared between periods (i.e. between multiple STECF reports).

4.3 Bulgaria

Overview of Bulgarian aquaculture

The overall performance of the Bulgarian aquaculture sector has improved significantly in the last decade as the total income in 2020 increased by 27% compared to the average value for the period 2012-2019. In 2020, the COVID-19 crisis was the main driver of the decline in the overall performance, decreasing the total sales weight and value by 25% and 24%, respectively. In 2021, the sales volume and value increased by 19% and 23%, respectively, but in 2022 sales volume and value decreased again by 19% and 2%, respectively. The most important species produced in the country are trout and carp. In terms of sales value, the largest 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 2019, the total sales weight and value reached the highest rate compared to 2008 or 2012. In 2020, the crisis due to the COVID-19 pandemic was the main driving force for the decline of the overall performance. Compared to 2019, the total sales weight and value in 2020 decreased by 25% and 24%, respectively, which is a drop close to the performance in 2017. The next two years could not be considered stable due to the increase in terms of volume and value of sales in 2021, followed by a decrease in 2022.

In 2017, the turnover from sales was €22.4 million, and in 2022, the turnover increased by 9% compared to the period 2017-2021 and amounted to €32.6 million. Compared to 2021, the turnover in 2022 decreased by 2%. Table 29 shows that the number of enterprises grew gradually during the period 2017-2021. In 2021, there has been an increase in the sales volume and value in both the freshwater and shellfish sectors compared to 2020. In 2022, there was an increase in the sales value of shellfish, but a decrease in the sales value of freshwater aquaculture.

4.3.2 Industry structure and total employment

In 2022, Bulgaria had 714 registered aquaculture enterprises. Only, 378 enterprises from the total population have sales, turnover, and employees; the rest of the 336 registered enterprises have declared that they have no sales. There were 671 enterprises with 5 or less employees, 23 enterprises with 6–10 employees, and 20 enterprises with more than 10 employees. Total employment (paid and unpaid) in 2022 was 1 518, corresponding to 1 236 FTEs. The level of employment decreased between 2009 and 2012 but increased in the period 2013–2017, followed by a 10% increase in 2019, when the total employment was 1 390 persons. Among the possible reasons for these fluctuations are the unstable economic situation in the country and the COVID-19 pandemic. The number of enterprises in 2020 with less than five employees and enterprises with 6-10 employees has increased by 4% and 7%, respectively, compared with 2019, while the number of enterprises with more than 10 employees increased by 38%, compared to 2019. The average wage in 2020 increased by 25% compared to 2019. Total employment in 2022 is 8% higher than the average for the period 2017-2021.

Since 2017, the social variables like gender, age classes, education, nationality, and employment status have been collected together with the economic variables. Due to the type of 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 from 2017 to 2022 it was gradually increasing, probably due to the increase in the minimum salary in the country. Total FTEs in 2020 decreased by 8% compared to 2019 but increased by 16% compared to the average for the period 2012-2019. The changes regarding the total employees are similar - there was a 7% decrease compared to 2019, but a 22% increase compared to the average for the period 2012-2019. In 2021 and 2022,

there is an increase in terms of total employment and FTE, which seems stable and corresponds to the levels from 2017.

Table 29. Production and sales, industry structure and employment for Bulgaria: 2017-2022.

Variable	2017	2018	2019	2020	2021	2022	Change 2021-22	Develop. 2022/(17-21)
Sales weight (thousand tonnes)	9.8	11.4	13.0	9.8	11.7	9.4	-19%	-15%
Freshwater	8.2	10.0	11.3	8.6	10.3	8.0	-22%	-17%
Shellfish	1.6	1.3	1.7	1.2	1.4	1.4	0%	-3%
Sales value (million €)	22.4	30.5	35.7	27.0	33.3	32.6	-2%	9%
Freshwater	21.3	29.5	34.2	26.1	32.2	31.1	-3%	9%
Shellfish	1.1	1.0	1.5	1.0	1.1	1.5	31%	30%
Number of enterprises	597	627	719	754	756	714	-6%	3%
Freshwater	566	600	696	731	735	692	-6%	4%
Shellfish	31	27	23	23	21	22	5%	-12%
Employment	1,572	1,262	1,390	1,292	1,503	1,518	1%	8%
Freshwater	1,469	1,213	1,324	1,216	1,451	1,455	0%	9%
Shellfish	103	49	66	76	52	63	21%	-9%
FTE	1,096	892	998	930	1,219	1,236	1%	20%
Freshwater	1,021	849	943	864	1,173	1,181	1%	22%
Shellfish	75	43	55	66	46	55	19%	-3%

Source: Own elaboration from EU Member States DCF data submission

4.3.3 Overall Economic performance

The economic performance of the Bulgarian aquaculture sector has deteriorated between 2008 and 2010, but in the last decade, the situation has significantly improved.

The amount of total income generated by the Bulgarian aquaculture sector in 2020 was €30 million, in 2021 it was €36 million, and in 2022 it was €36.5 million. The total income in 2022 has increased compared to 2021 by 1%, but compared to the average for 2017-2021, it has increased by 12%. The value of total operating costs after 2010 is increasing proportionally to the increase of the total income, and in 2022 their value is 53% higher than in 2021 and 84% compared to 2017-2021. Labour productivity is rather unstable for the whole period 2008-2022.

The total operating costs of the Bulgarian aquaculture sector in 2022 were €41.6 million and represented 114% of the total income. The total operating costs in 2022 increased by 84% compared to the average of the period 2017-2021. The largest expenditure item in 2022 was raw material: feed costs with €21.3 million, followed by wages and salaries with €6.2 million and other operational costs with €5.7 million. Expenditures for other operational costs, raw material: livestock costs, and raw material: feed costs in 2022 increased by 37%, 64%, and 66% compared to 2021, respectively.

According to capital cost, consumption of fixed capital is the main cost, with the amount of €4.7 million. In 2022, the consumption of fixed capital remains at the same levels as in 2019, 2020, and 2021; the financial costs increased by 225% and the financial expenditures increased by 45%. In regards to capital value, the total value of assets and debt amounted to €70.5 million and €28.2 million, respectively. The total value of assets in 2022 increased by 48% compared to 2021, but it should be noted that there was a significant increase in the variable in 2019. The debt also increased in 2022, by 36% compared to 2021.

The amount of raw material volume: feed and raw material volume: livestock in 2022 were 24.3 thousand tonnes and 1.1 thousand tonnes respectively. Raw material volume: feed in 2022 decreased by 72% compared to 2021, and raw material volume: livestock in 2022 decreased by 77% compared to 2021.

The GVA generated by the Bulgarian aquaculture sector was €0.3 million in 2022, representing 0.8% of the total income. The GVA in 2022 decreased by 98% compared to 2021 and to the period 2017-2021. EBIT was equal to €-9.9 million in 2022 and decreased by 341% compared to 2021, when the value was €4.1 million, and compared to the average for the 2017-2021 period, decreased by 287%. The net loss generated by the Bulgarian aquaculture sector in 2022 was €11.1 million and decreased by 396% compared to 2021, compared to the period 2017-2021, decreased by 318%.

Table 30. Economic performance of the Bulgarian aquaculture sector: 2017-2022.

Variable	2017	2018	2019	2020	2021	2022	Change 2021-22	Develop. 2022/(17-21)
Total income	25.2	33.3	38.3	30.0	36.0	36.5	1%	12%
Total operating costs	17.6	21.9	24.1	22.2	27.1	41.6	53%	84%
Total wages	3.7	3.5	4.1	4.8	4.9	6.8	41%	63%
Gross Value Added	10.5	13.5	16.8	11.1	12.6	0.3	-98%	-98%
Depreciation of capital	5.4	3.8	4.8	4.7	4.7	4.7	0%	1%
Earning before interest and taxes	2.2	7.6	9.4	3.1	4.1	-9.9	-341%	-287%
Financial costs, net	0.6	0.2	0.2	-0.2	0.4	1.2	225%	456%
Net profit	1.7	7.4	9.3	3.3	3.7	-11.1	-396%	-318%
Total value of assets	52.3	40.7	62.7	49.1	47.7	70.5	48%	40%
Capital productivity (%)	20.0	33.3	26.9	22.7	26.4	0.4	-98%	-98%
Return on Investment (%)	4.2	18.7	15.0	6.3	8.6	-14.0	-263%	-232%

Source: Own elaboration from EU Member States DCF data submission, 2024

4.3.4 Main species produced and economic performance by segment

The segments with the highest economic and social importance in 2022 were trout ponds, trout cages, carp ponds, and mussel long lines. In terms of net profit, the most valuable was trout ponds, followed by trout cages in the previous years, but due to the significant feed costs in 2022, all major segments generated net loss. The largest segment, regarding the number of enterprises, number of employees, and FTE, was carp ponds. In terms of the value of sales, the one that generated the largest turnover was trout ponds, followed by trout cages and carp ponds.

In terms of sales volume, the rainbow trout represented 42% of the total sales volume of the Bulgarian aquaculture sector in 2022, followed by common carp (28%) and Mediterranean mussel (15%). Turnover from rainbow trout represents 57% of the total turnover, followed by common carp with 24%.

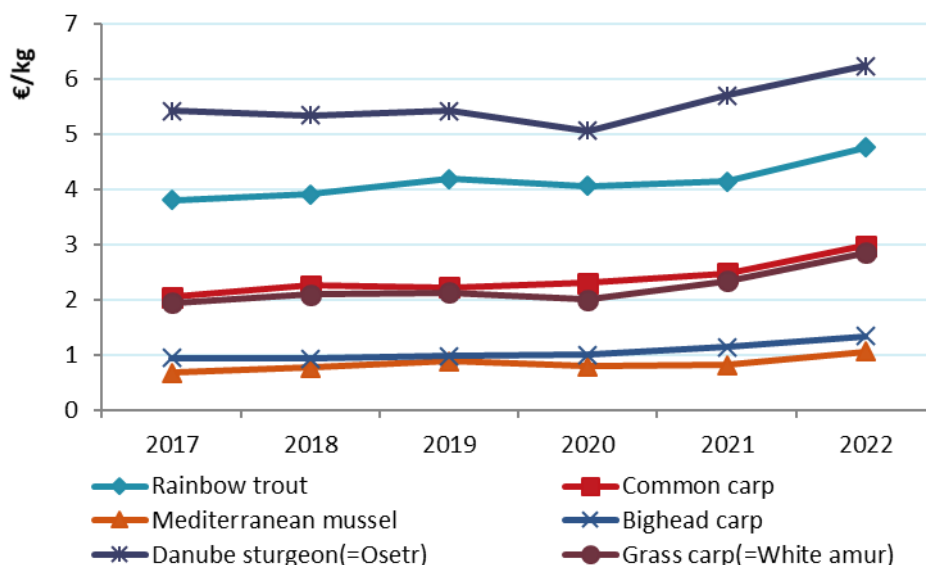
Figure 61. Main species in terms of weight and value in Bulgaria: 2022.



Source: Own elaboration from EU Member States DCF data submission

The average prices for the period 2017-2022 of the most important species are presented in Figure 62. The average price of rainbow trout was €4.8 per kg in 2022, an increase of 17% compared to 2021 with a price of €4.1 per kg. The average price of common carp was stable at €2.3 per kg in the period 2018-2020 with a 20% increase in 2022 (€3). The average price of Mediterranean mussel was €0.8 per kg in the period 2017-2021, increasing by 30% in 2022 to €1.1/kg.

Figure 62. Average prices €/kg for the main species produced in Bulgaria: 2017-2022.



Source: Own elaboration from EU Member States DCF data submission, 2024

The economic performance of the four most important segments in Bulgaria is shown in Figure 63 and Table 31.

Segment 1: Trout ponds

The most important segment regarding the sales value and volume in 2022 was trout ponds. This segment consisted of 78 active enterprises, where the main produced species is rainbow trout (99%). The value of total income in 2022 was €15.8 million, which is 22% more than in 2021 and 26% more compared to the average for the period 2017-2021. The amount of total sales volume in 2022 also increased, by 4% compared to 2021, and also increased, by 4% compared to the period 2017-2021.

In terms of economic indicators, the amount of GVA generated in 2022 was €2.5 million and has decreased by 31% compared to 2021 and by 55% over the period 2017-2021. The amount of net profit in 2022 was actually a net loss of €0.3 million and decreased by 130% compared to 2021 and by 109% over the period 2017-2021. The largest cost item remained feed costs with 47%, followed by the livestock costs representing 14%, and other operational costs with 13%.

For the purposes 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.

Segment 2: Trout cages

The segment has covered the same 12 enterprises over the last 8 years, which production contains 79% rainbow trout. In 2022, the value of total income was €4.6 million with a total sales volume of 1 thousand tonnes. The total income decreased by 4% compared to 2021 and by 22% compared to the

average of the period 2017-2021. Total sales volume is the same compared to 2021 and 2020, but decreased by 48% compared to the levels from 2018.

The amount of GVA generated in 2022 was €0.5 million, which is 200% less than 2021 and 40% less over the period 2012-2019. Total operating costs were €5.7 million and increased by 21% compared to 2021 and by 97% over the period 2017–2021. The net profit was negative €1.9 million and decreasing by 163% compared to 2021 and decreasing by 172% over the period 2017-2021.

The largest cost item of the trout cages segment in 2022 was the feed costs covering 41% of the total operational costs. Other operational costs made up 19% of all costs, and consumption of fixed capital 11%.

Table 31. Economic performance of main Bulgarian aquaculture segments: 2017-2022.

Variable	2017	2018	2019	2020	2021	2022	Change 2021-22	2017	2018	2019	2020	2021	2022	Change 2021-22
	Trout Ponds							Carp Ponds						
Number of enterprises	77	89	93	75	73	78	▲ 7%	396	414	471	554	577	503	▼ -13%
FTE	181	182	235	207	258	304	▲ 18%	559	440	389	369	557	520	▼ -7%
Average wage (thousand €)	3.9	4.9	4.4	8.0	5.5	6.6	▲ 21%	3.1	3.4	3.9	4.4	3.2	5.2	▲ 65%
Labour productivity (thousand €)	21.3	28.9	35.5	30.3	13.8	8.1	▼ -41%	4.4	4.2	7.2	3.3	10.4	-4.5	▼ -143%
Sales weight (thousand tonnes)	2.1	2.9	3.9	3.1	3.0	3.1	▲ 4%	3.5	4.1	3.6	3.2	4.9	3.1	▼ -37%
Total income (million €)	8.3	12.1	16.5	13.3	13.0	15.8	▲ 22%	6.8	8.2	7.3	6.6	11.2	9.4	▼ -16%
Total operating costs (million €)	5.1	7.4	9.2	8.1	10.7	15.1	▲ 41%	5.6	7.4	5.5	6.8	6.7	13.9	▲ 106%
Gross Value Added (million €)	3.9	5.3	8.3	6.3	3.6	2.5	▼ -31%	2.5	1.9	2.8	1.2	5.8	-2.3	▼ -140%
Net profit (million €)	2.6	4.0	6.3	4.3	1.1	-0.3	▼ -130%	0.1	-0.1	1.1	-1.2	3.9	-6.1	▼ -255%
Total value of assets (million €)	7.1	4.9	16.5	10.2	13.6	17.5	▲ 29%	10.8	11.0	7.6	10.6	7.1	18.8	▲ 167%
Net investments (million €)	0.2	0.2	0.2	0.7	1.1	0.4	▼ -67%	1.5	1.8	2.2	1.4	0.1	0.5	▲ 228%
Capital productivity (%)	54.2	106.9	50.4	61.6	26.1	14.0		22.8	16.9	36.9	11.4	81.7	-12.4	
Return on Investment (%)	38.4	82.5	38.3	43.9	11.2	-1.2		2.2	-1.3	12.9	-11.0	54.6	-27.9	
Future Expectation Indicator (%)	-4.1	-7.9	-5.0	0.1	2.2	-3.5		4.9	7.8	18.3	4.3	-6.5	-1.4	
	Trout Cages							Mussel Longline						
Number of enterprises	23	26	31	25	16	12	▼ -25%	31	27	23	23	21	22	▲ 5%
FTE	69	64	45	69	118	104	▼ -12%	75	43	55	66	46	55	▲ 19%
Average wage (thousand €)	4.2	4.4	3.4	3.5	4.3	6.4	▲ 47%	4.3	3.6	9.3	5.6	4.9	3.2	▼ -35%
Labour productivity (thousand €)	55.3	88.2	98.0	43.8	4.4	-4.9	▼ -212%	16.9	27.7	24.9	17.5	23.0	24.8	▲ 8%
Sales weight (thousand tonnes)	1.9	2.4	1.3	1.3	1.1	1.0	▼ -14%	1.6	1.3	1.7	1.2	1.4	1.4	▲ 0%
Total income (million €)	6.5	8.9	5.3	5.1	4.8	4.6	▼ -4%	1.7	1.3	1.6	1.5	1.4	1.7	▲ 23%
Total operating costs (million €)	3.0	3.6	1.1	2.2	4.7	5.7	▲ 21%	0.7	0.2	0.7	0.5	0.4	0.4	▲ 5%
Gross Value Added (million €)	3.8	5.6	4.4	3.0	0.5	-0.5	▼ -199%	1.3	1.2	1.4	1.1	1.1	1.4	▲ 29%
Net profit (million €)	2.7	4.8	4.0	2.2	-0.7	-1.9	▲ 163%	-0.2	0.9	0.3	0.0	-0.1	0.2	▲ 285%
Total value of assets (million €)	8.6	5.5	5.3	5.1	2.2	10.3	▲ 361%	7.8	8.9	12.7	10.2	9.9	9.3	▼ -6%
Net investments (million €)	0.0	0.0	0.0	0.0	2.0	0.0	▼ -100%	0.2	2.2	2.0	0.6	4.3	0.2	▼ -95%
Capital productivity (%)	44.3	101.6	83.7	58.5	23.1	-5.0		16.3	13.4	10.8	11.3	10.7	14.7	
Return on Investment (%)	31.9	88.0	75.7	45.0	-27.9	-17.9		-2.9	9.5	2.9	0.7	0.0	3.6	
Future Expectation Indicator (%)	0.0	-8.5	-5.1	-12.0	60.0	0.0		-13.3	22.2	11.0	-2.9	33.4	-7.9	

Source: Own elaboration from EU Member States DCF data submission

Segment 3: Mussels long line

The mussel segment is the only marine aquaculture, covering 22 enterprises. This is an increase of 5% compared to 2021, but decreased by 12% compared to the 2017-2021. The production from this segment is only Mediterranean mussel. The total income in 2022 was €1.7 million; 82% of the income came from sales, and 18% is from other income. The total income in 2022 increased by 23% compared to 2021 and by 14% to the 2017-2021. The total sales volume was 1.4 thousand tonnes in 2022, which was the same as in 2021 and 3% less than the average value for 2017-2021.

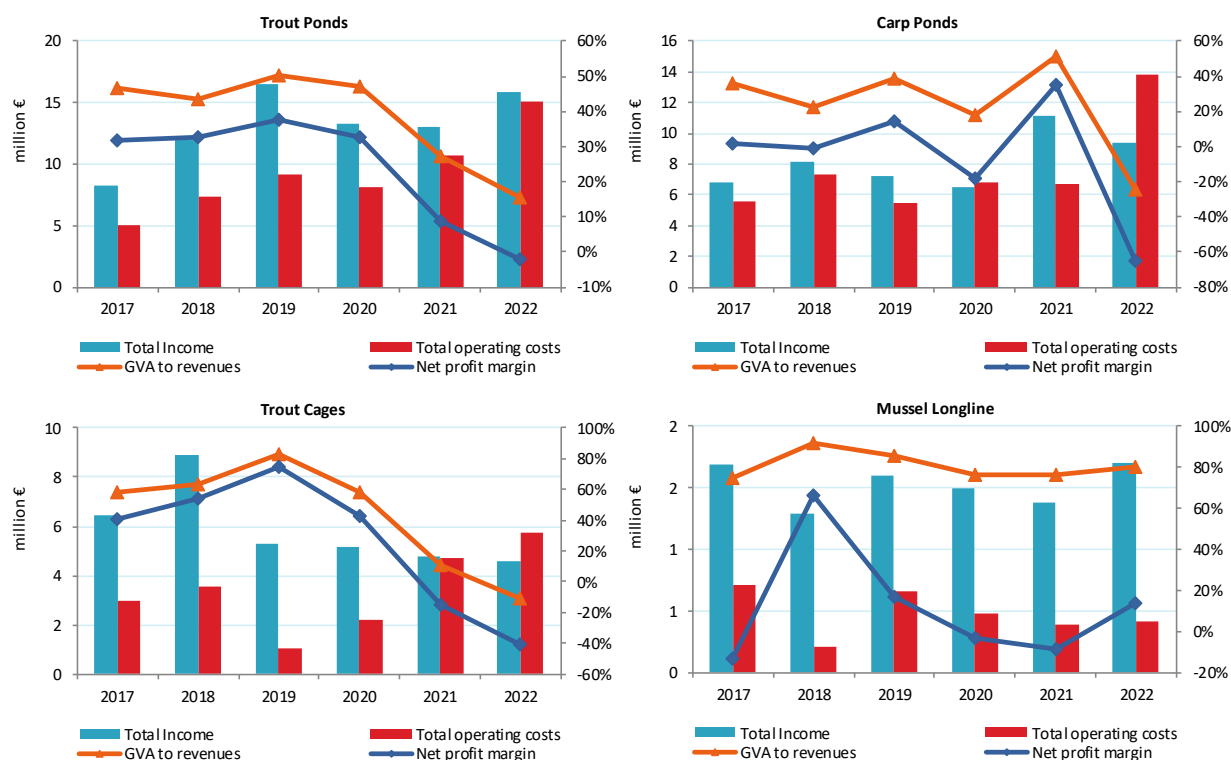
In terms of economic indicators, the GVA generated by the segment in 2022 was €1.4 million and has increased by 29% compared to 2021 and increased by 13% over the period 2017-2021. The amount of total operational costs was €0.4 million and increased by 5% compared to 2021, but decreased by 15%

over the period 2017-2021. The net profit was almost three times higher than in 2021, and compared over the period 2017-2021, it increased by 56%.

The largest cost item of the mussel long line segment was the consumption of fixed capital with 70%. Wages and salaries represented 12% of all operational costs, and other operational costs were 8%.

With the stable sales and the increased average price of the Mediterranean mussel, the segment generated net profit for the first time since after COVID-19.

Figure 63. Economic performance in € million, indicators for the main Bulgarian segments: 2017-2022.



Source: Own elaboration from EU Member States DCF data submission

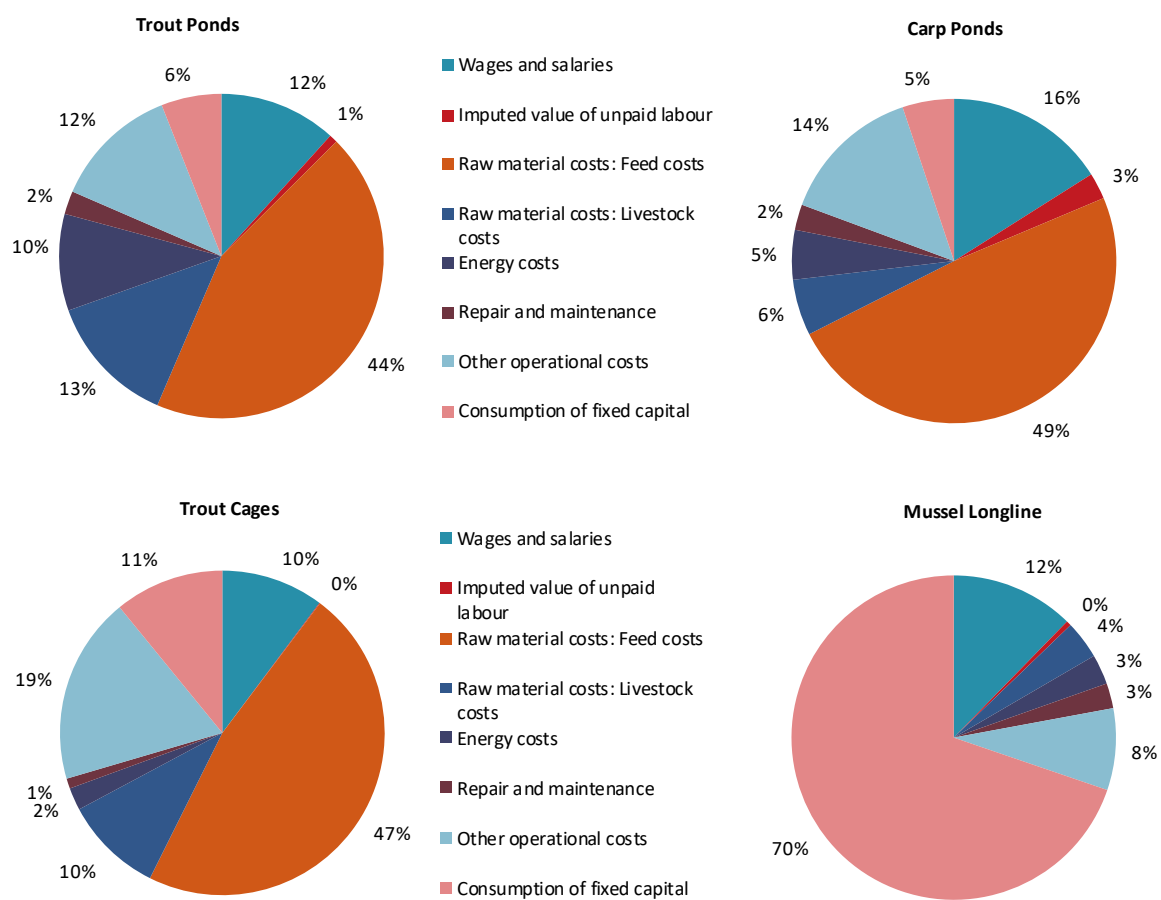
Segment 4: Carp ponds

The carp pond segment is the largest in terms of number of enterprises (503). It represented 67% of all active enterprises in Bulgaria and it employs 42% of the FTE in the sector. Most of the enterprises in this segment can be characterized as extensive. In 2022, the total income was €9.4 million, which was a 16% decrease compared to 2021 but an increase of 17% compared to the average for 2017-2021. The total sales volume was 3.1 thousand tonnes, which represented a 37% decrease compared to 2021 and a 20% decrease compared to the average for 2017-2021.

In terms of economic indicators, the amount of GVA generated by the carp ponds segment in 2022 was negative and has significantly decreased compared to 2021 and compared to the period 2017-2021. The total operational costs were €13.9 million and increased significantly compared to 2021 and over the period 2017-2021. This is the main reason for negative GVA and net profit loss. The net profit loss in 2022 was €6.1 million, which is a significant decrease compared to earlier years.

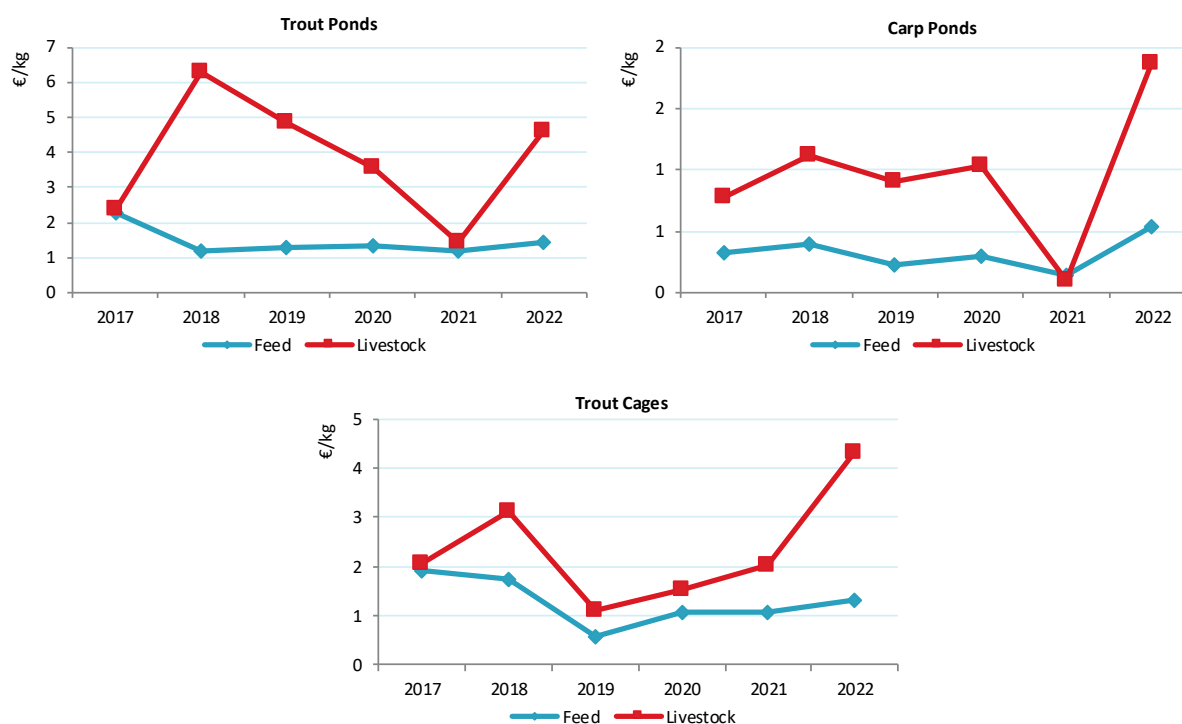
The largest cost item of the carp ponds segment in 2022 was the feed cost with 38%. Wages and salaries represented 19% of total operational costs, and other operational costs covered 14%.

Figure 64. Cost structure of the main segments in Bulgaria: 2022.



Source: Own elaboration from EU Member States DCF data submission

Figure 65. Feed and livestock average prices €/kg for the main Bulgarian segments: 2017-2022.



Source: Own elaboration from EU Member States DCF data submission

4.3.5 Outlook

Nowcasts for 2023-24

The official data for the national aquaculture production volumes, values, and employment for 2023 and 2024, which has been used for the nowcasting process, is provided by the Executive Agency for Fisheries and Aquaculture in Bulgaria. Given that data for 2024 is not yet available, the figures for 2023 are being treated as provisional estimates for the upcoming year, serving as a basis for predicting trends in the sector.

Trends and triggers

The increase in 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 2008-2020 period, we can expect a deterioration for the Bulgarian aquaculture sector. According to 2020 data, Bulgarian aquaculture production decreased by 25% in terms of volume and by 24% in value when compared to 2019. This negative sign together with the crisis due to the COVID-19 pandemic and the unstable situation in the Black Sea region is expected to deepen the situation in the sector.

The data for 2021 shows an increase of 9% in total sales volume and 15% in turnover compared in to 2020 and when we compared to the average for the 2012-2020 period total sales increased by 25% and the turnover increased by 41%. This positive sign for the recovery of the sector is based only on sales data and should be noted that 2021 was also a year impacted by the COVID-19 pandemic and the increase in electricity prices.

A significant part of Bulgarian aquaculture consists of the production of rainbow trout, carp, and Mediterranean mussels. The production of these species has been on a negative trend in the last year compared to 2021. Carp production has declined by 34% in terms of volume and 1% in terms of value. This decline was mainly due to the significant increase in 2021, which was caused by larger quantities actually produced in 2020 was transferred and harvested in 2021. The cultivation of Mediterranean mussels is stable during 2021 and 2022 due to stable domestic demand and export. Even with the increasing interest in trout farming and increased average price in the last two years, the production by the segment trout cages decreased in 2022 by 14% compared to 2021. Funding from European Funds (EMFF, EMFAF) to modernize the existing production capacities and promote sustainable aquaculture activities also plays an important role in the development of the sector.

Market structure

The market structure in Bulgaria did not show any changes over the last years. The slow process of development continues with a need for well-organized and constructed chains of retail stores and wholesale distribution networks 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. The distribution of fresh fish is absent in some regions, and the consumption of fish in these regions is much lower than the average per capita in the country. In general, Bulgaria has one of the lowest per capita consumption rates for fish and fisheries products in the EU. Compared to the EU average of 24 kg per person annually, Bulgarians consume an average of 7.2 kg annually (EUMOFA European Union Market Observatory for Fisheries and Aquaculture Products, 2023).

Bulgaria has provided a significant amount of financial support to the aquaculture sector throughout the EU funding programs (EUR 36 million representing 32% of the total budget allocation for fisheries and aquaculture over the seven-year period of EMFF 2014-2020). Even though this support was crucial for diversifying cultivated species and played an important role in the expansion of the sector in terms of total production, number of active fish farms, and people employed, the main kinds of products produced for consumption remain the chilled rainbow trout, the life species from the carp family, and frozen and fresh Mediterranean mussels. The production was increasing in terms of volume and value, year by year, due to stable domestic demand and increased export of processed products with added value.

The main drivers are still export-oriented products as well as products with added value achieving higher prices. In order to continue this development, the national strategic plan for the development of sustainable aquaculture for the period 2021-2027 sets the main priorities, such as promoting marketing, quality, and added value of aquaculture products as well as promoting sustainable aquaculture activities, while ensuring that the activities are environmentally sustainable in the long term.

The production of sturgeon species is not significant in volume and value, but continues to grow, and in 2022, the production of Russian sturgeon for consumption increases almost seven times on an annual basis. This slow growth of production can be explained by the fact that the main purpose of growing these species is the production of caviar. During the last year's more farms has started to extract caviar, which in turn also increases the amount of meat produced for consumption.

Despite the increasing interest in cage farming and recirculation system farming, only a few enterprises take the initiative to produce new species like coho salmon, Atlantic salmon, and African catfish. So far, only 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 pandemic outbreaks were the 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 exports to zero in the early stage of the pandemic. The reduction of exports was crucial for the Bulgarian aquaculture industry because the sector usually realizes a bigger part of the production out of the country market. In 2021, after the loosening part of the measures, the situation with access to the market shows improvement, while in 2022, with the restoration of full accessibility to both domestic and foreign markets, the aquaculture sector resurrected.

The data shows that the sales for 2022 decreased slightly by 2% compared to 2021, and turnover also decreased slightly, but compared to 2020, it increased by 20%, and it was close to the value from 2019. The average prices in 2022, respectively, mark an increase compared to 2021. In mussel farming, the increase in sales and average price were more visible (23% and 31%, respectively). The improvements for mussel farming were mainly due to the restoration of the national market and big quantities released for export and an increase in price at the same time.

During the 2020-2021 period, support from the EU was provided to the aquaculture sector under the EMFF with two measures due to COVID-19, for a total of €1 906 038. In 2020, 68 Bulgarian aquaculture farms managed by 61 enterprises were compensated due to COVID-19, for a total of €1 190 015. In 2021, 42 farms managed by 38 enterprises were compensated under the measure with a total of €716 023.

High energy prices

An increase in the price of electricity in 2022 led to an increase in the price of aquaculture products. The increase, which was expected to be within 20%, actually was near 40% compared to 2021, and this increase significantly exceeded prices. This, in turn, led to additional difficulty for the sector. The compensatory measure was adopted and applied in 2023 as well by the Bulgarian government, but for most of the operators in the sector, this was not enough to compensate them.

Social acceptance

The consumption of fish and other sea products in Bulgaria is still under the average for the EU countries. Bulgarian citizens are placed in one of the last places in the EU, and the main reason is the low salaries in the country and difficulty to purchase fish products. In fact, the consumption of aquaculture products is highly linked to the social practices and culture in the country where the consumption of carp is traditional. In the last few years, people prefer to include more healthy products, such as different dietary fish than carp, in their diet.

4.3.6 Data Coverage and Data Quality

Data quality and availability

Data quality: The achieved sample rate for economic data for 2022 was 100%, as in the last eight 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 in the 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 2022, 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 are separated into 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.

Other data issues or missing data

No other data issues or missing data.

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 144 enterprises in with aquaculture as main activity, producing 27.3 thousand tonnes in 2022 and creating 1 599 jobs totalling 1 267 FTEs. During period 2017-2022, 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 27.9 thousand tonnes in 2021 and 227.3 thousand tonnes in 2022, which is 60% of increase compared to 2017 and 2% decrease compared to 2021. The total value of production was €178.2 million in 2022, which corresponds to an increase of 6% over the same period in 2021. During period 2017-2022, Croatian aquaculture sector overall recorded steady growth in terms of sales values and stabilisation in terms of sales volume. Production and sales in marine aquaculture in total follow the objectives of the National Strategic Plan for Aquaculture 2021-2027.

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 2021-2027. Still, some changes are present in cyprinid production where increase in export indicate improvement in market strategies, while salmonid production expanded capacities, which resulted in slight increase of production but at the same time negative economic indicators.

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 the 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 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 57% of total number of employees, 80% of total sales weight and 92% of total sales value, which makes them convincingly the most important segment of aquaculture industry in Croatia. After long period of economic stagnation and decrease of production, freshwater sector started increasing production volume, values and number of employees. Salmonid production that has until recently been characterized by small companies with limited production capacity, has undergone changes recently, by expanding production capacities, although it is uncertain whether this will have a long-term effect on the total production results, which also might significantly depend on external factors, such as climate change in particular.

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 in period 2018 and 2020 and also new business openings and merging some smaller enterprises. 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 variation in number of enterprises, especially in the largest, shellfish segment.

The total number of persons employed in the Croatian aquaculture sector in 2021 was 1 509, corresponding to 1 242 FTEs and 1 599 in 2022, corresponding to 1 267 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 (agriculture, processing). Considering a strong trend of diversification and vertical integration – including processing industry and fisheries in marine aquaculture and other agricultural activities in freshwater aquaculture, variations in number of employees could be further expected. Overall, number of employees increased by 6% 2021-2022 and by 13% 2017-2022, while FTE varied less, by 2% 2021-2022 and by 12% 2017-2022.

Table 32. Production and sales, industry structure and employment for Croatia: 2017-2022.

Variable	2017	2018	2019	2020	2021	2022	Change 2021-22	Develop. 2022/(17-21)
Sales weight (thousand tonnes)	17.1	19.7	20.4	21.7	27.9	27.3	▼ -2%	▲ 28%
Marine	12.9	15.9	16.2	18.5	22.9	22.0	▼ -4%	▲ 28%
Freshwater	3.3	2.9	3.1	2.7	4.2	4.2	▬ 0%	▲ 30%
Shellfish	1.0	0.9	1.1	0.5	0.9	1.1	▲ 24%	▲ 22%
Sales value (million €)	101.0	120.0	120.8	133.0	167.4	178.2	▲ 6%	▲ 39%
Marine	92.3	111.6	111.1	126.0	156.3	164.6	▲ 5%	▲ 38%
Freshwater	7.0	6.7	7.1	6.2	9.5	11.1	▲ 17%	▲ 52%
Shellfish	1.7	1.7	2.6	0.8	1.6	2.5	▲ 57%	▲ 47%
Number of enterprises	173	161	162	155	138	144	▲ 4%	▼ -9%
Marine	30	26	28	29	28	26	▼ -7%	▼ -8%
Freshwater	40	38	32	28	29	32	▲ 10%	▼ -4%
Shellfish	103	97	102	98	81	86	▲ 6%	▼ -11%
Employment	1,476	1,389	1,360	1,366	1,509	1,599	▲ 6%	▲ 13%
Marine	795	768	838	853	908	908	▬ 0%	▲ 9%
Freshwater	439	365	367	375	465	523	▲ 12%	▲ 30%
Shellfish	242	256	155	138	136	168	▲ 24%	▼ -9%
FTE	1,116	1,085	1,108	1,105	1,242	1,267	▲ 2%	▲ 12%
Marine	684	700	736	745	795	791	▼ -1%	▲ 8%
Freshwater	361	296	322	307	344	353	▲ 3%	▲ 8%
Shellfish	71	88	51	52	103	123	▲ 19%	▲ 69%

Source: Own elaboration from EU Member States DCF data submission, 2024

4.4.3 Overall Economic performance

Total income increased from €258.2 million in 2021 to €292.4 million in 2022, or 13% respectively, and total operating costs made up for 88% of total income in 2022, compared to 84% in 2021.

The contribution of the sector to the economy was €51.7 million in 2021 and €50.5 million in 2022, which accounts for 17% of total income. Relatively high contribution of other income (31% in 2021, 36% in 2022) is a sign of diversification of economic activities and vertical integration, especially for large aquaculture companies, often involved in other types of production besides aquaculture and, increasingly often, processing industry. 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, fishing, 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 and Croatian National Strategic Plan for

Aquaculture 2021-2027. Besides promoting processing and marketing of seafood products, a significant part accounted for investments in aquaculture.

Overall, economic performance indicates gradually slowing and decreasing of profitability. EBIT margin and Net profit decreased by 5% and 2% in period 2021-2022 and by 34% and 38% in period 2017-2022. Although total income increased by 13% in 2021-2022 and by 34% in 2017-2022, the increase of other operating costs and total wages negatively impacted profitability, growing by 19% and 18% 2021-2022 and by 54 and 37% 2017-2022. The total value of assets increased by 10% 2021-2022 and by 19% 2017-2022, reflecting large investments, mostly oriented to vertical integration towards hatcheries and processing industry, but also investing to new production facilities, for example in trout segment. ROI turned positive at the end of the reference period with 4.3%, which is decrease of 14% compared to 2021 and of 45% compared to 2017, although slowing down, implies the efficient use of companies' asset base to generate sales. The social and economic challenges happened in the referent period impacted the overall sectors' performance. However, the sector remained stable and profitable, increasing income, showing resilience and providing a cautious optimistic view for the future period.

Table 33. Economic performance of the Croatian aquaculture sector: 2017-2022.

Variable	2017	2018	2019	2020	2021	2022	Change 2021-22	Develop. 2022/(17-21)
Total income	182.9	198.2	224.7	226.1	258.2	292.4	▲ 13%	▲ 34%
Total operating costs	121.9	155.0	177.5	169.0	217.7	258.3	▲ 19%	▲ 54%
Total wages	16.6	17.7	20.2	18.6	22.1	26.1	▲ 18%	▲ 37%
Gross Value Added	76.4	59.2	64.3	69.1	51.7	50.5	▼ -2%	▼ -21%
Depreciation of capital	13.1	14.8	16.0	13.5	16.2	11.1	▼ -32%	▼ -25%
Earning before interest and taxes	47.9	28.4	31.2	43.6	24.3	23.0	▼ -5%	▼ -34%
Financial costs, net	-2.4	0.5	0.8	1.1	2.4	1.6	▼ -32%	▲ 244%
Net profit	50.3	27.9	30.4	42.5	21.9	21.4	▼ -2%	▼ -38%
Total value of assets	416.4	441.4	453.8	470.5	489.9	540.7	▲ 10%	▲ 19%
Capital productivity (%)	18.3	13.4	14.2	14.7	10.6	9.3	▼ -12%	▼ -34%
Return on Investment (%)	11.5	6.4	6.9	9.3	5.0	4.3	▼ -14%	▼ -45%

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 64% of volume and 66% of total value of Croatian aquaculture production. Most farms are located on the middle part of coast, on the Zadar area. Around 74% of seabass and seabream production has been exported on the EU market, and the rest is exported to neighbouring countries or 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 ten years.

The second most important individual species in Croatian aquaculture is Bluefin tuna, covering the 22% of the total value and 12% 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 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 90% when considering also common carp. Meagre is relatively new and fast growing farmed species, which increased from 250 tonnes of total weight in 2017 to 1100 tonnes in 2022.

Mediterranean mussel covers about 4% of total production volume and 0.9% of the total value and is almost completely 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. After sharp decrease in shellfish production to disruption of market conditions during pandemic and significantly weaker tourist season 2020, shellfish production improved in 2022 to the highest production volumes in period 2017-2022. The freshwater aquaculture production is mostly sold at the national market, with some signs of improvement in cyprinids export.

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. Regarding the market trends, the domestic production of salmonid species falls short of consumer demand. Nevertheless, due to the lower average prices, the market fulfils the demand from the import, while production in the cyprinid segment mostly covers domestic market demands and gradually turns to export.

In the last reporting period, the sectors' economic performance revealed major investments (production facilities, expanding production capacities) which still did not impact the production significantly but it is expected to experience some changes in overall performance of the segment in the upcoming period.

In general, low performance of this segment over a long term period stem from the problem of using basic resources in production, especially disruptions in the availability of water due to increasingly pronounced and prolonged dry periods, as well as the problem of predatory species on farms, and the need for more systematic monitoring and prevention of diseases in farming.

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 EU-MAP 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 66. Main species in terms of weight and value in Croatian production: 2022.



Source: Own elaboration from EU Member States DCF data submission, 2024

Average prices for all species increased between 2021 and 2022, with a most significant increase of 22% for Bluefin tuna from 2021 to 2022 which follows the decrease in total volume of sales.

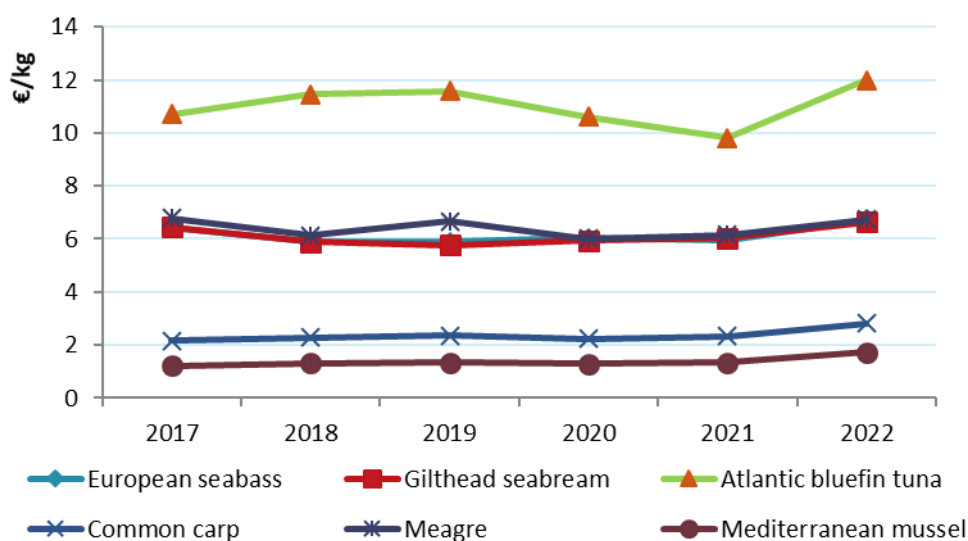
After reaching the highest price of €6.5 per kg in 2017 (regarding period 2012-2020), from 2021 to 2022 Sea bass increased 5% and reached the new highest price of €6.7 per kg, similar as Sea bream which reached the highest price in 2016 and 2017 (€6.5 per kg), then decreased to €6 in 2020 and increased in 2022 to €6 per kg. 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.

In general, prices in freshwater aquaculture did not change significantly due to well established end-market network. The average price of Carp remained stable in 2017-2021, with price of €2.2-€2.3 per

kg. In 2022, the price increased by 21%, to €2.8 per kg. Trout prices increased by 11% in the period 2021-2022 and by 30% from 2017 to 2022. The evolution of average prices suggests a differentiation between export and import prices. Salmonids reported considerably higher export prices (14.1 €/kg in 2023) than import prices (7.65 €/kg) targeting mostly neighbouring and central European countries (36% Slovenia). Conversely, the price of imported cyprinids in 2023 (8.78 €/kg), was considerably higher than export price (5.04 €/kg). The most important export countries in 2023 were Serbia, Romania and Bulgaria. Opportunities for growth could be in products with added value, such as smoked fish, which is in line with demand in tourism and HoReCa channel.

The price of Mediterranean mussel increased by 41%, from €1.2 per kg in 2017 to €1.7 per kg in 2022 due to increased sale during tourist season, directly to customers or to restaurants. It should be noted that from 2021 to 2022 the average price increased from €1.3 per kg to €1.7 per kg, or 28% respectively.

Figure 67. Average prices €/kg for the main species produced in Croatia: 2017-2022.



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

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 significant 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 a 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 2022, there were 4 active tuna farms with 318 FTEs, and they had a production of 3 270 tonnes of tuna primarily and smaller quantities of Sea bass and Sea bream and mussels. Total value corresponded of more than €42 million. The production value of this segment corresponds to 23% of the total Croatian aquaculture production.

In 2022 the segment reached the highest value of Total income (€72.5 million), which corresponds to increase of 12% compared to 2021. Total operating costs rose by 13% (€59 million) from 2021 and net profit increased by 34% to €9.4 million, which turned the negative trend of previous two years.

Labour productivity had an increase of 11% compared to 2021 and by 18% compared to 2017. Average wages in this segment amounted for €33.1 thousand, which is an increase of 38% compared to 2021 and increase of 62% compared to 2017.

Although the total sales volume decreased during the period 2021-2022, overall performance in 2022 is marked with growth. Variations between reference years could imply dependency and limitation of one primary factor and need to diversify business activities, which is partially realized through increasing processing activities but also could be expected in the following years due to increased investments (€5.8 mil in 2022).

The structure of cost in 2022 is similar to that for Sea bass & Sea bream cages, comprised mainly of feed costs (37%), other operational costs (31%) and wages and salaries (17%). Due to earlier investments, share of consumption of fixed capital is rather large, 7%.

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 8%.

Table 34. Economic performance of main Croatian aquaculture segments: 2017-2022.

Variable	2017	2018	2019	2020	2021	2022	Change 2021-22	2017	2018	2019	2020	2021	2022	Change 2021-22
	Sea bass & Sea bream Cages							Tuna Cages						
Number of enterprises	25	21	23	24	24	22	▼ -8%	4	4	4	4	4	4	0%
FTE	418	425	456	472	503	473	▼ -6%	260	269	274	272	292	318	▲ 9%
Average wage (thousand €)	18.9	19.7	22.2	19.4	20.4	22.0	▲ 8%	17.4	19.5	21.7	19.7	23.9	33.1	▲ 38%
Labour productivity (thousand €)	86.9	65.0	81.4	107.1	44.2	46.0	▲ 4%	54.5	74.6	53.6	49.3	62.3	69.5	▲ 11%
Sales weight (thousand tonnes)	10.3	12.1	13.0	14.7	17.3	18.2	▲ 6%	2.6	3.7	3.3	3.8	5.6	3.8	▼ -32%
Total income (million €)	101.0	114.9	131.0	130.0	138.9	157.8	▲ 14%	37.0	51.2	49.6	54.8	64.7	72.5	▲ 12%
Total operating costs (million €)	72.2	94.9	103.4	87.5	123.5	145.0	▲ 17%	27.1	35.8	40.5	46.0	51.9	58.7	▲ 13%
Gross Value Added (million €)	36.3	27.6	37.1	50.5	22.3	21.8	▼ -2%	14.2	20.1	14.7	13.4	18.2	22.1	▲ 21%
Net profit (million €)	23.1	12.9	19.2	36.4	6.9	8.7	▲ 25%	8.1	10.6	4.1	3.5	7.0	9.4	▲ 34%
Total value of assets (million €)	183.7	215.6	230.7	239.0	252.0	270.6	▲ 7%	108.1	116.6	110.0	114.6	119.0	120.0	▲ 1%
Net investments (million €)	12.5	10.5	8.7	6.1	17.7	9.0	▼ -49%	1.5	4.4	0.4	3.8	2.0	5.8	▲ 193%
Capital productivity (%)	19.8	12.8	16.1	21.1	8.8	8.0		13.1	17.2	13.4	11.7	15.3	18.4	
Return on Investment (%)	12.1	5.9	8.5	15.0	2.8	3.4		6.2	10.2	4.6	4.1	7.6	8.0	
Future Expectation Indicator (%)	3.2	1.5	0.3	-0.2	3.7	2.1		-1.6	0.8	-3.3	-0.2	-1.6	1.3	
	Carp Ponds							Trout Tanks and race-ways						
Number of enterprises	20	20	15	12	12	13	▲ 8%	20	18	17	16	17	19	▲ 12%
FTE	321	255	271	256	270	281	▲ 4%	40	41	50	52	74	72	▼ -2%
Average wage (thousand €)	8.3	9.7	9.8	10.8	11.7	10.5	▼ -10%	9.9	9.6	11.3	10.3	12.7	15.7	▲ 24%
Labour productivity (thousand €)	77.3	41.7	36.8	15.6	35.7	28.9	▼ -19%	10.9	12.4	13.6	9.2	1.7	-49.1	▼ -2960%
Sales weight (thousand tonnes)	2.9	2.5	2.7	2.4	3.8	3.8	▼ -2%	0.4	0.4	0.4	0.4	0.4	0.5	▲ 28%
Total income (million €)	39.9	27.4	37.1	36.6	49.5	54.2	▲ 10%	1.6	1.5	2.8	2.3	2.0	2.9	▲ 43%
Total operating costs (million €)	17.6	19.3	28.3	31.4	37.7	43.2	▲ 15%	1.4	1.3	2.5	2.2	2.8	7.5	▲ 168%
Gross Value Added (million €)	24.8	10.6	10.0	4.0	9.6	8.1	▼ -16%	0.4	0.5	0.7	0.5	0.1	-3.5	▼ -2903%
Net profit (million €)	20.7	5.9	6.1	2.4	8.2	8.5	▲ 4%	-1.2	0.1	0.1	0.1	-1.2	-5.6	▲ 352%
Total value of assets (million €)	114.0	96.9	99.7	101.1	103.3	132.6	▲ 28%	5.9	3.1	7.7	9.8	10.7	11.5	▲ 7%
Net investments (million €)	6.4	5.4	4.2	8.3	4.6	2.6	▼ -44%	0.0	0.1	0.0	0.1	0.5	1.0	▲ 100%
Capital productivity (%)	21.8	11.0	10.0	3.9	9.3	6.1		7.3	16.7	8.9	4.8	1.2	-31.0	
Return on Investment (%)	17.2	5.5	5.4	3.0	8.6	6.6		2.0	2.2	1.6	-0.5	-13.8	-46.8	
Future Expectation Indicator (%)	3.2	2.6	0.7	6.1	1.6	0.3		-1.0	1.2	-1.7	-0.9	-2.0	1.9	

Source: Own elaboration from EU Member States DCF data submission

Segment 2: Seabass and seabream cages

This is the segment with the largest production, which covers 67% of total sales volume in 2022, compared to 62% of total sales volume in 2021. All of these farms are growing both sea bass and sea bream, with a small quantity of other marine finfish species and shellfish. It is remarkable, that this

segment has almost a half of the value of the total value of assets (46%), and also almost half of the total investments of the sector.

An increase in production has been noted between 2021 and 2022 in terms of weight and value for this segment and the same trend is expected in the following years. During the period of reporting, total sales volume increased by 6% and total income increased from €138.9 million to €157.8 million or 14% 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 2022, which produced 18.2 thousand tonnes of fish and employed 580 employees in 2022.

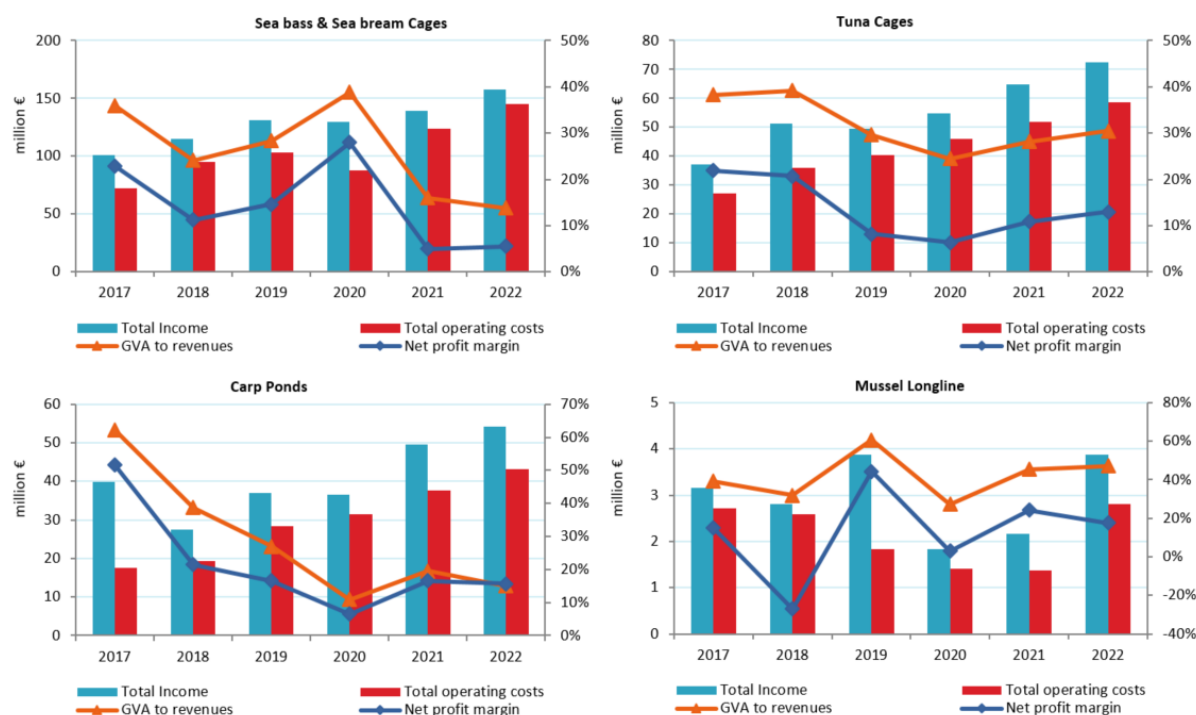
In general, enterprises in this sea bass and sea bream segment did not have production of eggs and larvae but some of them started their own production in the reference period; therefore, buying juveniles partly from other Croatian hatcheries and import from other EU countries decreased, along with share of livestock costs in cost structure from 2017 (12%) to 2022 (7%). The largest part of total costs are feed costs (47%), other operational costs (32%), wages and salaries (7%), and livestock costs (7%) while other costs make up for 14%.

In 2022, GVA decreased by 2% to €21.8 million and net profit, after reaching the highest value in 2020 - €36.4 million, dropped to €8.7 million in 2022. Net investments reached the record values in 2021 with €17.7 million and then declined to €9 million in 2022. The evolution of Future Expectation Indicator, after decline in 2020, shows a trend of improvement in 2021. Despite the current drop, the segment overall had a positive economic performance and stabilisation might be expected in the following period.

The reference period was marked by inflation and a significant increase in production costs through record-high fish feed prices, energy and other input raw materials. Nevertheless, the sector managed to maintain a positive economic performance with the timely reaction of adjusting its market policies through selling prices, strengthening the market position and brand awareness, supported by marketing activities in all key markets. Also, new species reached the market in 2021 (Greater amberjack, Common dentex) and organic production is marked by steady growth in total volume of production and sales.

To conclude, the production in this segment continues to expand, followed by realization of 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 providing high valued innovative products and constantly expanding the product portfolio.

Figure 68. Economic performance in € million, indicators for the main Croatian segments: 2017-2022.



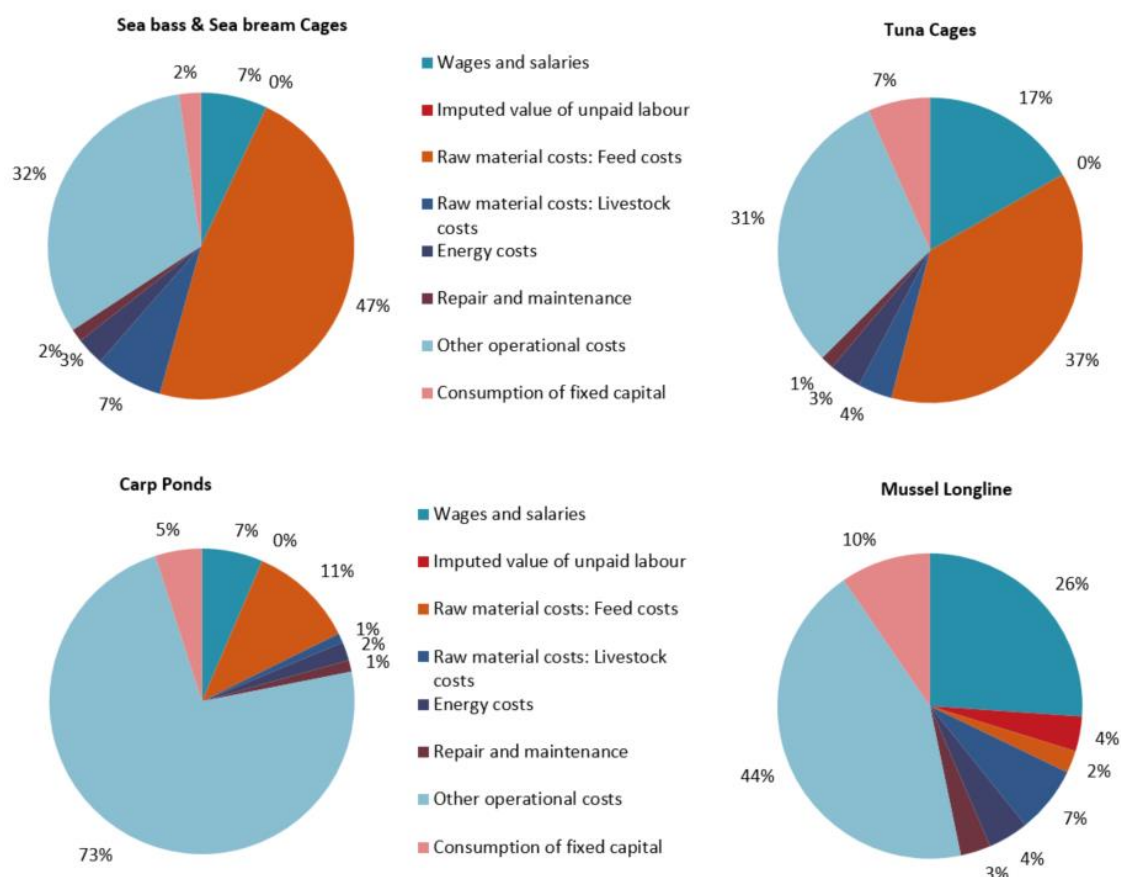
Source: Own elaboration from EU Member States DCF data submission

Segment 3: Carp ponds

In total, in 2022, about 73% of production in the segment accounts for carp, which is a decrease compared to 2021 (74%) and could imply a diversification in farming. From 2021 to 2022, volume of carp production, so as value, declined from 2 876 tonnes to 2 524 tonnes. Still, production trends in general are improving, increasing from 2 039 tonnes in 2017. Production of the other freshwater fishes increased from 971 tonnes in 2021 to 1 239 tonnes in 2022, or by 27% in volume and 41% in value. After a long period of stagnation in carp segment, this might imply some recovery in terms of diversifying production and implementing new marketing strategies, which is also visible from positive export trends of this segment. Overall economic performance also implies some progress; net profit increased by 4%, reaching €8.5 million. ROI declined from 8.6% in 2021 to 6.6% in 2022, but still implies overall stabilization.

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 69. Economic performance in € million, indicators for the main Croatian segments: 2017-2022.



Source: Own elaboration from EU Member States DCF data submission

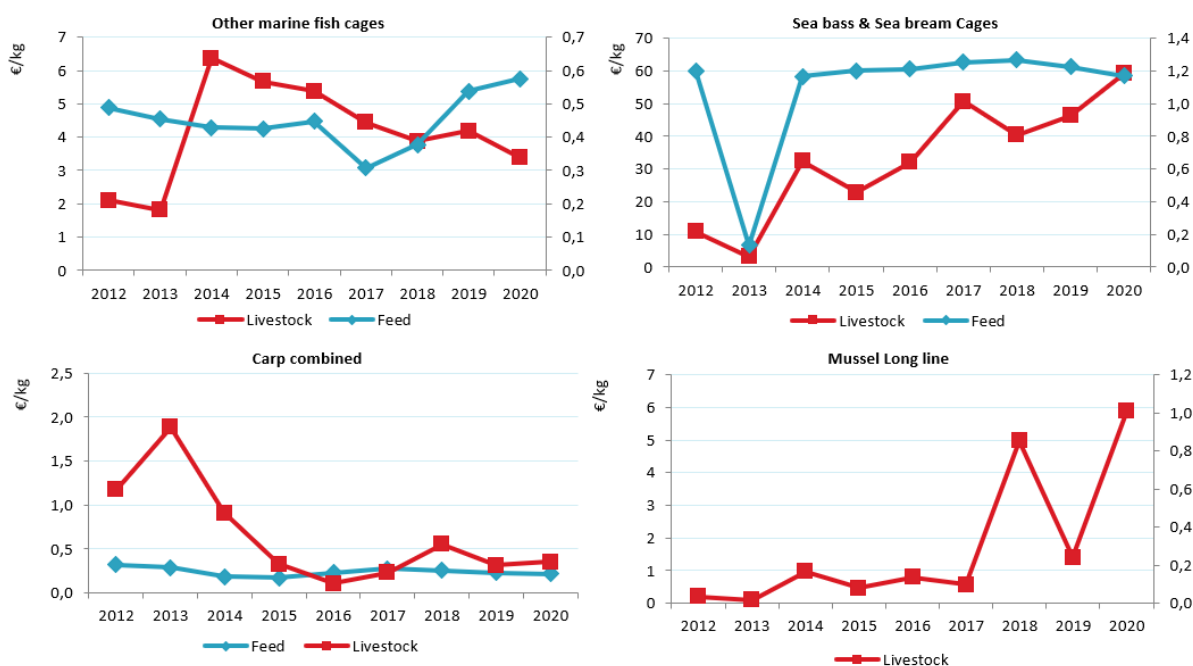
Segment 4: Mussels long line

Although the mussel long line segment represents only 3% of the total weight, and less than 1% of the value, it is an important segment in terms of number of enterprises and employees. The segment contains around 60 enterprises in 2021 and 2022, 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. Also, most of the enterprises in this segment combine mussels and oyster production and fluctuate from mussels to oyster segment and back, which makes the analysis less consistent. Overall, after major decline in 2020, the segment is going through recovery, increasing total income from €1.8 million in 2020 to €2.2 million in 2021 and €3.9 million in 2022. At the same time, total operating costs reached the highest values in the reference period, amounting €2.8 million in 2022. Positive trends are also visible in ROI and Future Expectation Indicator, which performed positively in 2022.

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. This segment was largely affected by COVID crises which caused a major decline in production and consequently number of active enterprises, and at the same time is extremely vulnerable to environment indicators and predators. Traditionally, in this segment oysters are also farmed in variable proportions, depending on market demand.

Figure 70. Feed and livestock average prices €/kg for the main Croatian segments: 2017-2022.



Source: own elaboration from EU Member States DCF data submission

4.4.5 Outlook

Current production trends and main drivers

The aquaculture sector in Croatia continues to grow, but at a slower rate than in previous periods. The preliminary data for 2023 shows stagnation in the production volume, but increase in value and total income, which implies some structural changes and improvement in product placement. The growth is not equally distributed among the sector, so the most significant improvement was recorded in marine aquaculture, namely in the 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. New cycle of large investments is expected in the upcoming period with preliminary data of increase from 2021 to 2023 by 46%.

Production of Bluefin tuna is determined by ICCAT quotas and prices on the world market, so this production follows world market trends. After recovery 2021-2022, with lower production in 2022, but better economic performance, further development regarding economic performance is expected 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.

Other marine aquaculture segments, Mussels long line and Oysters long line, after very challenging 2020, stabilized in terms of production and 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 falling behind with some signs of recovery. 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, the 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 the challenging task of developing new technologies, and 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. New investments and significant expand of production capacities in trout segment impacted the economic performance of the segment. Return on investment and significant increase of production might not be expected in short-term period but rather will gradually change the overall performance of the sector.

In general, it might be expected that aquaculture sector will attract more labour force, where also some structural changes are already visible and might progress in the future, regarding more foreign workers, mostly in marine aquaculture segments. According to preliminary data for 2023, there is an increase of FTE by 4% and increase in number of employees by 5.6%.

Social acceptability

The Croatian market went through a period of intensive changes and improvements over the last several years. First, there has been an improvement in public perception of aquaculture products, which is reflected in 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 in marketing and sales. Also, in the National Aquaculture Development Strategy 2014-2020, in the part of appropriate positioning of aquaculture products on the market, increasing competitiveness and improving the promotion and consumer perception in the period until 2020, marketing activities were undertaken, such as the campaign "Croatian fish - eat what it's worth". within the framework of which the quality and sustainability of all domestic fishery products, including aquaculture products, were promoted, with the aim of increasing consumption and improving the perception of consumers about these high-value food products, or advertising spots that targeted aquaculture products, as well as their nutritional value, but also a contribution to sustainable development and protection of nature and the environment. Aquaculture products were also promoted through the application of suitable certification models, such as obtaining a mark of authenticity for the Maloston oyster.

The general goals of the development were to strengthen the social, business, and administrative environment for the development of aquaculture, as well as to improve the perception and increase the national consumption of aquaculture products. In addition to the general development goals, the Plan also determined the number of development priorities, grouped into several thematic areas aligned with the then-current Strategic Guidelines of the European Commission for the sustainable development of EU aquaculture from 2013.

During the preparation of the Croatian National Development Plan for Aquaculture for 2021-2027, several workshops have been held with farmers, scientists, and other stakeholders of the sector, in order to identify strengths, weaknesses, threats, and opportunities for each segment. Good social acceptability was identified across the sector mostly due to ensuring jobs and supporting rural development. Also, due to the accessibility of certified and quality fresh products, and relatively affordable prices (compared to rising prices of wild fish), there is growing support for the sector.

High energy prices

During 2021 and 2022 aquaculture sector has been affected by increased energy costs, as well as by high logistic costs and trade disruption. Eurostat data on Harmonised Indices of Consumer Prices (HICP) that measure the changes over time in the prices of consumer goods and services acquired by households shows the increase of annual average indices for all items out of which the highest ones are in energy, transport and food. The crisis caused by the Russian war against Ukraine is likely to have serious consequences on the supply of grain (in particular maize and wheat) and oilseeds (sunflower, rapeseed) or starch-derivatives from Ukraine and Russia to the EU, leading to a strong increase in feed prices. The total feed prices increased by 32% from 2021 to 2023. At the same time, the energy costs increased by 50% in the same period, but also the other costs increased, which finally resulted in a lower profitability, but did not affect the positive economic performance overall. It might be concluded that the sector showed a certain resilience towards socio-economic disruptions.

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 general, 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. Also, some investments are being realized in expanding trout production to marine environment. The results might be visible in the next reporting period.

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 by providing subsidies during 2020 and 2021.

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 (feed costs, material costs, personnel 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.

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. Finally, according to the economic results, most of the companies managed to overcome this challenging period.

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 questionnaires 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 questionnaires 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 questionnaire. 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 2021 and 2022 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. Based on the latest (2022) EU aquaculture production reported to the EUROSTAT, the Cyprus production is 0.7% of the total EU aquaculture production (i.e., below the threshold). As a result, Cyprus was not obliged to provide economic data for this report. However, Cyprus provided some data, but not the whole set of data, in particular the historical ones needed for this report. As a consequence, the analysis of the Cypriot aquaculture sector is based both on data extracted from FAO and DCF data.

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 2022 was 7.6 tonnes valued approximately €48 million. This corresponds to a decrease in weight of around 3% (7.86 tonnes in 2021) in regards to previous year 2021 but basically it shows a steady trend during the period 2017 to 2022. This is not the case for the value of production where an increase of 6% (€45 million in 2021) is shown and also a rise of 18% if compared 2022 over the period 2017to 2021. This trend mainly follows the tendency of the major sector of the Cyprus aquaculture, the marine one. The significant increase in value of production is mainly due to the higher prices in main species: Gilthead seabream and European seabass.

Table 35. Production and sales for Cyprus: 2017-2022.

Variable	2017	2018	2019	2020	2021	2022	Change 2021-22	Develop. 2022/(17-21)
Production weight (thousand tonnes)	7.3	7.3	8.1	7.3	7.9	7.6	 -3%	 0%
Marine	7.2	7.3	8.0	7.3	7.8	7.5	 -4%	 0%
Shellfish	0.0	0.0	0.0	0.0	0.0	0.0	 -31%	 -48%
Freshwater	0.0	0.0	0.1	0.0	0.1	0.1	 25%	 49%
Production value (million €)	37.5	39.0	43.8	37.0	45.1	47.7	 6%	 18%
Marine	36.8	38.3	43.1	36.6	44.4	47.0	 6%	 18%
Shellfish	0.3	0.3	0.2	0.2	0.2	0.2	 -9%	 -32%
Freshwater	0.3	0.4	0.5	0.3	0.5	0.6	 24%	 52%

Source: Own elaboration from EU Member States DCF data submission

4.5.2 Industry structure and total employment

In 2022, the industry consisted of 7 enterprises employing 205 employees, a decrease of 16% compared to the previous year 2021 despite the fact that the number of companies in the sector was stable. However, there was a reduction in the weight of production between the years 2021-2022 according to previous Table 35.

Table 36. Industry structure and Employment: 2021-2022.

Variable	2021	2022	2023	Change 2021-22
Number of enterprises	7	7	7	 0%
Employment	225	205	189	 -16%
FTE	225	205	189	 -16%

Source: Own elaboration from EU Member States DCF data submission

4.5.3 Overall Economic performance

The Cyprus aquaculture sector in 2022 was in net profit position of €14.6 million for the 7 enterprises of the sector. The return on investment was high since it was positive at 28.9%.

Table 37. Production and sales for Cyprus: 2017-2022.

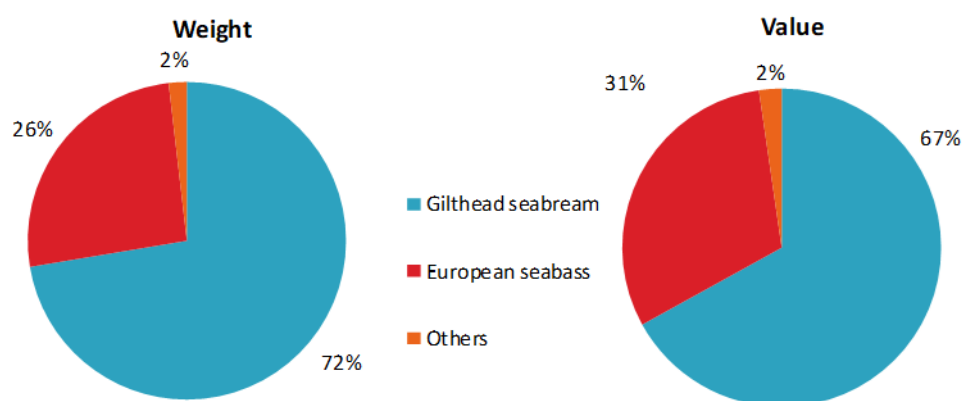
Variable	2021	2022	2023	Change 2021-22
Total income	33.8	48.6	42.3	▲ 25%
Total operating costs	32.2	32.2	38.4	▲ 19%
Total wages	5.0	4.0	4.0	▼ -19%
Gross Value Added	6.4	20.2	7.8	▲ 21%
Depreciation of capital	1.5	1.7	1.6	▲ 3%
Earning before interest and taxes	0.1	14.6	2.4	▲ 2472%
Financial costs, net	0.1	0.1	0.0	▼ -42%
Net profit	0.0	14.6	2.4	▲ 10593%
Total value of assets	49.3	50.5	59.4	▲ 21%
Capital productivity (%)	13.0	39.9	13.1	▲ 1%
Return on Investment (%)	0.2	28.9	4.0	▲ 2034%

Source: Own elaboration from EU Member States DCF data submission

4.5.4 Main species produced and economic performance by segment

Gilthead seabream remains the main species produced by the Cypriot aquaculture sector representing 72% of the total weight and 67% of the total value of production in 2022. The other important species is European seabass accounted for 26% of the production volume and 31% of the total value. Freshwater fish and other species represent less than 1% of total volume and of total value.

Figure 71. Main species in terms of weight and value in Cyprus production: 2022.

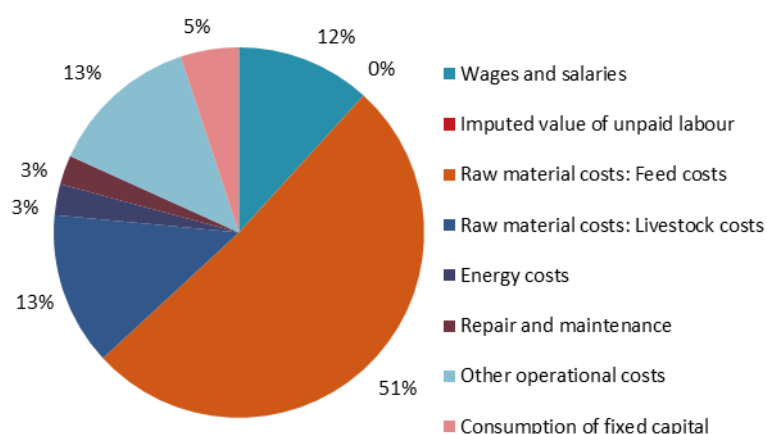


Source: Own elaboration from EU Member States DCF data submission

Cost Structure

The largest by far cost item of the Cyprus aquaculture sector in 2022 was the raw materials: feed costs, which accounted for more than half (51%) of the total expenses of the sector. The next most significant cost was the raw material: livestock costs which represented 13% of the total costs of the sector. It is pretty clear that the raw material costs Feed and livestock which account together for 64% of total cost are the most important expenditures and thus, any change in these two cost times affects greatly the economic performance of the sector

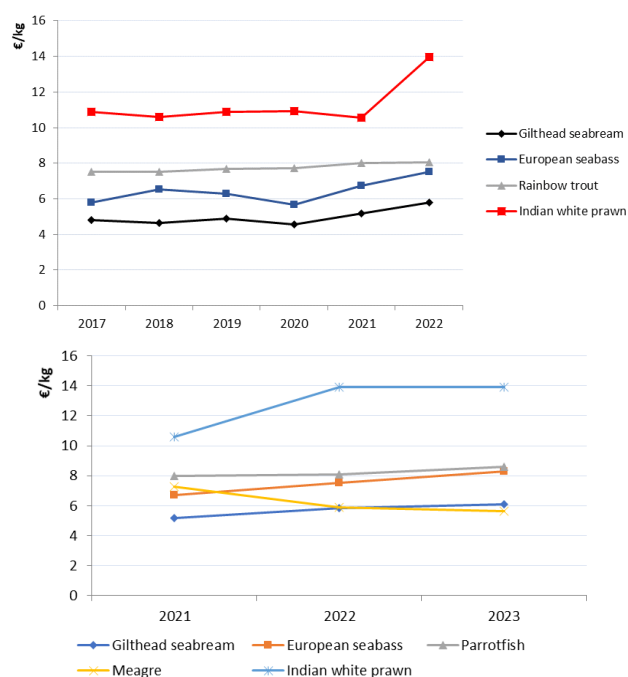
Figure 72. Cost structure of the Cyprus Aquaculture sector: 2022.



Source: Own elaboration from EU Member States DCF data submission

The average prices for the period 2017-2022 of the most important species for the Cyprus aquaculture sector are presented in Figure 72. Apart from the price of rainbow trout which was stable at around €8 per kg in the period 2017- 2022 the prices of the other species have gone up. In particular, in 2022 the average price of Gilthead seabream increased to €5.8 per kg from €5.2 per kg in 2021, whereas the average price of European seabass showed a bigger increase. Actually, it has gone up from €6.7 per kg in 2021 to €7.5 per kg in 2022. The species that enjoyed the biggest increase was the Indian white prawn, which increased significantly from €10.6 per kg in 2021 to €14 per kg in 2022.

Figure 73. Average prices for the main species produced in Cyprus, FAO data (on the left) and DCF reported (on the right): 2017-2022.



Source: Own elaboration from EU Member States DCF data submission and FAO (2024) data

4.5.5 Outlook

Nowcasts for 2023

In 2023, the Cyprus aquaculture sector is predicted to keep its profitability, but at a lower amount. The turnover on 2022 was very high and it is very difficult to be maintained in 2023, as well. The increase in feed costs, which is the by far the largest cost item of the sector is expected to increase significantly the operating costs and thus, leading to the reduction of the profits. The return on investment in 2023 is expected to be positive but lower than the one of 2022.

Trends and triggers

Aquaculture in Cyprus shows a growing trend and the sector adjusts to different consumer needs. Recently, one of the main companies of the sector entered dynamically in the field of processing its own products. It is mainly engaged in filleting sea bream and sea bass.

Main drivers:

- Progress of Marine Spatial Planning in such a way that aquaculture can have necessary ground infrastructure. (Further analysis follows in “Social acceptance” chapter).
- Construction of collective infrastructure to serve the Marine Aquaculture Units (Port and Land Facilities) operating in the wider Vasilikos-Monis area financed by Recovery and Resilience Plan (RRF). The total amount of this very significant project is around €35 million and it is expected its implementation to begin in 2025.
- Funding from European Structural Funds (EMFF, EMFAF) such as modernization of the existing capacities and the use of more advanced technologies.
- New markets for export of aquaculture products.

Entered dynamically in fish processing that increases added value of products and diversifies the supply.

Main challenges:

- Increasing operational costs, especially the rise in raw material prices that reduces profitability.
- Very competitive market.

Social Acceptance

Cyprus has recently progressed with Marine Spatial Planning in such a way that aquaculture can have necessary ground infrastructure combined for more units where possible. Specifically, within the framework of this legislation provisions are included both for securing marine areas for the operation of marine aquaculture units and for its future development.

With the adoption of this legislation, the planning and use of the maritime space in Cyprus will no longer be done in a piecemeal manner and will be done on the basis of an integrated spatial plan that focuses on sustainable development. In this way, a stable zoning framework is expected to emerge which will provide legal certainty and predictability and will have a positive impact in terms of promoting investments in various sectors and industries operating in the Marine area, including aquaculture.

4.5.6 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 since its production below a certain threshold. Cyprus only produces a small amount of aquaculture products. According to the latest (2022) EU aquaculture production reported to the EUROSTAT, Cyprus production is 0.7% of the total EU aquaculture production. Thus, Cyprus was not obliged to provide economic data for this report. However, Cyprus provided some data but not the whole set of data needed for this report. As a consequence, the analysis of the Cypriot aquaculture sector is therefore based both on data extracted from FAO in regards to historical data and DCF data.

4.6 Czechia

Overview of Czech aquaculture

Czechia has a centuries-old tradition of aquaculture in earthen ponds. Czechia is a landlocked country producing only freshwater aquaculture products. Production in recent years has been close to 20 thousand tonnes, and the dominant species in production remains common carp.

4.6.1 Total Production and sales

The Czech aquaculture sector produced 24.1 thousand tonnes of fish in 2022. This production was valued at about €66.3 million. Czechia produces only freshwater species.

The production has been showed increasing trend between 2017-2022, in terms of volume and increasing trend in terms of value. Following the decline in production and its value that took place in 2020, activity has increased again during 2021 and 2022. In the last year analysed, production and its value have grown by 2% and 40%, respectively, compared to 2021.

4.6.2 Industry structure and total employment

In 2022, there were 440 companies, employing 2 463 employees.

Table 38. Production and sales, industry structure and employment for Czechia: 2017-2022.

Variable	2017	2018	2019	2020	2021	2022	Change 2021-22	Develop. 2022/(17-21)
Sales weight (thousand tonnes)	24.5	23.9	23.8	22.5	23.5	24.1	▲ 2%	■ 2%
Sales value (million €)	51.7	49.9	47.0	42.7	47.5	66.3	▲ 40%	▲ 39%
Number of enterprises	480	480	480	480	480	440	▼ -8%	▼ -8%
Employment	2,332	2,189	2,193	2,391	2,180	2,463	▲ 13%	▲ 9%
FTE	816	794	678	725	671	808	▲ 20%	▲ 10%

Source: Own elaboration from EU Member States DCF data submission

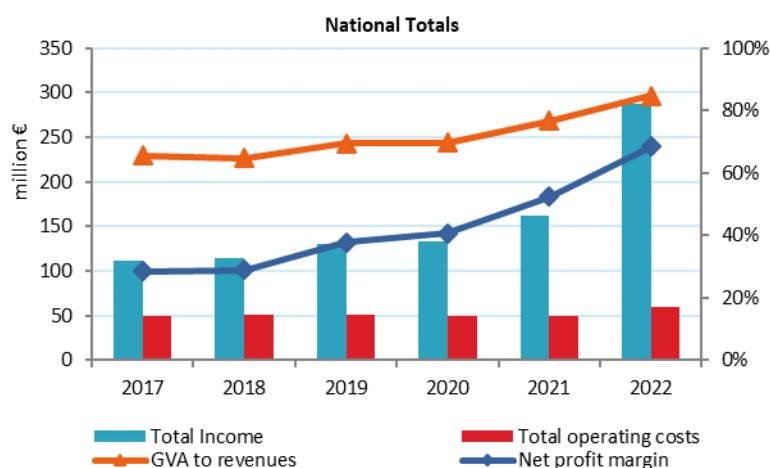
4.6.3 Overall Economic performance

The economic performance of the Czech aquaculture sector has increased during the period analysed. The GVA reached €244 million in 2022. Total incomes from the aquaculture industry are significantly higher than the sales value of production due to the existence of revenues reported as other incomes.

4.6.4 Main species produced and economic performance by segment

According to available FAO statistics, the common carp was the main species produced by the Czech aquaculture sector, representing 85% in terms of volume and 84% in terms of value in 2022. According to Multiannual National Strategic Plan for aquaculture for the years 2021 to 2030, from 40 to 50% of carp production is intended for export - to, among others, Germany (a decline in recent years), Slovakia (a decline), Belgium, France, Italy and Poland (export to the latter market is subject to strong fluctuations, but some farms adapt the production system to the requirements of the Polish market). The prospects for growth in ponds production are small, and the limitations result not only from market barriers in export and on the domestic market, but also from water deficits and the shallowing of some ponds.

Figure 74. Economic performance in € million, indicators for the Czech aquaculture: 2017-2022.



Source: Own elaboration from EU Member States DCF data submission

Table 39. Economic performance of the Czech aquaculture sector: 2017-2022.

Variable	2017	2018	2019	2020	2021	2022	Change 2021-22	Develop. 2022/(17-21)
Number of enterprises	480	480	480	480	480	440	▼ -8%	▼ -8%
FTE	816	794	678	725	671	808	▲ 20%	▲ 10%
Average wage (thousand €)	19.9	21.0	24.2	17.6	22.7	27.4	▲ 21%	▲ 30%
Labour productivity (thousand €)	89.2	93.2	133.4	128.2	185.5	302.3	▲ 63%	▲ 140%
Sales weight (thousand tonnes)	24.5	23.9	23.8	22.5	23.5	24.1	▲ 2%	▲ 2%
Total income (million €)	111.0	114.2	130.0	133.5	162.3	288.1	▲ 77%	▲ 121%
Total operating costs (million €)	49.9	51.4	51.3	49.0	49.1	59.7	▲ 22%	▲ 19%
Gross Value Added (million €)	72.8	74.0	90.4	92.9	124.5	244.2	▲ 96%	▲ 169%
Net profit (million €)	31.6	33.0	49.1	54.3	85.0	197.5	▲ 132%	▲ 290%
Total value of assets (million €)	115.7	134.3	123.0	148.0	164.4	193.0	▲ 17%	▲ 41%
Net investments (million €)	17.4	15.3	21.2	13.0	13.3	15.4	▲ 16%	▼ -4%
Capital productivity (%)	62.9	55.1	73.5	62.8	75.7	126.5		
Return on Investment (%)	27.3	24.6	39.9	36.5	51.5	102.2		
Future Expectation Indicator (%)	-10.4	-10.7	-6.9	-11.8	-9.4	-8.1		

Source: Own elaboration from EU Member States DCF data submission

Silver, bighead carps, grass carp and tench are farmed in polyculture with common carp, and they represent 4.7% of production volume and 3.7% in value.

In Czech aquaculture, the importance of fish produced in intensive aquaculture is slowly growing, including salmonids (rainbow trout, brook trout) and North-African catfish. While trouts accounted for only 3.6% of production in 2022 in terms of quantity, in terms of value it already accounted for 6.1%.

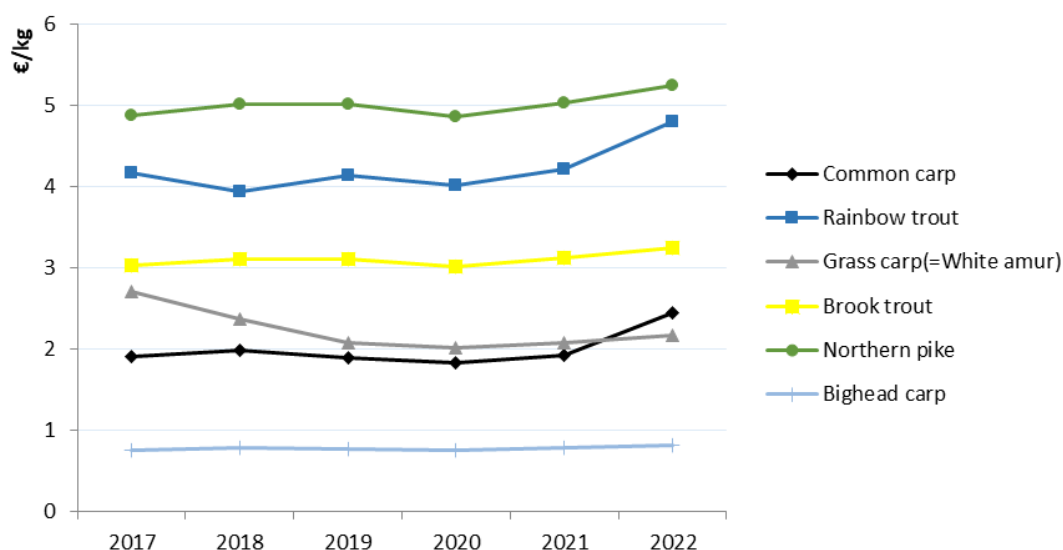
In 2022, the price of carp increased significantly (to €2.44/kg, which means a 24% increase compared to the previous year) and rainbow trout (to €4.80/kg, which means a 14% increase). The prices of other fish species increased only slightly (by about 4% year on year).

Figure 75. Main species in terms of weight and value in Czechia: 2022.



Source: Own elaboration from FAO (2024) data

Figure 76. Average prices for the main species produced in Czechia: 2017-2022.

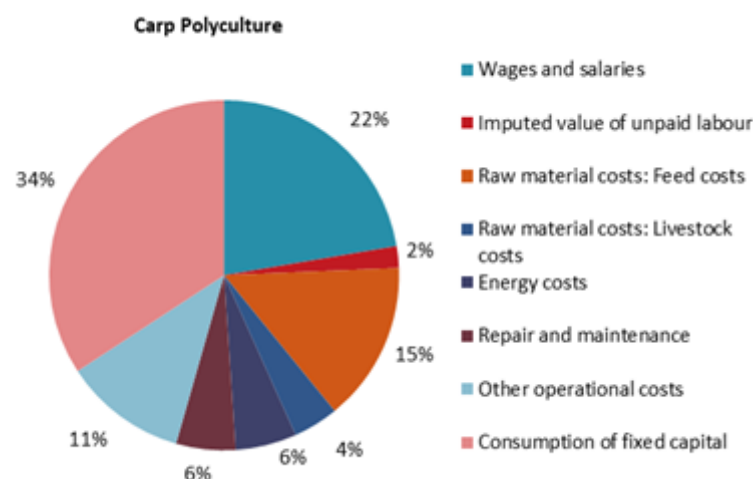


Source: Own elaboration from FAO (2024) data

Main segments

The main aquaculture segment in Czechia is carp polyculture. Figure 77 shows the cost structure of the carp polyculture, where the main cost is the consumption of fixed capital (i.e., depreciation of capital) with 34% of all the production costs, followed by wages and salaries (22%), and feed costs (15%).

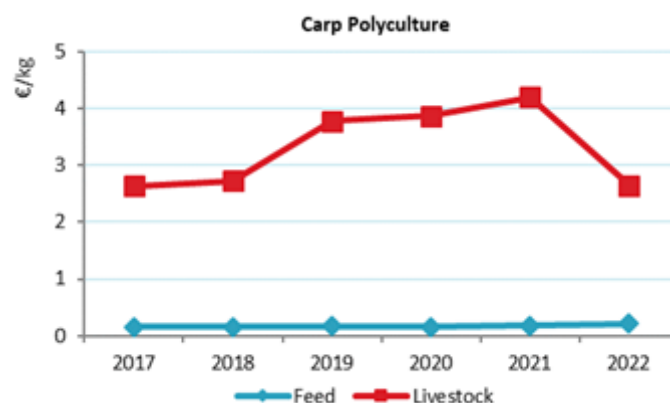
Figure 77. Cost structure in Czechia: 2022.



Source: Own elaboration from EU Member States DCF data submission

Figure 78 shows feed and livestock prices for carp polyculture. Feed cost have been around 0.2 €/kg for the period 2017-2022, while livestock prices fluctuated between 2.6 and 4.2 €/kg.

Figure 78. Feed and livestock average prices €/kg for the Czech carp polyculture segment: 2017-2022.



Source: own elaboration from EU Member States DCF data submission

4.6.5 Data Coverage and Data Quality

There is socio-economic data for carp polyculture, which is the main aquaculture segment in Czechia, for the whole period of analysis (2017-2022). The data submitted has been complemented in this chapter with FAO data to report minor productions of other species that are produced together carps. The share of Czech aquaculture is under 2.5% of total EU production and value, so the reporting is not mandatory under the DCF.

The interpretation of the economic performance indicators has to be done with caution since the existence of high amounts of other incomes affects the calculation of GVA and EBIT, as well as the rest of the economic and productivity indicators, which are biased by the existence of extraordinary income not related to the ordinary activity of the companies.

4.7 Denmark

Overview of Danish aquaculture

The Danish aquaculture sector mainly produces trout in cages, ponds and recirculation systems and blue mussels on longline. In 2022, the total sales weight show a decrease of 2%, whereas the sales value increased 7% compared to 2017 to 2021. From 2021 to 2022, the sales weight decreased 3% and the value increased 11%. The segment trout cages and blue mussels provided a positive net profit, whereas trout ponds and trout in recirculation systems had a negative net profit.

4.7.1 Total Production and sales

In total, the Danish aquaculture sector produced 56 258 tonnes in 2022, which is a slight decrease compared to 2021, however, an increase of 4% compared to 2020. The total sales value reached €213 million in 2022, which is an increase from both 2020 and 2021 of 15% and 11%, respectively. Compared to the average of 2017 to 2021, the total sales weight has decreased 2%, and the total sales value increased 7% in 2022.

4.7.2 Industry structure and total employment

In 2022, the total population of commercial aquaculture farms was 181, distributed amongst 79 enterprises. The sector is dominated by small enterprises with less than 5 employees, which amounted to around 70% of the enterprises in 2022.

Table 40. Production and sales, industry structure and employment for Denmark: 2017-2022.

Variable	2017	2018	2019	2020	2021	2022	Change 2021-22	Develop. 2022/(17-21)
Sales weight (thousand tonnes)	53.6	55.9	64.5	54.1	57.8	56.3	-3%	-2%
Marine	13.8	14.4	14.4	11.3	12.3	13.6	11%	3%
Freshwater	37.4	38.4	41.2	35.9	36.7	32.0	-13%	-16%
Shellfish	2.4	3.1	8.9	6.9	8.9	10.7	19%	76%
Sales value (million €)	205.1	205.9	210.7	180.8	192.2	213.0	11%	7%
Marine	74.3	71.8	60.8	53.8	58.2	78.2	34%	23%
Freshwater	129.3	131.9	144.4	123.7	128.5	129.2	0%	-2%
Shellfish	1.4	2.3	5.5	3.3	5.5	5.7	3%	58%
Number of enterprises	100	99	94	90	84	79	-6%	-15%
Marine	4	4	4	4	4	4	0%	0%
Freshwater	92	89	82	77	72	64	-11%	-22%
Shellfish	4	6	8	9	8	11	38%	57%
Employment	662	681	675	675	643	602	-6%	-10%
Marine	137	146	90	95	133	137	3%	14%
Freshwater	504	507	533	530	473	427	-10%	-16%
Shellfish	21	28	52	50	37	38	3%	1%
FTE	388	399	426	425	500	459	-8%	7%
Marine	94	101	64	65	98	99	2%	18%
Freshwater	282	282	329	331	374	332	-11%	4%
Shellfish	12	16	33	29	28	28	-2%	17%

Source: Own elaboration from EU Member States DCF data submission

The total number of persons employed in 2022 was 602, corresponding to 459 FTE. From 2021 to 2022, the number of employees decreased by 6%, whereas the number of FTE decreased with 8%. Compared to the average from 2017 to 2021, the number of employees has decreased by 10% whereas the FTE has increased by 7% in 2022.

4.7.3 Overall Economic performance

From 2021 to 2022, total income increased by 13%, while total operating cost increased by 10%. The total wages also increased by 7% resulting in an increasing gross value added (GVA) of 27%. Depreciation of capital increased by 11%, which resulted in a slightly negative overall profit of €0.1 million. This is the best net profit result over the past three years, however, compared to the years 2017 and 2018 it is a relatively a poor result. The reason for the poor economic result stems from the segments "trout recirculating systems" and "other land based recirculating systems" producing a variety of species in closed recirculating aquaculture system. These two segments alone contribute with a negative net profit of almost €10 million in 2022.

Table 41. Economic performance of the Danish aquaculture sector: 2017-2022.

Variable	2017	2018	2019	2020	2021	2022	Change 2021-22	Develop. 2022/(17-21)
Total income	208.7	217.4	222.6	190.8	195.3	220.6	▲ 13%	▲ 7%
Total operating costs	177.5	192.9	208.2	185.9	190.5	209.1	▲ 10%	▲ 9%
Total wages	26.4	31.1	32.6	32.0	28.2	30.3	▲ 7%	■ 1%
Gross Value Added	57.6	55.6	47.1	37.0	33.0	41.9	▲ 27%	▼ -9%
Depreciation of capital	8.9	9.5	10.6	10.9	8.4	9.3	▲ 11%	▼ -4%
Earning before interest and tax	22.3	15.0	3.8	-6.0	-3.6	2.3	▲ 164%	▼ -63%
Financial costs, net	2.9	2.9	1.3	2.7	1.3	2.4	▲ 92%	▲ 9%
Net profit	19.5	12.0	2.5	-8.7	-4.9	-0.1	▲ 98%	▼ -103%
Total value of assets	225.9	260.3	278.3	269.6	252.1	288.2	▲ 14%	▲ 12%
Capital productivity (%)	25.5	21.4	16.9	13.7	13.1	14.5	▲ 11%	▼ -20%
Return on Investment (%)	9.9	5.8	1.4	-2.2	-1.4	0.8	▲ 156%	▼ -70%

Source: Own elaboration from EU Member States DCF data submission

4.7.4 Main species produced and economic performance by segment

The two main species produced in the Danish aquaculture sector are rainbow trout and blue mussel. Rainbow trout is the dominating species in Denmark and constitutes 64% of the production weight and 76% of sales value. Blue mussel constitutes 23% of production weight but only 4% of sales value, due to the low price on mussels per kilo produced.

There are furthermore, several species produced in land based recirculation systems where salmon constitutes 3% of production weight and 4% of production value, European eel with 1% of production weight but 2% of production value due to a higher price per kilo. Finally, there is also a minor production of yellowtail amberjack and pike perch.

The price of blue mussel has been relative constant from 2017 to 2022, fluctuating between €0.5 and €0.7 per kg. However, the production volume has almost increased 5 times over the period, which has resulted in an increasing turnover of almost 300%.

The price of rainbow trout has increased in the same period, rising from €3.9 per kg in 2017 to €4.5 per kg in 2022, an increase of 16%. In the same period, total sales volume has decreased by 10%, whereas the total sales value have increased by 4%.

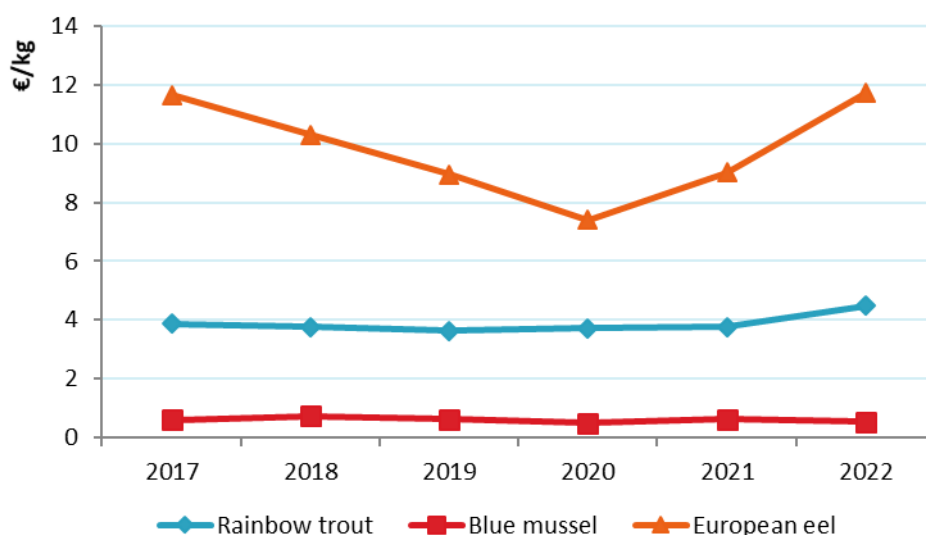
The price of European eel has fluctuated over the years, showing a low point in 2020 at €7.4 per kg increasing to €11.7 per kg in 2022. The total sales volume decreased by 54% and sales value decreased by 53% from 2017 to 2022, mainly due to reduced availability of glass eel and a reduction in demand.

Figure 79. Main species in terms of weight and value in Denmark: 2022.



Source: Own elaboration from EU Member States DCF data submission

Figure 80. Average prices €/kg for the main species produced in Denmark: 2017-2022.



Source: Own elaboration from EU Member States DCF data submission

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

- Trout Cages
- Trout Recirculation systems
- Trout Ponds
- Mussel Longline

In Table 42, the economic performance of the four most important segments in Danish aquaculture is presented. From the table, it can be seen that the gross value added is positive for all segments, but the net profit varies significantly from 2017 to 2022. In 2022, trout produced in sea cage farms and blue mussels produced on longlines have a positive net profit. On the other hand, trout produced in recirculated systems and in ponds provide a negative net profit.

However, looking at the Future Expectation Indicator for all segments it is positive in 2022. The indicator can be interpreted as a proxy for the industry's intent to stay in business in the medium/long term. Thus, if investment minus depreciation is positive, it means that the sector is allocating more resources in to the production to increase its future production capacity, which is seen as a positive sign for future production and results.

Table 42. Economic performance of main Danish aquaculture segments: 2017-2022.

Variable	2017	2018	2019	2020	2021	2022	Change 2021-22	2017	2018	2019	2020	2021	2022	Change 2021-22
	Trout Cages							Trout Recirculation systems						
Number of enterprises	4	4	4	4	4	4	0%	18	17	17	17	24	23	-4%
FTE	94	101	64	65	98	99	2%	71	53	88	99	190	176	-7%
Average wage (thousand €)	66.1	61.3	88.4	93.3	59.3	65.1	10%	78.1	124.5	98.8	71.5	55.5	67.2	21%
Labour productivity (thousand €)	219.2	195.2	235.3	189.6	166.8	214.0	28%	146.0	185.2	92.9	111.0	47.1	50.7	8%
Sales weight (thousand tonnes)	13.8	14.4	14.4	11.3	12.3	13.6	11%	16.3	15.1	17.9	16.1	22.1	19.8	-11%
Total income (million €)	75.7	74.9	60.6	55.8	59.9	82.0	37%	47.2	47.2	58.9	49.3	69.1	72.3	5%
Total operating costs (million €)	61.3	61.4	51.2	49.6	49.4	67.2	36%	42.4	44.0	59.4	45.4	70.7	75.1	6%
Gross Value Added (million €)	20.6	19.7	15.1	12.3	16.3	21.3	30%	10.4	9.8	8.2	11.0	8.9	8.9	0%
Net profit (million €)	12.1	11.6	8.0	5.0	9.2	13.5	47%	1.3	0.9	-2.2	2.3	-4.1	-5.6	36%
Total value of assets (million €)	56.3	51.2	48.8	54.5	63.3	86.5	37%	61.7	56.5	63.1	47.0	71.6	63.6	-11%
Net investments (million €)	1.6	1.6	3.1	2.2	4.3	2.7	-37%	2.4	3.2	7.8	4.9	1.9	3.4	74%
Capital productivity (%)	36.6	38.5	30.9	22.7	25.8	24.6		16.8	17.4	13.0	23.5	12.5	14.0	
Return on Investment (%)	22.3	23.2	16.8	9.6	14.7	15.5		3.6	2.4	-4.3	4.8	-5.6	-8.1	
Future Expectation Indicator (%)	-0.4	-0.1	3.8	2.2	5.0	1.6		-0.3	2.4	8.9	6.9	-0.7	1.8	
	Trout Ponds							Mussel Longline						
Number of enterprises	66	61	54	49	38	33	-13%	4	6	8	9	8	11	38%
FTE	175	165	162	150	112	89	-21%	12	16	33	29	28	28	-2%
Average wage (thousand €)	61.5	72.9	69.7	71.6	55.4	64.3	16%	57.8	53.6	36.8	49.6	59.1	62.8	6%
Labour productivity (thousand €)	103.4	104.6	87.6	115.1	36.1	58.7	62%	61.2	95.4	122.1	79.8	106.5	111.8	5%
Sales weight (thousand tonnes)	17.0	17.7	17.6	15.4	8.9	8.0	-10%	2.4	3.1	8.9	6.9	8.9	10.7	19%
Total income (million €)	62.4	64.8	66.0	58.6	37.7	34.3	-9%	1.5	2.5	5.5	3.8	5.5	5.7	3%
Total operating costs (million €)	55.1	59.6	63.1	52.0	39.8	34.8	-13%	1.5	1.8	2.7	2.9	4.2	4.3	4%
Gross Value Added (million €)	18.1	17.3	14.2	17.3	4.0	5.2	29%	0.7	1.5	4.0	2.3	3.0	3.1	3%
Net profit (million €)	3.6	2.0	0.9	3.6	-4.4	-3.8	14%	-0.1	0.5	2.4	0.4	1.0	1.0	1%
Total value of assets (million €)	67.5	63.4	61.7	60.4	46.2	48.2	4%	2.7	3.6	6.9	6.9	8.2	8.4	3%
Net investments (million €)	5.4	1.4	2.8	3.2	1.7	7.8	358%	0.0	0.0	0.3	0.1	0.5	0.6	3%
Capital productivity (%)	26.8	27.2	23.0	28.6	8.8	10.8		27.6	42.0	58.5	34.1	37.0	37.0	
Return on Investment (%)	6.9	4.4	1.1	6.5	-8.6	-6.5		-3.0	13.9	36.1	6.8	11.9	11.6	
Future Expectation Indicator (%)	4.1	-1.6	0.9	0.9	-0.3	10.7		-6.2	-5.1	0.0	-4.7	2.1	2.1	

Source: Own elaboration from EU Member States DCF data submission

Segment 1: Trout cages

The first segment is the sea cage farms producing trout in the Baltic Sea. The main product, besides fish, is trout eggs for consumption. In 2022, there were 18 farms distributed among 4 enterprises. The production volume was 13.6 thousand tonnes bringing about a total income of €82.0 million. This segment covers 24% of the sales volume and 37% of the total income in 2022.

Segment 2: Trout Recirculation systems

The second segment is land-based farms producing trout in recirculation systems. The product from these farms is mainly portion size trout of 300 to 400 grams with white meat; but they are also producing smolt to sea cage farms. The farms are in general larger than traditional pond farms and use more technology to clean the water on the farm and when discharged from the farms. The segment consists of 17 enterprises. The total sales volume was 19.8 thousand tonnes with a corresponding sales value of €72.3 million. This constitutes 33% of the total sales volume and 25% of the total income in 2022.

Figure 81. Economic performance in € million, indicators for the main Danish segments: 2017-2022.



Source: Own elaboration from EU Member States DCF data submission

Segment 3: Trout ponds

The third segments, which is the most important segment in Denmark in terms of number of enterprises is covering land-based production of trout in ponds. The segment consists of 33 enterprises with a total sales volume of 8.0 thousand tonnes with a corresponding income of €34.3 million. This constitutes 14% of the sales volume and 16% of total income in 2022. In most cases, enterprises in Denmark combine the production in hatcheries and nurseries with grow out farms. The product from these farms is mainly 300-400 gram trout for consumption, but they also produce different sizes and fish for live export and for put and take.

Segment 4: Mussels long line

The fourth segment is blue mussels on long lines. The production was 10.7 thousand tonnes, which generated an income of €5.7 million in 2022. The segment had 11 enterprises. The segment covers 19% of the sales volume but only 3% of the total income of the total Danish production in 2022.

Other segments

The Danish aquaculture sector also have production in two other segments.

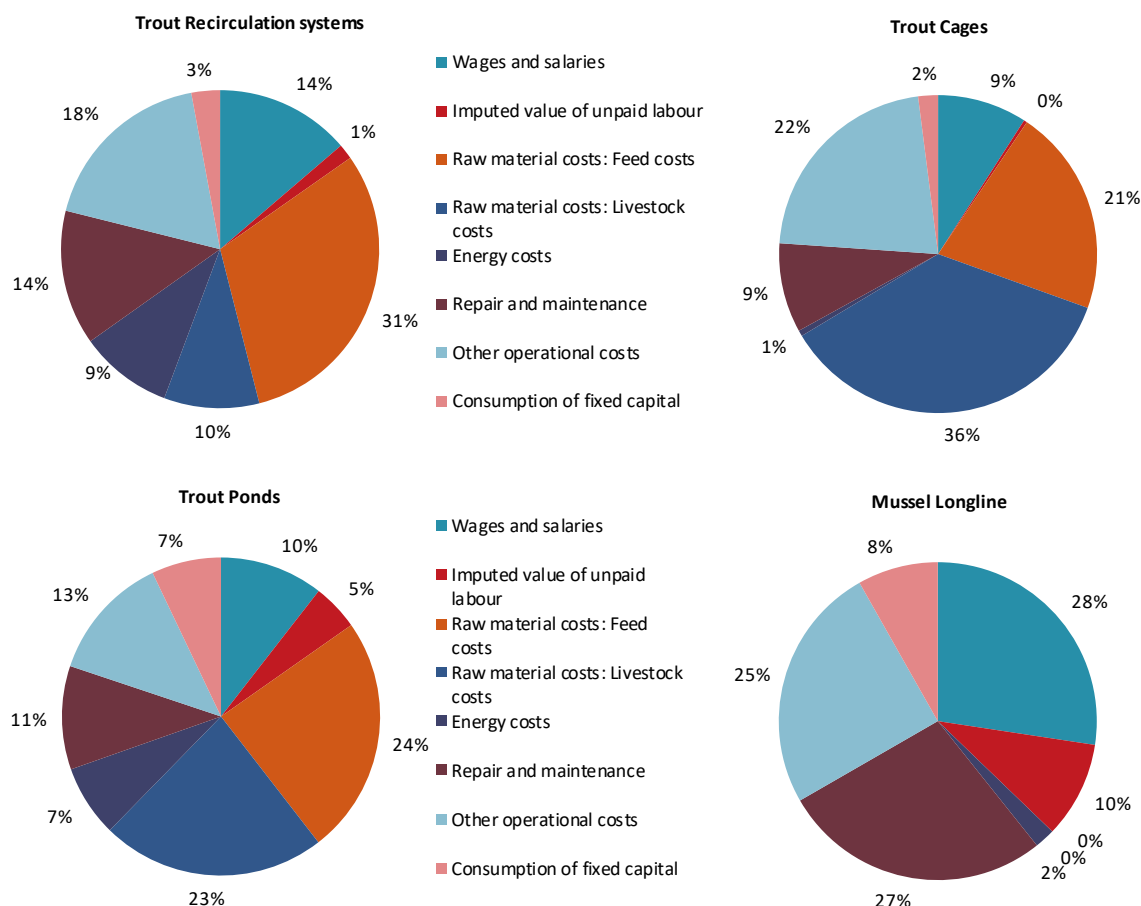
Eel Recirculation systems producing European eel for consumption. This segment has been declining over time due to fact that the production is based on wild caught glass eel and that reduction of the wild stock is a major concern. The production is only 0.4 thousand tonnes, which generated an income of €4.2 million. This correspond to 1% of the volume and 2% of the value of the total Danish production in 2022.

The segment Other freshwater fish in recirculation systems, contains species produced in land based recirculation systems. In 2022, the segments produced a total sales volume of 3.8 thousand tonnes, which generated an income of €22.3 million. This correspond to 7% of the volume and 10% of the value of the total Danish production.

In Figure 81, economic indicators for the four main segments are shown. It shows that Net profit margin is positive for trout cages for all years, whereas mussel longline have a positive profit from 2018 to 2022.

For Trout ponds, the GVA to revenue and net profit has decreased as the activity in this segment has slowed down, showing a significant negative profit for 2021 and 2022. Trout recirculated systems face a reduction in GVA to revenue and Net profit margin from 2020 to 2021 and again in 2022.

Figure 82. Cost structure of the main segments in Denmark: 2022.



Source: Own elaboration from EU Member States DCF data submission

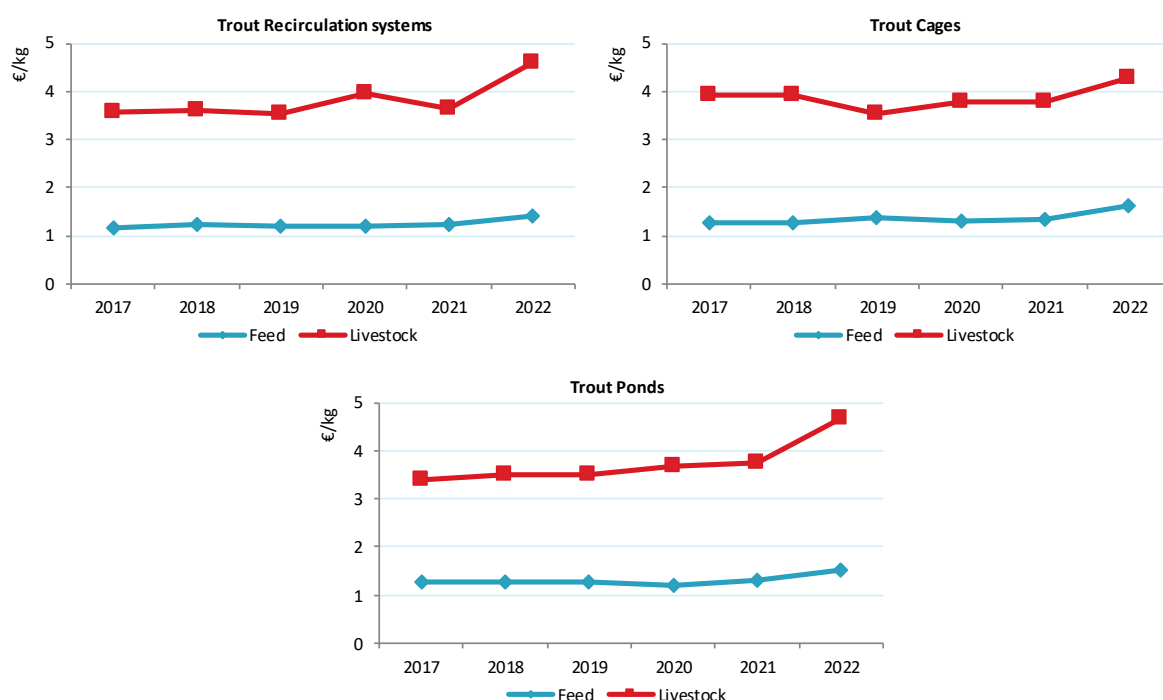
Figure 82 shows the cost structure for the four main segments, which account for 93% of the Danish aquaculture sales volume and 88% of the total income. It is noticeable that Feed cost is an increasing part of total costs as production methods get more specialized exemplified by trout produced in pond versus trout produced in recirculation systems. Conversely, Livestock costs decrease as production methods get more specialized. Another reason for the decreasing cost shown for fingerlings (livestock) is that there is vertical integration in the sector, which means that hatcheries and nurseries becomes a part of the grow out farms and the cost for livestock 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. The reason for the higher livestock cost in sea cage farms is that the size of fish is much larger when it is bought from freshwater farms and released into the sea cages.

Figure 83 below shows feed and livestock prices for Trout cages, Trout ponds and Trout recirculation systems. Even though the cost structures are different for Trout ponds and Trout recirculation systems, the price of feed and livestock are largely similar.

It can also be seen that the price of feed is quite similar for the sea cage farms and the other two types of production. It is noticeable, though, that the price of livestock is higher for Trout cages in the beginning of the period, but lower in the end. 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. Thus, the price per kilo is normally higher for larger smolts/fry. However, the more stable prices for sea cage farm may be a result of vertical integration of land based facilities for smolt production and sea cage farms, controlling the supply of smolts for the sea cage farms and thereby obtaining a

more stable price. The increase in the price of livestock for the other two segments may be a result of higher prices on feed and energy for the hatcheries, which is transferred to grow out farms.

Figure 83. Feed and livestock average prices €/kg for the main Danish segments: 2017-2022.



Source: own elaboration from EU Member States DCF data submission

4.7.5 Outlook

Nowcasts for 2023-24

Danish production volumes, values and employment collected by the Danish Directorate of Fisheries for 2023 have been used for the nowcasting of the Danish sales volume, value and employment for the years 2023 and 2024. The data collected forms the background for the Danish aquaculture account statistics from Statistics Denmark, but is the net production data. Therefore, the value and volumes are estimated based on 2023 data, but adjusted according to the difference experienced in 2022 between data from the Danish Directorate of Fisheries and the Danish account statistics for aquaculture. Data for 2024 is not yet available and therefore data for 2023 is used as a guesstimate.

Trends and triggers

Current production trends and main drivers

Mussel farming in Denmark has been increasing and been quite successful in terms of increasing both volume and value from the sector. However, a moratorium is now in place and no new production sites will be made available. Thus, production is not expected to increase. This could potentially harm the industry as economics of scale is a major driver and the industry will potentially attract less investment in the future.

There is also a moratorium for sea cage farming in Denmark. Thus, no new farms are expected in the near future, which also means that the current production is expected to be stable at the current level at 10-15 thousand tonnes.

The land-based production has shown a downward trend of production over the years. The production was expected to increase when the new regulation going from feed quotas to nitrogen quotas were fully implemented, however, the transition takes time and the number of farms have been reduced in the meantime. Thus, the production will stay at the current level around 30 thousand tonnes.

In Denmark, a few new farms are experimenting on the production of new species and using highly advanced recirculation systems. The species produced is Pikeperch, Atlantic salmon and Yellowfin amberjack (*Seriola Lalandi*). 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 emission 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. In 2022, these farms produced around 2 000 tonnes, however, the full operational capacity of these farms may exceed 6 000 tonne per year. These farms require a high initial investment and the financial reports from these farms suggest that it is difficult at the moment to generate a positive economic outcome, however, with a higher capacity utilization this might be possible in the near future. Some enterprises have managed to provide a positive net profit, while others are struggling with large deficits.

Issues of special interest

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 2022, around 10 land based farms and 1 sea cage farm all producing trout and all the blue mussel farms have been certified as organic. The organic producers of trout have higher costs for feed and fry, but they are also receiving a price premium for their products. It is, however, questionable how large the trout production volume can grow before the price premium will disappear. The bulk of production in this segment is mussels.

Production trends

COVID-19 impact

The Danish aquaculture sector doesn't seem affected by COVID-19 looking at the sales and income from 2020 compared to 2021 and 2022. Even though enterprises report diminishing sales it is not what the data collected reveals. Thus, some may have lost sales to restaurant and the fresh fish markets during the COVID-19 pandemic but others may have gained by changing market channels such as sales to supermarkets or focusing on the market for frozen or smoked products (Nielsen et al., 2022).

High energy prices

In particular, farms with recirculation systems are affected by the higher energy costs due to their design and need for continuously recirculating the water with electric pumps. The share of total cost on energy has increased from 5% in 2020 to 10% in 2022 for trout recirculation systems. Farms relying more on flow through systems like trout ponds experienced an increase in total cost share of energy from 4% in 2020 to 7% in 2022, whereas sea cage and mussel farms are less affected by the increasing prices.

Nevertheless, the increase in energy prices also affect the price of feed because the making of fishmeal and oil is an energy demanding process. It also affects the production of fingerlings, which in many cases is done in recirculated systems. Thus, even though the traditional aquaculture systems and sea cage farms are less affected directly, they are indirectly affected by the higher feed prices.

Social acceptance

The attitude towards the aquaculture sector in Denmark is both positive and negative.

On the positive side, consumers acknowledged that aquaculture farms provide healthy, high quality and safe food. It is also acknowledged that mussel and sea weed production have positive environmental effects removing nutrients from the water.

On the negative side, the finfish sector have received a lot of negative attention for its negative effects on the environment. However, the general public cannot distinguish the agriculture and aquaculture sectors from each other and do not know that finfish produced in aquaculture perform better than many other terrestrial animal protein producing sectors (Gephart et al., 2021; Bianchi et al., 2022).

Especially the negative perception hinders new licences to be issued. The competition for space and emission on land with the agriculture sector leaves little room for expanding the sector. At sea other industries (trawling and energy production) will not share the space with aquaculture. Thus, space is also a limitation for both finfish as well as for mussel farms. Even though mussels can improve the water quality.

Finally, many people do not know which fish are caught wild and which are farmed. This may give a misperception on what aquaculture is and what quality of fish is produced and the effects on environment and climate.

4.7.6 Data Coverage and Data Quality

Data quality

The account statistic for 2022 is based on a sample of 83 aquaculture farms, which covers 46% of the total population of 181 farms. In the data set sales volume and value 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 in which 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 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.

Other data issues or missing data

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.

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 operate more than one farm, which may 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 EU-MAP data compared with other official data sources

The Danish data for EU-MAP 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 EU-MAP 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 who reports to the EU-MAP. 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 sales 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 has mainly freshwater aquaculture. There is also a company in Estonia which started fish farming in sea cages in 2018. Since no data were submitted in the related data call, FAO data were used instead.

Total Production and sales

According to FAO data, total aquaculture production in 2022 were 801 tonnes valued €4.9 million. Compared to 2021, the production weight decreased by 6% and value increased by 13%. The development since 2017 also showed a decreasing trend in production weight and an increasing trend in the value. The average price for rainbow trout in 2022 was €5.7 per kilo, showing an increasing trend since 2019 (€3.3 per kilo).

Table 43. Production and sales for Estonia: 2017-2022.

Variable	2017	2018	2019	2020	2021	2022	Change 2021-22	Develop. 2022/(17-21)
Production weight (thousand tonnes)	0.9	0.9	1.1	1.1	0.8	0.8	▼ -6%	▼ -17%
Marine	0.0	0.0	0.2	0.1	0.3	0.3	▲ 10%	▲ 147%
Shellfish	0.0	0.0	0.0	0.0	0.0	0.0	▼ -22%	▼ -31%
Freshwater	0.9	0.9	0.9	1.0	0.6	0.5	▼ -13%	▼ -40%
Production value (million €)	3.7	4.2	3.7	4.3	4.3	4.9	▲ 13%	▲ 21%
Marine	0.0	0.0	0.6	0.5	1.3	1.5	▲ 14%	▲ 212%
Shellfish	0.0	0.0	0.0	0.0	0.0	0.0	▲ 34%	▲ 2%
Freshwater	3.7	4.2	3.1	3.8	3.0	3.4	▲ 13%	▼ -5%

Source: Own elaboration from FAO (2024) data

Industry structure

According to the data of the Estonian Agriculture and Food Board, 48 registered companies were operating in the aquaculture sector in 2020; 24 of them farmed fish and 24 were engaged in crayfish farming. However, shellfish production reported by the FAO is almost negligible.

Fish farms are small, with low employment rate. Due to the small volume the production are mainly marketed domestically.

Main species produced

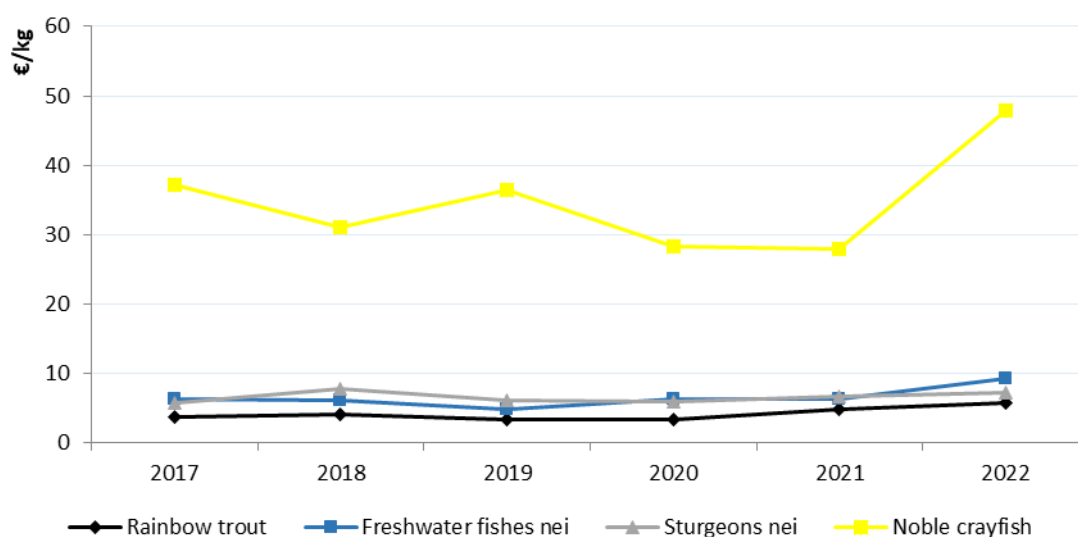
Rainbow trout remains the main species produced by the Estonian aquaculture sector representing 84% of the total weight and 79% of the total value of production in 2022. In most cases, fish of 1-2.5 kg intended for human consumption are farmed. Rainbow trout in portion size (250-400g) is also produced 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.

Figure 84. Main species in terms of weight and value in Estonian aquaculture production: 2022.



Source: Own elaboration from FAO (2024) data

Figure 85. Average prices for the main species produced in Estonian aquaculture: 2017-2022.



Source: Own elaboration from FAO (2024) data

Data Coverage and Data Quality

The share of the Estonian aquaculture is under 1% of total EU production and value, so the reporting is not mandatory under the DCF. The analysis of the Estonian aquaculture sector is therefore based on FAO data.

4.9 Finland

Overview of Finnish aquaculture

In 2022, the Finnish aquaculture industry produced 13.9 tonnes of fish and fry, generating a total turnover of €90.3 million. The industry consisted of 161 aquaculture enterprises engaged in both marine and freshwater production. It employed 583 people, amounting to 385 full-time equivalents (FTEs). The year 2022 was somewhat successful for the Finnish aquaculture sector in terms of sales volume and value. However, the sector experienced a net loss of €4.2 million. Significant differences in performance exist between various segments within the Finnish aquaculture industry, with the negative net profit primarily attributed to the poor performance of the recirculation systems segment (RAS).

4.9.1 Total Production and sales

In 2022, the Finnish aquaculture sector produced 13.9 thousand tonnes of fish and fry, generating a turnover of €94.3 million. Sales volume increased by 11%, while sales value rose by 17%. Rainbow trout accounted for 91% of the total production weight and 79% of the production value. European whitefish also plays an important role in Finland's food fish supply, contributing 7% to the total production weight and 13% to the production value. Combined, these two species made up 98% of the total production weight and 92% of the production value in Finnish fish farming.

The production of fry in fish farms primarily consists of rainbow trout fry for food fish farming. Additionally, fish farms produce fry of sea trout, Baltic salmon, grayling and pike-perch. In 2022, the hatcheries and nurseries segment contributed 24% of the sector's total turnover. There were four companies using RAS (Recirculating Aquaculture Systems) as their main technology, producing 1 500 tonnes of fish with total income of €10.5 million.

4.9.2 Industry structure and total employment

In 2022, Finland had 161 enterprises whose primary economic activity was aquaculture, a decrease of 12 enterprises compared to the previous year. The sector employed 583 people, amounting to 385 full-time equivalents (FTEs). Overall, the sector is highly concentrated, with most enterprises being micro-enterprises and only a few companies employ more than 10 people.

Table 44. Production and sales, industry structure and employment for Finland: 2017-2022.

Variable	2017	2018	2019	2020	2021	2022	Change 2021-22		Develop. 2022/(17-21)	
Sales weight (thousand tonnes)	12.6	11.9	12.6	13.1	12.6	13.9	▲	11%	▲	11%
Marine	9.0	8.2	8.9	8.7	8.2	8.8	▲	7%	■	2%
Freshwater	3.6	3.7	3.8	4.4	4.4	5.2	▲	17%	▲	30%
Sales value (million €)	84.0	78.9	76.5	73.3	79.4	94.2	▲	19%	▲	20%
Marine	51.0	48.0	47.7	40.3	41.8	49.6	▲	19%	▲	8%
Freshwater	33.0	30.9	28.8	33.0	37.6	44.6	▲	19%	▲	37%
Number of enterprises	177	157	165	160	173	161	▼	-7%	▼	-3%
Marine	28	29	32	28	28	25	▼	-11%	▼	-14%
Freshwater	149	128	133	132	145	136	▼	-6%	■	-1%
Employment	579	501	525	519	575	583	■	1%	▲	8%
Marine	186	161	184	153	155	147	▼	-5%	▼	-12%
Freshwater	393	340	341	366	420	436	▲	4%	▲	17%
FTE	350	320	320	370	395	385	▼	-3%	▲	10%
Marine	132	111	122	126	120	113	▼	-6%	▼	-8%
Freshwater	218	209	198	244	275	272	■	-1%	▲	19%

Source: Own elaboration from EU Member States DCF data submission, 2024.

4.9.3 Overall Economic performance

In 2021, the overall profitability of the aquaculture industry reached an all-time low. However, profitability has since improved, and 2022 was a somewhat successful year for the Finnish aquaculture sector in terms of sales volume and value. In 2022, the sector's total income was €101 million, resulting in losses of €3.7 million before interest and taxes (EBIT). The net profit of the industry was negative, amounting to €-4.2 million. Significant differences in economic performance exist among the various segments within the Finnish aquaculture sector, with the negative net profit primarily attributed to the poor performance of the recirculation systems segment. Total operating costs were €97.9 million, with the largest expenses being feed costs (34%), wages and salaries (17%), and livestock costs (17%) of the total operating costs.

Table 45. Economic performance of the Finnish aquaculture sector: 2017-2022.

Variable	2017	2018	2019	2020	2021	2022	Change 2021-22	Develop. 2022/(17-21)
Total income	85.6	81.5	78.3	75.8	82.7	101.1	▲ 22%	▲ 25%
Total operating costs	75.3	73.1	73.2	76.2	83.6	97.9	▲ 17%	▲ 28%
Total wages	14.8	13.2	14.0	15.0	17.5	18.9	▲ 8%	▲ 27%
Gross Value Added	25.0	21.6	19.1	14.7	16.6	22.1	▲ 33%	▲ 14%
Depreciation of capital	3.7	4.7	5.3	5.7	7.3	7.0	▼ -5%	▲ 30%
Earning before interest and taxes	6.5	3.8	-0.2	-6.0	-8.2	-3.7	▲ 54%	▼ -355%
Financial costs, net	-3.8	1.5	1.5	1.4	4.1	0.5	▼ -88%	▼ -47%
Net profit	10.3	2.3	-1.7	-7.4	-12.3	-4.2	▲ 66%	▼ -141%
Total value of assets	148.0	131.4	133.7	129.6	157.7	161.3	▲ 2%	▲ 15%
Capital productivity (%)	16.9	16.4	14.3	11.3	10.5	13.7	▲ 31%	▼ -1%
Return on Investment (%)	4.4	2.9	-0.1	-4.6	-5.2	-2.3	▲ 55%	▼ -329%

Source: Own elaboration from EU Member States DCF data submission, 2024.

4.9.4 Main species produced and economic performance by segment

Food fish production in 2022 was primarily made up of rainbow trout, which accounted for 91% of the total production weight and 79% of the production value. The second largest species in terms of production weight and value was European whitefish, making up 7% of the production weight and 13% of the production value.

Figure 86. Main species in terms of weight and value in Finland: 2022.



Source: Own elaboration from EU Member States DCF data submission, 2024.

The production of fry in fish farms mainly consists of rainbow trout fry for food fish farming. Fish farms also produce fry of Baltic salmon, landlocked salmon, brown trout, sea trout, and grayling. In 2022, the hatcheries and nurseries segment generated 29% of the sector's total income.

Finnish aquaculture sector is divided into 5 segments in the EU-MAP:

- Trout Cages
- Trout Tanks and raceways
- Trout Recirculation systems
- Trout Hatcheries and nurseries
- Other freshwater Fish Ponds

The primary fish farming method for human consumption is trout cage farming, which encompasses the production of marine rainbow trout and European whitefish. Two other trout food production methods include inland food fish farming in tanks and raceways, as well as recirculation systems. Additionally, the hatcheries and nurseries segment also includes farms involved in rainbow trout production. The final and smallest segment consists of natural food ponds, which produce freshwater juveniles for restocking.

Table 46. Economic performance of main Finnish aquaculture segments: 2017-2022.

Variable	2017	2018	2019	2020	2021	2022	Change 2021-22	2017	2018	2019	2020	2021	2022	Change 2021-22
	Trout Cages							Trout Hatcheries & nurseries						
Number of enterprises	28	29	32	28	28	25	▼ -11%	25	24	24	23	29	29	▬ 0%
FTE	132	111	122	126	120	113	▼ -6%	128	125	93	105	101	131	▲ 30%
Average wage (thousand €)	37.5	35.8	40.6	39.8	48.8	48.9	▬ 0%	43.1	42.1	49.2	42.2	45.4	50.3	▲ 11%
Labour productivity (thousand €)	138.2	178.3	144.3	79.9	111.4	154.2	▲ 38%	72.2	65.5	59.7	59.4	82.9	86.4	▲ 4%
Sales weight (thousand tonnes)	9.0	8.2	8.9	8.7	8.2	8.8	▲ 7%	2.2	2.2	1.8	1.7	1.6	2.7	▲ 69%
Total income (million €)	51.5	48.8	49.1	41.0	42.4	52.7	▲ 24%	21.7	21.8	16.5	18.3	20.4	29.6	▲ 46%
Total operating costs (million €)	38.2	33.0	36.5	35.9	34.9	40.8	▲ 17%	17.9	18.8	15.5	16.5	16.6	24.9	▲ 50%
Gross Value Added (million €)	18.2	19.8	17.6	10.1	13.4	17.4	▲ 30%	9.2	8.2	5.6	6.2	8.4	11.3	▲ 35%
Net profit (million €)	16.4	14.1	10.9	3.1	5.1	9.1	▲ 80%	3.5	2.3	0.2	1.6	3.5	4.5	▲ 30%
Total value of assets (million €)	53.6	46.4	55.1	47.7	52.3	56.9	▲ 9%	23.5	26.5	19.5	19.2	21.9	36.6	▲ 68%
Net investments (million €)	2.2	2.4	2.6	3.5	2.9	4.8	▲ 65%	0.6	2.3	1.0	1.1	0.6	1.8	▲ 179%
Capital productivity (%)	34.0	42.7	32.0	21.1	25.6	30.6		39.4	30.9	28.6	32.6	38.3	30.9	
Return on Investment (%)	21.7	30.8	20.0	6.8	9.9	16.4		13.5	8.9	1.7	6.5	13.7	9.7	
Future Expectation Indicator (%)	0.9	1.9	1.8	3.6	1.1	3.9		0.2	6.5	1.9	3.0	-0.7	1.7	
	Trout Recirculation systems							Trout Tanks and race-ways						
Number of enterprises	7	5	5	5	6	4	▼ -33%	18	15	17	14	15	16	▲ 7%
FTE	50	45	59	68	83	93	▲ 12%	24	21	21	10	18	39	▲ 117%
Average wage (thousand €)	57.2	53.3	48.0	49.1	51.4	51.5	▬ 0%	38.4	41.8	44.8	36.2	28.3	25.8	▼ -9%
Labour productivity (thousand €)	-108.8	-193.9	-116.0	-69.5	-113.5	-101.6	▲ 11%	87.0	62.2	80.2	41.1	35.9	37.0	▲ 3%
Sales weight (thousand tonnes)	0.5	0.8	1.3	1.5	1.7	1.5	▼ -13%	0.8	0.7	0.6	0.5	0.5	0.8	▲ 63%
Total income (million €)	4.9	4.7	5.7	7.2	8.8	10.5	▲ 20%	5.3	3.8	4.1	2.4	2.7	4.7	▲ 73%
Total operating costs (million €)	13.1	15.8	15.4	15.3	22.4	24.7	▲ 10%	4.1	3.3	3.4	2.4	2.6	4.2	▲ 65%
Gross Value Added (million €)	-5.4	-8.7	-6.8	-4.7	-9.4	-9.4	▬ 0%	2.1	1.3	1.7	0.4	0.6	1.4	▲ 123%
Net profit (million €)	-10.6	-14.3	-13.3	-11.9	-21.1	-17.7	▲ 16%	1.0	0.3	0.5	-0.1	0.0	0.1	▲ 628%
Total value of assets (million €)	63.7	49.5	50.1	51.3	70.4	56.1	▼ -20%	4.7	4.5	5.0	3.3	3.6	5.6	▲ 54%
Net investments (million €)	2.3	25.2	2.6	6.9	2.3	0.0	▼ -98%	0.2	0.2	0.2	0.2	0.2	1.8	▲ 668%
Capital productivity (%)	-8.5	-17.6	-13.7	-9.2	-13.4	-16.8		44.6	28.8	33.7	12.5	17.9	25.9	
Return on Investment (%)	-14.7	-26.6	-24.3	-20.3	-23.9	-29.7		21.6	6.3	11.3	-3.0	0.8	3.8	
Future Expectation Indicator (%)	1.9	46.7	0.1	8.9	-1.2	-4.3		0.8	1.4	0.7	0.3	3.4	27.3	

Source: Own elaboration from EU Member States DCF data submission, 2024.

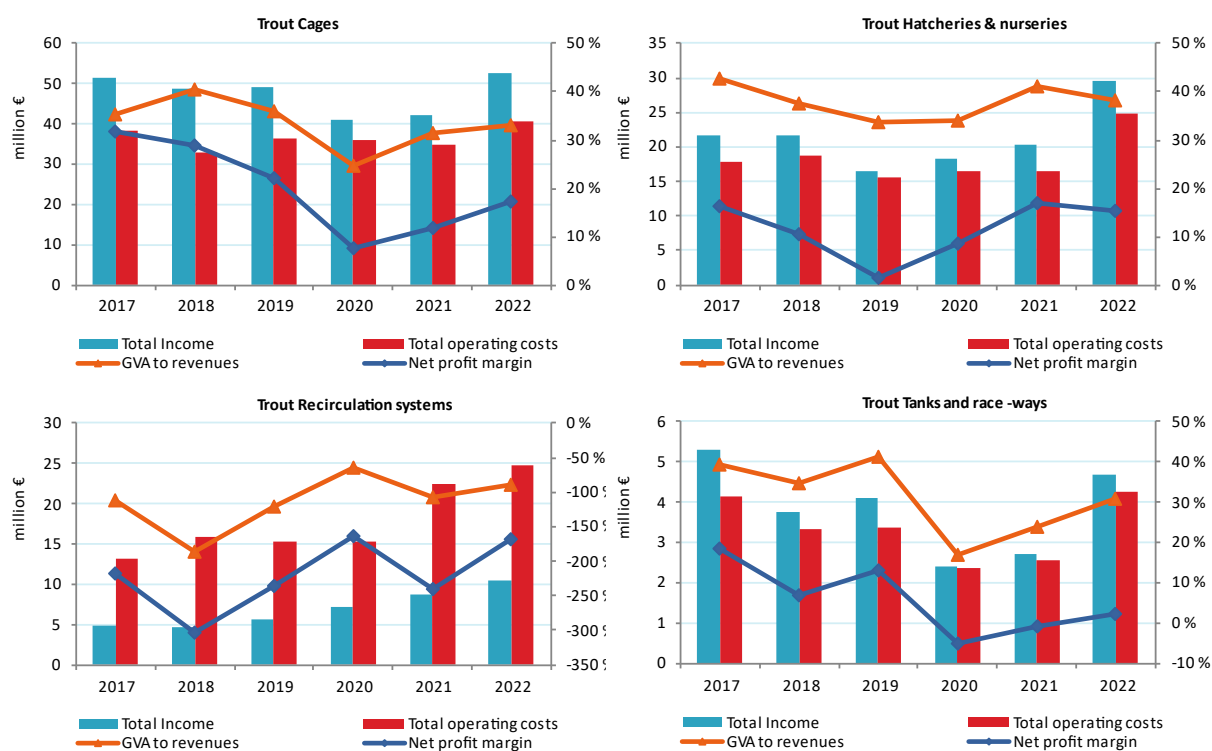
Segment 1: Trout cage production

In 2022, the most important segment in terms of production was the marine farming of rainbow trout and European whitefish in cages, with a total income of €52.7 million. The production was primarily rainbow trout (8.3 thousand tonnes), along with 470 tonnes of European whitefish. Gross value added increased to €17.4 million, and the segment recorded a net profit of €9.1 million in 2022. Marine cage farming remains the most profitable segment in the sector. Economic performance has improved following the challenges of 2020 and 2021, with the net profit now 8% higher than the long-term average from 2017 to 2021. In 2022, the return on investment also improved, reaching 16.4%.

Segment 2: Trout tanks and raceways

Trout tanks and raceways are traditional inland aquaculture production methods. In 2022, this segment produced 730 tonnes of rainbow trout and 63 tonnes of European whitefish. The total sales weight increased by 63% compared to the previous year, while total income surged by 73% to €4.7 million. Operating costs also rose accordingly, resulting in a net profit of €0.1 million for the segment in 2022.

Figure 87. Economic performance in € million, indicators for the main Finnish segments: 2017-2022.



Source: Own elaboration from EU Member States DCF data submission, 2024.

Segment 3: Recirculation systems

Recirculating aquaculture systems (RAS) are a developing segment in Finland. While this production method is becoming more common, it still faces challenges in achieving profitability. From an environmental perspective, RAS holds great potential, as nutrient loads can be easily managed, and optimal culturing conditions can be maintained year-round.

Despite significant investments in RAS in recent years, the segment continues to incur substantial losses, large enough to drive the entire Finnish aquaculture sector into negative profitability. In 2022, there were only four enterprises operating within the recirculation systems segment. These enterprises employed 93 full-time equivalents (FTEs) and produced 1.5 thousand tonnes of fish, generating a total income of €10.5 million. This represents a 20% increase in income compared to the previous year, and the total income has doubled over the past five years. Nonetheless, in 2022, total operating costs increased by 10%, and the segment reported losses of €17.7 million.

Segment 4: Trout Hatcheries and nurseries

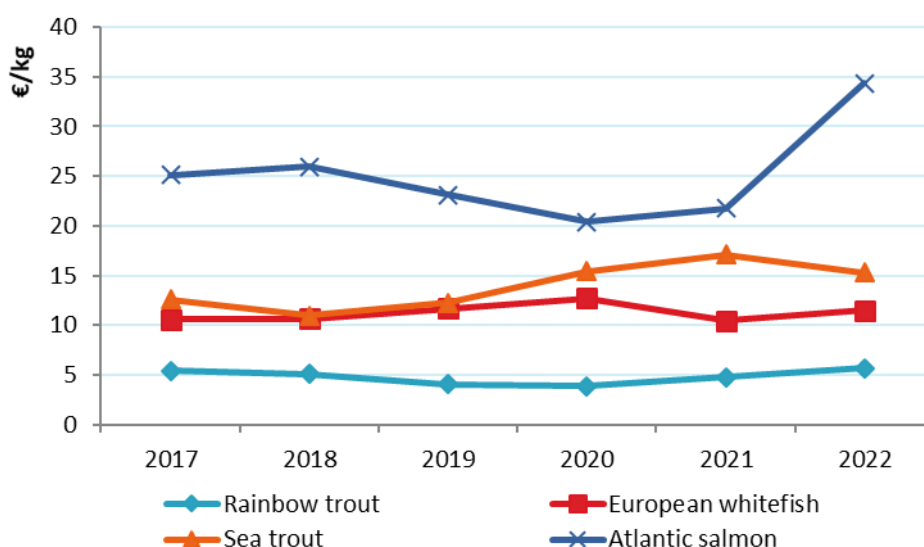
The production of fry in fish farms consists mainly of rainbow trout fry for food fish farming. Fish farms also produce Baltic salmon, landlocked salmon, brown trout, sea trout and grayling fry. In this segment, there are also enterprises with combined production of food fish.

The total income of the segment was €29.6 million in 2022, with 29 companies in operation. Income surged by 46% compared to the previous year, exceeding the long-term average by €10 million. Operating costs increased by 50%, reaching €24.9 million. Despite this, the segment's net profit rose by 30%, amounting to €4.5 million.

Segment 5: Other freshwater Fish ponds

Natural food fish ponds are traditional inland aquaculture production methods and the segment consist of small companies. Total sales volume decreased to 250 tonnes and the total income of the segment in 2022 was €3.7 million.

Figure 88. Average prices €/kg for the main species produced in Finland: 2017-2022.



Source: Own elaboration from EU Member States DCF data submission, 2024.

The cost structures for the four Finnish aquaculture segments are shown in Figure 89. The segments share somewhat similar cost structures, with feed costs being the largest expense. This is particularly evident in the Trout Cages and Trout Tanks and raceways segments, where feed costs account for nearly half of the total costs. The second most significant cost item in these two segments is livestock costs. The share of wages and salaries ranges between 12% and 24% of total costs.

However, the cost structure of the Trout Recirculation Systems segment is notably different from the other segments, with a much higher proportion of energy and other operational costs. Interestingly, the data from 2022 deviates from this trend, suggesting potential anomalies. In fact, Trout Hatcheries & Nurseries had the highest share of energy costs, largely due to the energy-intensive process of thermiculture used for fish fry during the winter months.

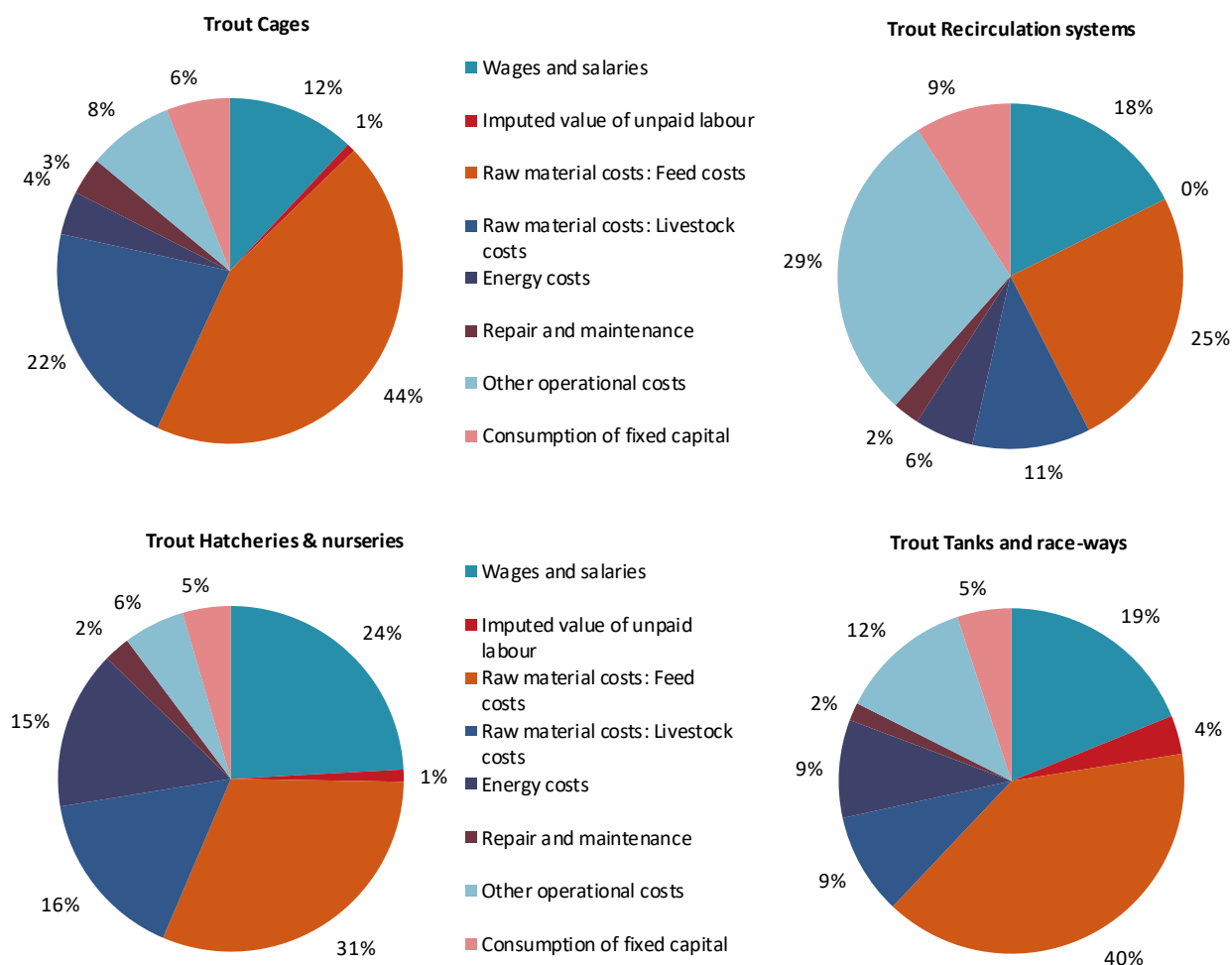
4.9.5 Outlook

Nowcast for 2023-2024

In 2023, all aquaculture companies, including both primary and secondary activity firms, produced approximately 15.2 thousand tonnes of food fish for sale. This total production was over one million

kilograms less than in 2022. The production of rainbow trout reached 14.4 million kilograms, accounting for 95% of the total food fish production. The value of food fish production amounted to €93 million, nearly 9 million lower than in 2022.

Figure 89. Cost structure of the main segments in Finland: 2022.



Source: Own elaboration from EU Member States DCF data submission, 2024.

Trends and triggers

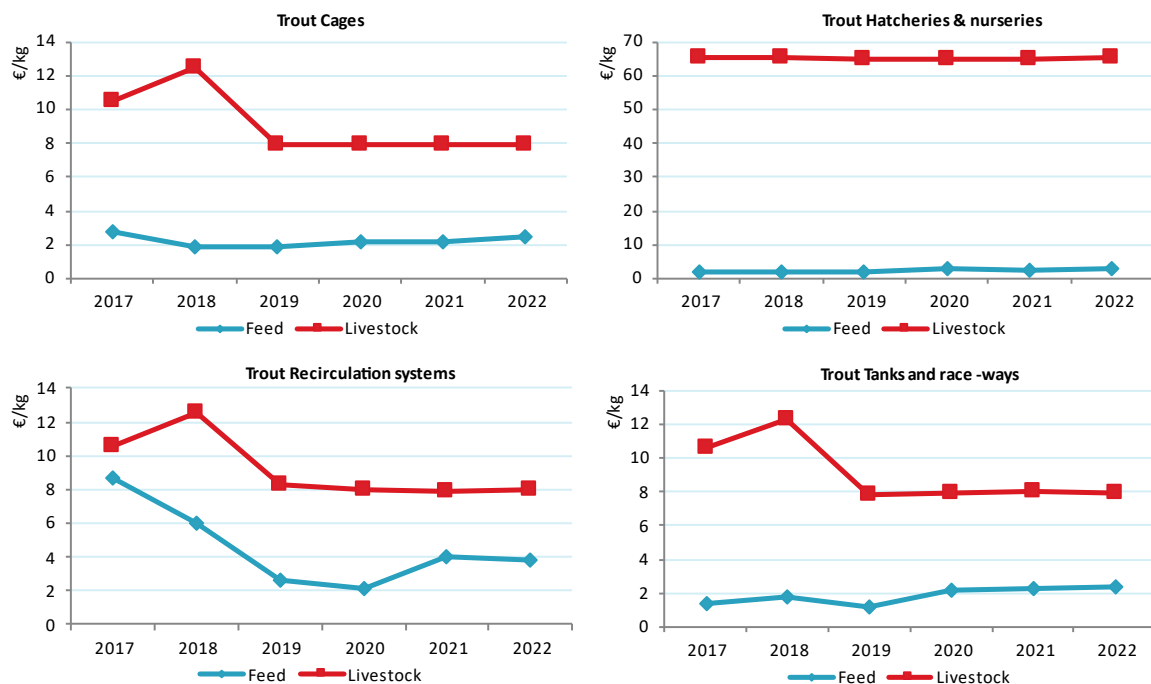
The Finnish aquaculture sector is becoming increasingly concentrated, with around ten enterprises generating more than half of the sector's total turnover. While this concentration allows the industry to benefit from economies of scale, it also makes it more vulnerable to risks such as viral outbreaks. For example, in 2021, Infectious Hematopoietic Necrosis (IHN) was detected at five fish establishments in Finland, necessitating corrective actions that impacted the performance of these enterprises. By 2022, production had recovered to previous levels.

Prices play a crucial role in the aquaculture sector. The industry's performance is heavily dependent on the prices of key species, particularly rainbow trout, salmon and, European whitefish. Additionally, feed and energy costs significantly impact overall profitability. In 2022, rising prices affected both the income and expenditure of the aquaculture sector. Generally, the Finnish economy is highly sensitive to interest rates. Over the past two years, interest rates have been too high from Finland's perspective, especially

since inflation has been lower than the EU average. This situation has significantly hindered the overall Finnish economy.

The cost structures of the various segments within the Finnish aquaculture sector differ, and as a result, changes in energy prices affect each segment differently. The trout recirculation systems segment is by far the most energy-intensive, making it the most impacted by high energy prices. As a developing segment that has seen significant investment, the rising energy costs present yet another challenge to investor confidence.

Figure 90. Feed and livestock average prices €/kg for the main Finnish segments: 2017-2022.



Source: Own elaboration from EU Member States DCF data submission, 2024.

The Finnish aquaculture sector was mainly affected by the COVID-19 through changes in the world markets of salmon. Together with decreased demand for fish, there was oversupply for salmon, which 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. In 2022 these impacts were negligible.

The Finnish aquaculture sector has been significantly impacted by environmental permit policies. These permits, granted to fish farms, effectively dictate the allowable volume of fish that can be produced. The primary reason for implementing the environmental permit system is to control nutrient load in the Baltic Sea. Fish ponds are the only facilities allowed to operate without the need for an environmental permit.

The restrictive environmental policy has, in part, limited aquaculture production and reduced the benefits of economies of scale. Finland has a National Spatial Planning Program aimed at concentrating aquaculture production in marine areas into larger production units and guiding production to locations where marine space can be optimally utilized. Moving marine aquaculture operations to larger units further offshore into open waters holds potential for increasing production. In recent years, the government has taken steps to streamline the process of obtaining environmental permits.

Due to the low environmental impact of recirculating fish farms, they are considered a promising means of increasing Finnish food fish production. Significant investments have been made in this technology over the past decade. In 2022, RAS fish farms produced approximately 1 500 tonnes of food fish,

primarily rainbow trout. However, making RAS operations profitable has proven to be a challenging task. There are also high expectations for Partial Recirculation Aquaculture Systems, which are hoped to optimize the economic potential of aquaculture while minimizing the environmental impact.

The government's program to promote domestic fish aims to ambitiously double fish consumption and domestic production in Finland by 2027. However, this goal has proven to be challenging, and unforeseen negative factors affecting the global fish economy are not making it any easier. To reach this target, it is essential to harness the growth potential of new technologies, both economically and environmentally. Changing consumer spending habits is difficult, but increased consumption would play a crucial role in achieving the goal, helping the industry to grow, become profitable, and expand.

4.9.6 Data Coverage and Data Quality

Data quality

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 are available for all firms in Statistical Business Register above tax liability threshold and 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 were estimated within stratum. Account data was surveyed by Natural Resources 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.

Data availability

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.

Confidentiality

Natural Resource Institute does not provide or publish any information about the financial statements or key indicators of individual companies.

Differences in EU-MAP data compared with other official data sources

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, also including production of companies that are not main activity producers whereas DCF data includes only those companies that have aquaculture as their main economic 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 2022, French aquaculture continues to be characterized by a better overall performance compared to the last five years (2017-2021). It is unsure if this trend will be confirmed in 2023, therefore, it is important to take a nuanced approach and look at the situation from different angles: both the segments specific to French aquaculture and the overall national and international context.

Certain species and segments are not included in the analysis for marine production (sea bass and sea bream (hatcheries, nurseries, and cages), and other marine fish on-growing), freshwater production (sturgeon (caviar) and species reared in ponds like carp, pike, pike perch, roach and burbot), shellfish production (mussel raft, mussel long line, other shellfish long line), and algae production (macroalgae, microalgae and spirulina).

4.10.1 Total Production and sales

This chapter includes the 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), and multispecies on-bottom and rafts.

These segments represented 231.9 thousand tonnes of farmed product in 2022, which corresponds to an increase of 2.4% compared to the average between 2017-2021 (226.4 thousand tonnes). Total production value increased by 10%: an average of €849.2 million (2017-2021) to €937 million in 2022 (Table 47). This significant increase can be attributed mostly to the 16% increase in the shellfish sector between 2020 and 2022, which might be interpreted as a return to and improvement on pre-COVID-19 production.

Table 47. Production and sales, industry structure and employment for France: 2017-2022.

Variable	2017	2018	2019	2020	2021	2022	Change 2021-22	Develop. 2022/(17-21)
Sales weight (thousand tonnes)	209.1	218.0	235.6	232.0	237.3	231.9	▼ -2%	▲ 2%
Freshwater	37.8	37.4	38.0	40.0	37.2	34.4	▼ -7%	▼ -10%
Shellfish	163.6	173.0	177.5	178.0	182.3	178.3	▼ -2%	▲ 2%
Others	7.7	7.5	20.1	14.0	17.8	19.3	▲ 8%	▲ 44%
Sales value (million €)	799.1	850.9	885.3	823.7	887.0	937.0	▲ 6%	▲ 10%
Freshwater	148.4	147.0	159.6	160.7	160.5	166.7	▲ 4%	▲ 7%
Shellfish	618.7	668.0	659.4	613.0	666.5	698.6	▲ 5%	▲ 8%
Others	32.0	35.9	66.3	50.0	60.0	71.7	▲ 19%	▲ 47%
Number of enterprises	2,779	2,782	2,516	2,527	2,386	2,584	▲ 8%	▼ -1%
Freshwater	324	327	327	313	291	315	▲ 8%	▼ 0%
Shellfish	2394	2394	2105	2134	1999	2163	▲ 8%	▼ -2%
Others	61	61	84	80	96	106	▲ 10%	▲ 39%
Employment	15,187	15,249	17,186	16,269	15,870	17,380	▲ 10%	▲ 9%
Freshwater	1477	1539	1566	1446	1763	1506	▼ -15%	▼ -3%
Shellfish	13308	13308	14435	14280	13404	15198	▲ 13%	▲ 11%
Others	402	402	1185	543	703	676	▼ -4%	▲ 4%
FTE	5,842	5,888	6,029	6,027	9,365	9,830	▲ 5%	▲ 48%
Freshwater	809	855	889	766	1,124	1,146	▲ 2%	▲ 29%
Shellfish	4,799	4,799	4,823	5,020	7,803	8,260	▲ 6%	▲ 52%
Others	234	234	317	242	438	424	▼ -3%	▲ 45%

Source: Own elaboration from EU Member States DCF data submission, 2024.

4.10.2 Industry structure and total employment

The overall positive outlook in 2022, in both the shellfish and freshwater sectors, shows a positive trend of recovery after the COVID-19 pandemic. In both sectors, there is a decline in volume of sales volume (-1.3% for the shellfish sector and -7.5% for the freshwater sector) but an increase in sales value (+6% for the shellfish sector and +3.9% for the freshwater sector). This means that despite a decrease in production, both sectors are successful in selling their product at a higher price.

In 2022, the total number of companies is 2 584, which represents an increase of 8.3% over both sectors compared to 2021. The overall decrease in number of companies observed in previous years seems to be moving in the other direction as numbers return to 2019/2020 metrics after a decrease in 2021. Overall, when taking the period 2017-2021 into consideration, the number of companies is remaining stable.

In 2022, 17 380 persons were employed in the French aquaculture sector, which corresponds to 9 830 full-time equivalents (FTE). The shellfish sector accounts for 8 684 FTEs, or 88% of the total FTEs in the French aquaculture sector. An aquaculture company employs on average 3.9 FTE (3.8 FTE for a shellfish enterprise and 3.6 FTE for a freshwater enterprise). In both sectors, these are mainly small enterprises.

4.10.3 Overall Economic performance

For segments where all economic indicators are available, the weight of the shellfish farming sector (85% of total turnover) heavily influenced the overall results of national economic performance. Therefore, an average indicator over all these segments can hide a disparity between segments.

Total revenues and total operating costs have increased since 2020, reaching €998.5 million and €778 million in 2022, respectively (Table 48). Wages represented 31% of total operating costs. Compared to the average over the 2017-2021 period, salary costs have remained stable (0.2% increase) and the cost item "capital depreciation" has increased by 5.3%. On the other hand, financial costs increased by 24% (due to the increase in interest rates after 2021). Overall, the aquaculture sector achieved a positive net profit in 2022 of €112.5 million (11% of total revenues).

Despite strong uncertainty in future production, a sector subject to natural hazards, and a possible decrease in investment due to COVID-19, it is viewed as important that professionals continue to reinvest in order to renew their outdated equipment. As earnings before interest and taxes have decreased (-6.2%) while total value of assets has increased (+4%), the return on Investment has decreased by 11% in 2022 over the 2017-2021 average.

Table 48. Economic performance of the French aquaculture sector: 2017-2022.

Variable	2017	2018	2019	2020	2021	2022	Change 2021-22	Develop. 2022/(17-21)
Total income	854.5	909.8	943.2	908.3	963.0	998.5	▲ 4%	▲ 9%
Total operating costs	652.4	695.7	708.3	682.3	717.4	778.0	▲ 8%	▲ 13%
Total wages	223.8	247.6	265.8	259.0	222.2	244.1	▲ 10%	▲ 0%
Gross Value Added	421.5	457.6	496.5	459.8	453.9	456.3	▲ 1%	▲ 0%
Depreciation of capital	73.8	77.6	97.1	98.2	85.2	91.0	▲ 7%	▲ 5%
Earning before interest and taxes	128.3	136.6	137.8	127.8	160.4	129.6	▼ -19%	▼ -6%
Financial costs, net	14.1	18.1	16.8	10.3	9.8	17.1	▲ 74%	▲ 24%
Net profit	114.2	118.5	121.1	117.5	150.6	112.5	▼ -25%	▼ -10%
Total value of assets	1144.1	1235.2	1486.4	1394.4	1212.6	1346.8	▲ 11%	▲ 4%
Capital productivity (%)	36.8	37.0	33.4	33.0	37.4	33.9	▼ -9%	▼ -5%
Return on Investment (%)	11.2	11.1	9.3	9.2	13.2	9.6	▼ -27%	▼ -11%

Source: Own elaboration from EU Member States DCF data submission, 2024.

4.10.4 Main species produced and economic performance by segment

The Pacific cupped oyster represents the largest share of French production with more than half of production sold i.e. 52% of the total volume and 55% of the total value (Figure 91). Blue mussels and rainbow trout are the second and third most important species.

Figure 91. Main species in terms of weight and value in French production: 2022.



Source: own elaboration from EU Member States DCF data submission, 2024.

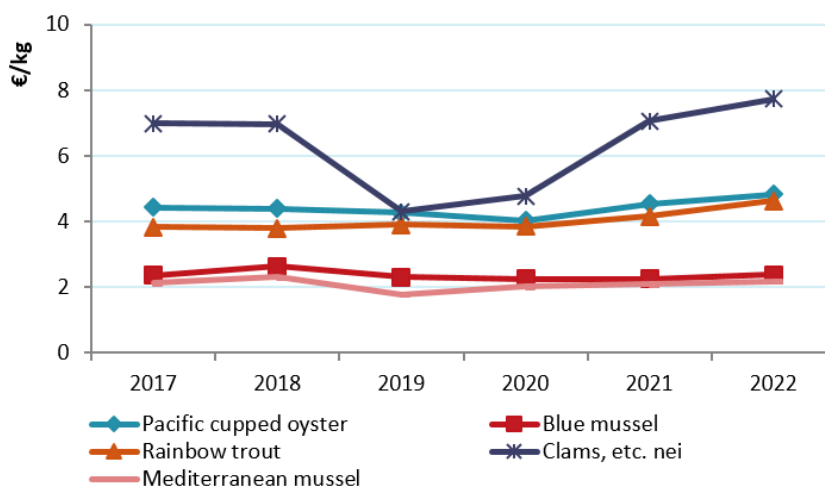
The production numbers (volume and value) combine the sales of juveniles (spat, smolts, etc.) to other aquaculture farms with adults sold for human consumption, so the average price obtained should be considered an overall indicator (Figure 92).

The Pacific oyster has seen a slight increase in its value over the last two years after relative stability between 2017 and 2020. Its selling price was around €4.44/kg during this period, rising to €4.80/kg in 2022, with relatively stable volumes and therefore an increase in value for this species.

After a very slight increase in the average price of rainbow trout between 2016 and 2020, with slight fluctuations over this period, its price rose above the €4/kg mark in 2021 to reach €4.60/kg in 2022, due to an increase in volumes sold.

Blue mussels and Mediterranean mussels are the least valued species, with an average price of €2.40/kg and €2.10/kg over the period 2017 to 2020, with an identical average price in 2022. After a sharp increase in volumes of Mediterranean mussels between 2018 and 2019, these volumes seem to be holding steady in 2022.

Figure 92. Average prices €/kg for the main species produced in France: 2017-2022.



Source: Own elaboration from EU Member States DCF data submission, 2024.

The highest-valued species in 2022 is the clam, with an average price of €7.77/kg, slightly higher but in line with 2017-2018 standards after a fall in price in 2019 and 2020. This rising average price is illustrated by the total value of clam production, which has risen from €12 million in 2017 to more than €27 million in 2022.

In Table 49, the economic performance of the 4 main French segments is presented and is completed by the Figure 93 which shows the GVA per revenue for 2022, slightly below the average for the last 5 years for the shellfish farming sector. For trout farms, GVA is almost at the record level of 2019.

The operational cost structures for the four French segments are detailed in Figure 94 and in Table 49. While the costs of wages and imputed value are the most important expenditure items for shellfish enterprises, the main burden for trout enterprises is logically the feed cost.

Table 49. Economic performance of main aquaculture segments: 2017-2022.

Variable	2017	2018	2019	2020	2021	2022	Change 2021-22	2017	2018	2019	2020	2021	2022	Change 2021-22
Oyster On-bottom								Mussel On-bottom						
Number of enterprises	1667	1667	1535	1511	1388	1530	▲ 10%	351	351	252	278	273	275	▲ 1%
FTE	3764	3764	3752	3924	5655	6111	▲ 8%	531	531	666	721	1198	1201	▲ 0%
Average wage (thousand €)	39.1	42.2	47.2	41.8	23.5	24.1	▲ 3%	57.2	67.5	41.3	49.3	25.2	26.5	▲ 5%
Labour productivity (thousand €)	63.8	68.9	78.2	66.3	41.8	42.1	▲ 1%	164.4	182.6	118.4	122.1	83.8	59.3	▼ -29%
Sales weight (thousand tonnes)	106.8	111.3	121.5	116.1	116.4	117.1	▲ 1%	48.4	49.6	47.3	53.6	57.5	51.3	▼ -11%
Total income (million €)	499.8	525.9	549.7	515.3	542.1	572.6	▲ 6%	122.1	140.1	114.3	130.9	142.7	125.0	▼ -12%
Total operating costs (million €)	405.3	423.4	431.5	403.4	430.8	458.4	▲ 6%	64.7	78.0	62.7	74.7	70.8	84.8	▲ 20%
Gross Value Added (million €)	240.0	259.2	293.4	260.2	236.2	257.4	▲ 9%	87.3	97.0	78.8	88.0	100.4	71.2	▼ -29%
Net profit (million €)	39.0	42.7	44.6	48.2	57.8	55.6	▼ -4%	41.5	42.1	35.7	35.6	54.5	21.0	▼ -61%
Total value of assets (million €)	686.8	763.4	936.6	800.4	635.8	721.7	▲ 14%	222.2	253.2	232.4	303.9	286.2	291.1	▲ 2%
Net investments (million €)	54.1	39.0	42.3	31.7	28.8	32.3	▲ 12%	2.6	9.0	1.3	1.3	1.4	5.6	▲ 311%
Capital productivity (%)	34.9	34.0	31.3	32.5	37.2	35.7		39.3	38.3	33.9	29.0	35.1	24.5	
Return on Investment (%)	6.9	7.0	5.9	6.8	9.9	9.1		19.8	18.5	16.8	12.5	19.9	8.4	
Future Expectation Indicator (%)	1.0	-1.3	-2.2	-3.2	-3.0	-2.3		-4.8	-2.5	-4.9	-5.6	-4.8	-3.5	
Trout Tanks and race-ways								Oyster rafts						
Number of enterprises	324	327	327	313	291	315	▲ 8%	376	376	318	345	338	358	▲ 6%
FTE	809	855	889	766	1124	1146	▲ 2%	504	504	406	374	950	947	▲ 0%
Average wage (thousand €)	27.6	28.3	26.6	34.4	23.8	22.4	▼ -6%	29.7	38.6	38.5	42.8	15.3	13.9	▼ -10%
Labour productivity (thousand €)	71.3	63.5	76.6	81.2	58.1	61.7	▲ 6%	35.9	62.4	37.0	48.5	18.9	17.4	▼ -8%
Sales weight (thousand tonnes)	37.8	37.4	38.0	40.0	37.2	34.4	▼ -7%	8.5	12.2	8.7	8.3	8.5	9.9	▲ 17%
Total income (million €)	158.9	154.7	168.5	167.6	173.2	177.5	▲ 2%	40.6	52.0	39.9	41.2	39.3	44.9	▲ 14%
Total operating costs (million €)	121.7	123.6	122.9	130.8	132.9	129.6	▼ -2%	37.2	39.9	39.8	34.2	33.9	41.4	▲ 22%
Gross Value Added (million €)	57.6	54.3	68.0	62.1	65.3	70.7	▲ 8%	18.1	31.5	15.0	18.1	17.9	16.5	▼ -8%
Net profit (million €)	30.0	24.4	38.1	27.2	29.7	35.0	▲ 18%	-1.4	5.3	-4.5	2.2	2.2	-0.4	▼ -119%
Total value of assets (million €)	132.8	114.9	135.0	147.6	152.6	164.5	▲ 8%	61.5	80.6	61.5	69.9	48.1	57.0	▲ 19%
Net investments (million €)	6.9	6.0	11.2	12.4	7.6	7.9	▲ 4%	8.0	5.1	1.9	2.3	0.9	1.3	▲ 40%
Capital productivity (%)	43.4	47.3	50.4	42.1	42.8	43.0		29.4	39.0	24.4	26.0	37.3	28.9	
Return on Investment (%)	23.7	22.1	28.9	18.4	19.7	22.1		-0.9	8.0	-6.5	4.0	5.4	0.9	
Future Expectation Indicator (%)	0.8	0.3	3.4	1.9	-1.7	-2.2		6.7	-0.6	-3.5	-2.7	-4.0	-2.9	

Source: Own elaboration from EU Member States DCF data submission, 2024.

Segment 1: Oyster bottom

This 'Oyster On-Bottom' segment groups together companies located on the Atlantic and Channel coasts that operate on the foreshore and which can be very heterogeneous (size, turnover, etc.), and have different production strategies. From the supply of spat to the maturing of the oysters, these companies can concentrate on one stage of production (short cycle) or carry out the entire farming cycle. Since 2008, the French oyster farming industry has been faced with spat mortality (shellfish less than one year old) in Pacific oysters. The different strategies put in place by companies to deal with the various risks they face may explain the changes in economic indicators since 2017.

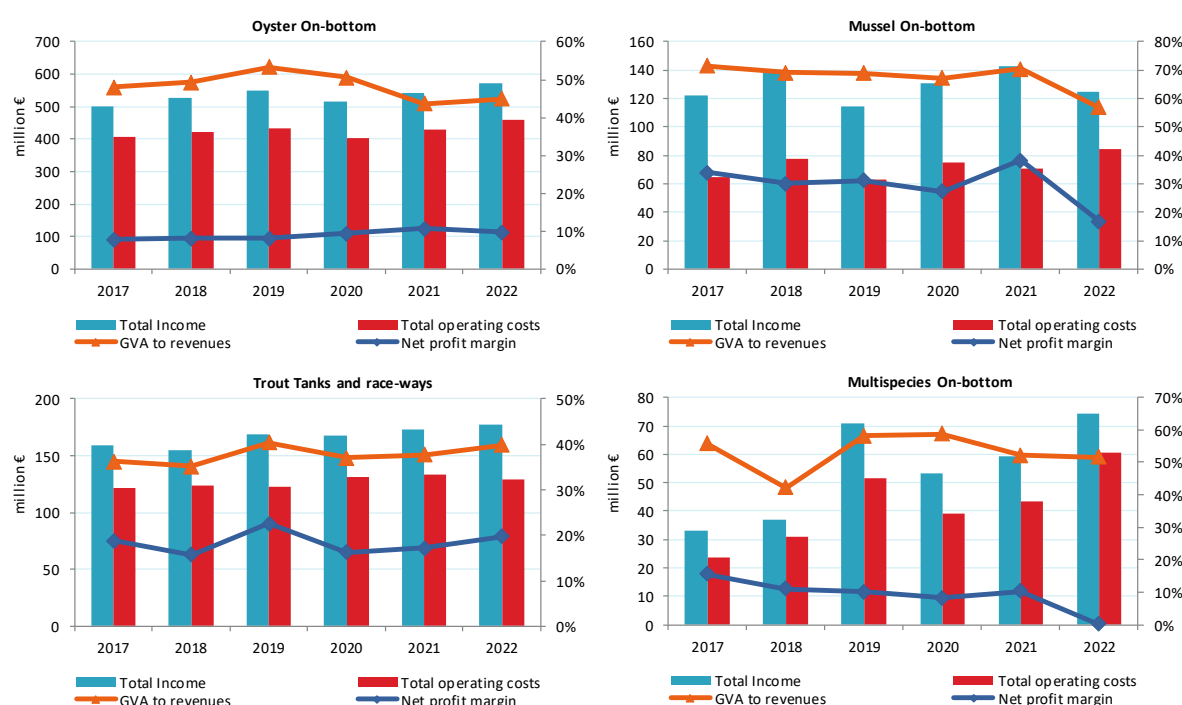
In 2022, this segment reports 1 530 companies and 6 111 FTEs. The volume of production sold is 117.1 thousand tonnes, with a corresponding total income of €572.8 million. Volume represents 50% of total French production, which corresponds to 57% of the total value.

In terms of manpower, the number of FTEs per company has remained stable over the past 5 years, and is around 4.0 FTEs per company in 2022, despite the fact that recruitment could prove increasingly difficult for companies.

After a rise in the total value of assets, linked to the increase in the average size of businesses, until 2019, the total value of assets rises again in 2022, after a fall in 2021. Gross value added (GVA) of €257.4 million in 2022 is almost the same as in 2020.

In terms of the structure of operating costs, livestock is the main cost (33% of total operating costs in 2022), as oysters are traded between regions to improve shellfish growth and to provide adults to farmers specializing in the refining process. Salaries and the value of unpaid work still represent a high cost for businesses (35% of total costs).

Figure 93. Economic performance in € million, indicators for the main French segments: 2017-2022.



Source: Own elaboration from EU Member States DCF data submission, 2024.

Segment 2: Mussel bottom

The second largest segment is mussels, with 275 companies and 1 201 FTEs in 2022.

This sector is highly exposed to natural hazards and has had to deal with various crises since 2010. Adverse weather conditions have led to a production deficit and poor quality mussels (2011, 2012). This shortfall may also be due to a major upsurge in predators (starfish, birds, spider crabs, etc.) in certain production areas (Channel and Atlantic coasts). Since 2014, heavy mussel mortality has occurred in production areas on the west coast of France (Pertuis Breton and Bourgneuf Bay). Mortalities have reached up to 100% in the long-line sector for some professionals and 50-80% in the 'bouchot' culture system. The causes of these mortalities are difficult to establish (pathological, environmental and physiological). Given the mussel's short life cycle, producers are unable to rebuild their stocks.

Production in 2022 will be lower than in 2021 (around -11% in volume and value), but will be on a par with the average for the last five years, with total sales of 51.3 thousand tonnes in 2022 for total income of €125 million.

Gross value added (GVA) in 2022 is lower than in previous years due to the increase in all costs for mussel farming businesses of more than 20% between 2022 and the average for the previous five years, which affects the profitability of businesses.

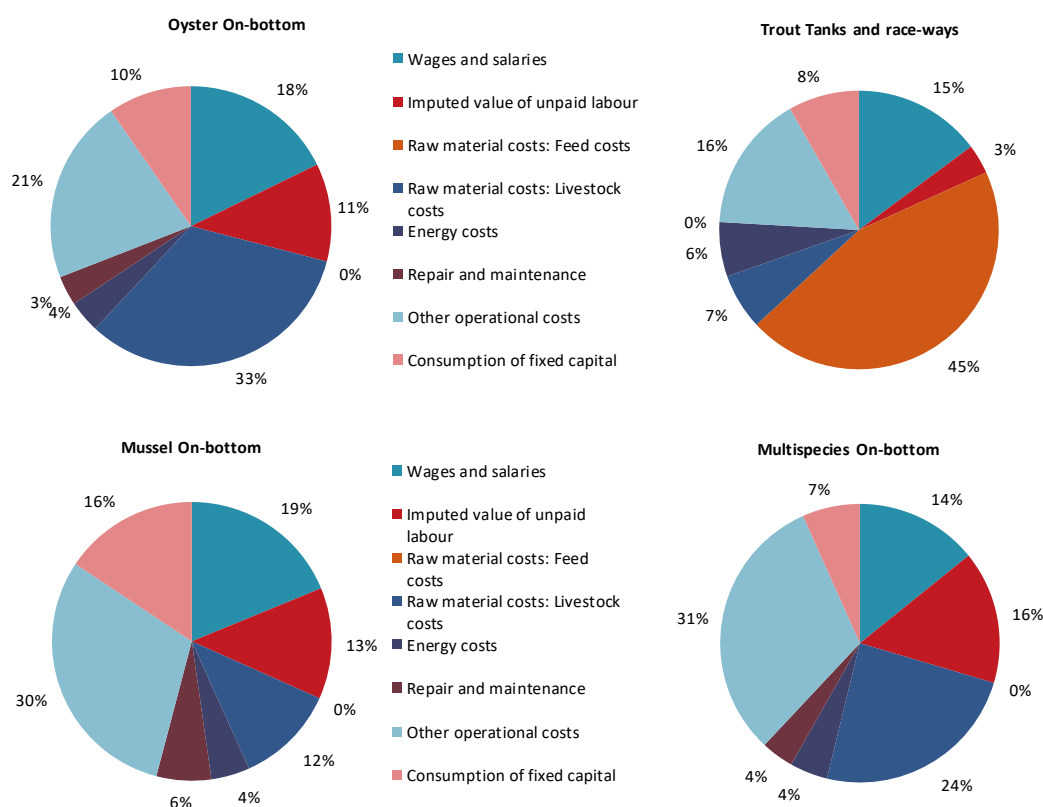
In terms of the structure of these operating costs, the largest operating cost items are wages and the imputed value of unpaid labour (32%) but with an increase this year in other operating costs. In the case of mussel farming, spat supply comes exclusively from wild sources, so farming costs are limited (12%) compared with other segments.

Segment 3: Multispecies On-bottom

This EU-MAP segment corresponds to the former DCF segment 'Other shellfish bottom' and includes companies that farm several species of shellfish (mainly oysters and mussels). Over time, the companies that make up this segment may vary significantly, since the indicator used to include them corresponds to a percentage of turnover (a species may not represent more than 60% of the company's total turnover).

In 2022, the Multispecies On-bottom segment are comprised of 76 companies and 371 FTEs, with total revenues of €74.1 million, at the same level as 2019, compared with around €50 million in 2020 and 2021. As a result, the highly heterogeneous nature of the companies and its volatile composition do not allow for a solid analysis of trends in the various indicators and results.

Figure 94. Cost structure of the main segments in France: 2022.



Source: Own elaboration from EU Member States DCF data submission, 2024.

Segment 4: Trout tanks and raceways

This EU-MAP segment combines the previous DCF 'Growing Trout' and 'Combined Trout' segments. This segment represents 34.4 thousand tonnes, or total revenue of €177.5 million. This segment includes 315 companies with 1 146 FTEs.

From 2010 to 2016, the economic situation of this segment evolved unfavourably. Sales (-5%), sales volume (-38%), total asset value (-21%) and the total number of FTEs (-12%) fell over this period.

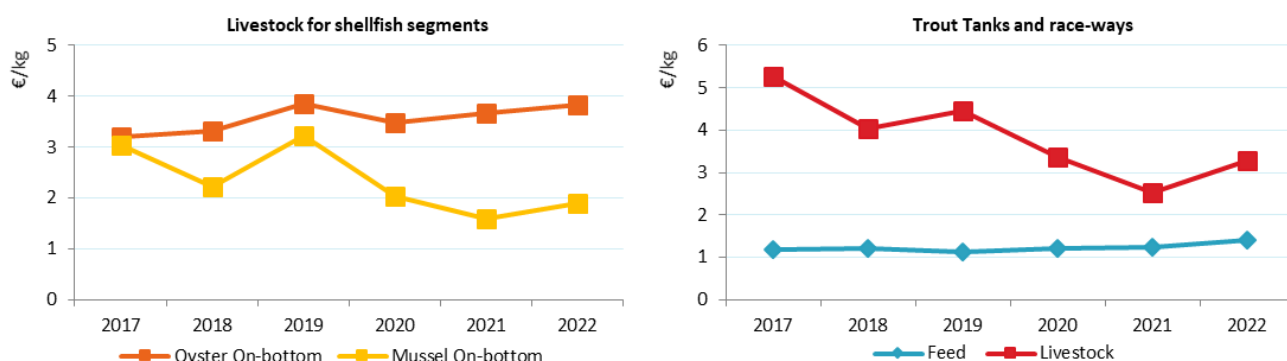
But since 2016, the economic performance of trout companies has been improving, as illustrated by the steady rise in total income, which has increased every year and will reach €177 million in 2022 despite a drop in production volumes in the latter year. The market is therefore buoyant, with sustained domestic demand in France and rising prices. The various profitability indicators for companies in this segment are on the rise.

Overall costs for these companies are holding steady at their 2020 level, which was marked by a sharp rise in costs (feed costs in particular).

As farmers have to feed their juvenile fish, as well as the adults they rear for their own production, feed costs represent the main item of expenditure for these businesses (45% of their operating costs). Wages and salaries are the second largest item.

In the shellfish sector, the average purchase price for spat is €2/kg for mussel farms and €4/kg for oyster farms. For trout farms, feed prices have been rising steadily and slightly since 2019.

Figure 95. Feed and livestock average prices €/kg for the main French segments: 2017-2022.



Source: Own elaboration from EU Member States DCF data submission, 2024.

4.10.5 Outlook

Nowcasts for 2023-2024

Compared to 2022, the year 2023 is characterized by a decrease in sales to final consumers, particularly in the oyster sector. Most shellfish, including oysters, are considered a holiday food in France, and around 60% of annual volumes are sold between December 15 and 31, with two-thirds for Christmas and one-third for New Year. At the end of 2023, the oyster sector was hit with a significant norovirus crisis. Of the 375 oyster farming zones defined in France, ten were closed in the Arcachon basin, two in Calvados, in addition to other oyster beds in the Channel and in Vendée. Overall, around 10% of oyster beds were banned from selling their product last season. This represents over 2 000 tonnes of oysters, or over 2% of French production.

The year 2024 is very similar to 2023. There has been a 20% drop in consumption of oysters in France over the past three years, and sale prices are down 60% from an average of €3/kg to €1/kg in 18 months. The financial crisis and inflation have affected the industry greatly, and the current view is that it will not make a recovery for the 2024 holiday season.

Additionally, general inflation and the financial crisis are impacting citizens and the final consumers' budget, which is limiting overall consumption. Oyster and other shellfish sales are being affected, even

though sales are concentrated around the end-of-year holidays. There is also a mistrust of the sanitary protocols put in place due to the proliferation of norovirus.

Starting in 2023, a few companies have started investing in valorising undersized mussels, which have previously been discarded. This innovation has been increasing employment in the mussel sector, but the effect of this new product on the industry is not yet known. Any new development will be reported in the next version (2026).

Trends and triggers

Environmental hazards can lead to fluctuations in production quantities and market prices. In a context of high uncertainty, the management of shellfish stocks and relations with the various customers (between shellfish farmers, with retailers or wholesalers, final consumers etc.) are at the heart of the companies' concerns.

The specific contamination by noroviruses in certain production areas (mainly Atlantic and Normandy regions in 2023, south Brittany in previous years) has led professionals and health authorities to develop a specific management protocol. Work and tools for predicting this contamination are also underway, in conjunction with the major networks managing wastewater treatment plants.

Mass mortalities in the oyster segment is now stabilized to an average of 40% of loss on the initial quantity of spat immersed.

Predation by birds, spider crabs, sea stars, and sea bream affects the mussel sector more and more each year, especially in the Channel and North Sea where the combination of seagulls and spider crabs can cause up to 30% of production loss.

COVID-19 impact

In 2022, freshwater and shellfish segments represented 231.9 thousand tonnes of farmed product and €937 million in sales. This corresponds to a slight decrease of 1.3% in production since 2019 (the year just before COVID-19) but an overall increase of 8.3% in sales value. It is unsure if this trend will continue into 2023 and 2024, due to the crisis in the oyster sector. Prices in 2022 reached a high of almost €4/kg for shellfish, but it has been reported that certain oyster beds are selling their product for €1/kg in 2024.

The number of companies for both the freshwater and shellfish sectors have returned to pre-COVID-19 numbers in 2022.

Social acceptance

The two main obstacles to the development of the shellfish farming in France are:

- Access to new space with a quality of water compatible with shellfish cultivation,
- Increased demand on the market for French shellfish.

These two points are closely linked to social acceptance:

- By the citizens, mainly those living on the coasts,
- By consumers, mainly those living in rural areas and cities onshore.

Some citizens are strongly opposed to the development of various activities at sea or near the shoreline, not only to shellfish. Some of them are also opposed to offshore development. Two cases lodged in the administrative Court of Justice have blocked the attribution of new shellfish and algae concessions at sea in South Brittany and Charente Maritime for over ten years, until the Council of State ruled in favour of the professionals recently. Only 17% of French citizens consider the social, environmental or ethical impact of aquaculture as a barrier to buy and consume seafood⁸.

⁸ [EU consumer habits regarding fishery and aquaculture products – EUROBAROMETER 2021.](#)

4.10.6 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, since the COVID-19 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 reinforced in the future.

In 2022, in the shellfish segments, the socioeconomic data of 364 enterprises were collected (274 in 2010) representing 15% of the population. The main segments had an appropriate sampling rate, giving good precision.

The socioeconomic data of 50 enterprises in the trout segments was collected for year 2022, representing 16% of the population.

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 company is included in “Multispecies On-bottom”. This minimum ratio was fixed to 60% of the total turnover.

Economic indicators are available for the segments presented in this report, which correspond to more than 90% in volume and value of total French production. Consequently, although total data is presented for the entire French aquaculture sector, the economic indicators have been calculated using only data relating to the main indicators for which all the 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

The leading form of marine aquaculture in Germany is on-bottom blue mussel production. Due to the extensive nature of this farming method and exposure to weather and natural conditions, harvests are highly variable. Between 2017 and 2023, annual yields ranged from under 10 000 tonnes to over 20 000 tonnes. Germany's freshwater aquaculture production has been fluctuating roughly between 17 000 and 19 000 tonnes since 2017 (Destatis). 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). The latter group is considered in the total national volume above, but not in economic analyses in this chapter, due to limited data availability. If not indicated otherwise, the chapter only focuses on species for consumption, not for (re-)stocking.

4.11.1 Total Production and sales

Blue mussel (*Mytilus edulis*) production occurs in the coastal areas of the southern and central North Sea. The total sales volume of blue mussels comprised ~10 300 tonnes in 2021 and ~11 700 tonnes in 2022. Gross sales reached approximately €19 million in 2021 and €17.4 million in 2022 (Table 50). The years 2021 and 2022 cannot be regarded as particularly successful in terms of sales weight or value.

In **freshwater aquaculture**, the most important species in Germany are salmonids—primarily rainbow trout (*Oncorhynchus mykiss*), brown trout (*Salmo trutta fario*), and char (*Salvelinus fontinalis* and *Salvelinus alpinus* × *fontinalis*) - as well as common carp (*Cyprinus carpio*). In 2021, about 15 700 tonnes of salmonids and carp were produced, creating a sales value of an estimated €66 million. In 2022, the total sales weight from salmonid and carp farms remained stable, while the estimated sales value reached €76.3 million (Table 50). Further freshwater niche segments exist in Germany, producing catfish (*Clariidae* and *Siluridae*), eel (*Anguilla anguilla*), sturgeon (*Acipenseridae*) and other species, mainly produced in RAS. These accounted for an additional sales weight of 2 620 tonnes in 2022 (Destatis).

Table 50. Production and sales, industry structure and employment for Germany: 2017-2022.

Variable	2017	2018	2019	2020	2021	2022	Change 2021-22	Develop. 2022/(17-21)
Sales weight (thousand tonnes)	35.0	30.9	37.1	27.0	26.1	27.4	▲ 5%	▼ -12%
Freshwater	16.4	15.0	15.1	15.0	15.7	15.7	■ 0%	■ 1%
Shellfish	18.6	15.9	22.0	12.0	10.3	11.7	▲ 14%	▼ -26%
Sales value (million €)	109.1	102.1	108.7	100.3	85.0	93.7	▲ 10%	▼ -7%
Freshwater	83.6	69.6	66.6	75.0	66.0	76.3	▲ 16%	▲ 6%
Shellfish	25.5	32.5	42.1	25.3	19.0	17.4	▼ -8%	▼ -40%
Number of enterprises	2,900	2,755	2,642	2,403	2,382	2,283	▼ -4%	▼ -13%
Freshwater	2,891	2,746	2,633	2,394	2,373	2,274	▼ -4%	▼ -13%
Shellfish	9	9	9	9	9	9	■ 0%	■ 0%
Employment	5,893	5,745	5,619	4,862	4,837	4,980	▲ 3%	▼ -8%
Freshwater	5,766	5,610	5,476	4,712	4,676	4,834	▲ 3%	▼ -8%
Shellfish	127	135	143	150	161	146	▼ -9%	■ 2%
FTE	3,048	2,900	2,833	2,659	2,745	2,932	▲ 7%	▲ 3%
Freshwater	2,952	2,792	2,713	2,547	2,622	2,820	▲ 8%	▲ 3%
Shellfish	95	108	120	112	123	112	▼ -9%	■ 0%

Source: Own elaboration from EU Member States DCF data submission, 2024.

4.11.2 Industry structure and total employment

The German aquaculture sector is small but highly diverse. Around 2 300 farms (> 0.3 ha or 200 m²) were cultivating fish and seafood in fresh and marine waters in 2022, employing around 2 159 people. An additional unpaid workforce of approximately 3 100 individuals, including owners and family members, is involved in the operation.

Blue mussel enterprises are located in the federal states of Lower-Saxony and Schleswig-Holstein holding production licenses granted by the states. These licenses are valid for a restricted time. Mussel producers are obliged to form producer organisations according to the Common Fisheries Policy (CFP). Consequently, the number of enterprises has remained stable at nine producers (Table 50). Mussel cultures in Schleswig-Holstein have been more productive and profitable compared to Lower Saxony. Favouring environmental conditions in the central North Sea contrast with negative environmental impacts observed in the southern North Sea. In the German Baltic Sea mussel aquaculture is conducted on a very small scale and negligible for the overall sector in terms of the number of farms and production volume. In 2021, 152 people were employed in marine aquaculture in Germany, while the number decreased to 137 in 2022 (Table 50 includes unpaid labour). The statistic also includes employees from marine aquaculture research facilities.

Freshwater aquaculture in Germany is characterized by small salmonid and carp family businesses. These ~2 300 freshwater facilities often serve as additional sources of income and are operated on a part-time basis. In 2022, nearly 80% of the freshwater facilities produced less than five tonnes per year (Destatis). Social data from 2020 (n=122) showed that only 9% of the farms employed more than five workers. Overall, employment within salmonid and carp farms increased from 1 600 registered employees in 2021 to ~1 780 employees (FTE for paid labour = 1 149) in 2022. However, the additional unpaid labour plays a decisive role in salmonid and carp aquaculture. For 2022 it can be inferred, that unpaid labour provides an additional 1 671 FTE in the carp and salmonid segments. The actual input of unpaid labour in Germany's aquaculture enterprises is believed to be even higher, when considering smaller operations that conduct aquaculture as side business (less than 0.3 ha or 200 m²).

Table 51. Economic performance of the German aquaculture sector: 2017-2022.

Variable	2017	2018	2019	2020	2021	2022	Change 2021-22	Develop. 2022/(17-21)
Total income	114.0	137.1	114.9	105.4	94.1	104.9	▲ 12%	▼ -7%
Total operating costs	133.1	121.4	112.5	111.1	128.0	135.7	▲ 6%	▲ 12%
Total wages	71.8	68.3	65.7	67.4	73.0	70.0	▼ -4%	▲ 1%
Gross Value Added	49.6	84.1	65.3	58.1	33.2	32.9	▼ -1%	▼ -43%
Depreciation of capital	7.6	7.0	7.2	5.2	6.1	6.5	▲ 7%	▼ -2%
Earning before interest and taxes	-26.8	8.8	-4.8	-11.0	-40.0	-37.3	▲ 7%	▼ -152%
Financial costs, net	1.4	0.7	0.7	0.9	2.3	1.1	▼ -52%	▼ -8%
Net profit	-28.2	8.1	-5.5	-11.9	-42.3	-38.4	▲ 9%	▼ -140%
Total value of assets	156.1	67.4	309.6	279.2	491.8	190.0	▼ -61%	▼ -27%
Capital productivity (%)	31.8	124.7	21.1	20.8	6.7	17.3	▲ 156%	▼ -58%
Return on Investment (%)	-17.2	13.0	-1.6	-3.9	-8.1	-19.6	▼ -141%	▼ -452%

Source: own elaboration from EU Member States DCF data submission, 2024.

4.11.3 Overall Economic performance

Blue mussel producers have experienced poor harvests for three consecutive years, in 2021 volumes reached less than half of the harvest levels seen in 2019. With a sales value of €19 million in 2021, there was a significant decline from €42 million in 2019. In 2022, the sales volume increased by 14% while prices for mussels dropped (Table 50). Regarding the fact, that blue mussel on-bottom production is highly fluctuating, peaks of production are necessary to balance the weak economic periods of the segment.

The decline in **freshwater aquaculture** results from an ongoing concentration process, which affects small, traditional enterprises primarily operating with carp or trout ponds. Table 50 shows a steady decline in freshwater aquaculture enterprises from 2017 to 2020, recently stagnating at around 2300 enterprises in 2021 and 2022. This clearly illustrates the high economic pressure traditional freshwater segments have been facing. Small-scale farms have exited the market, due to unprofitability in mid-terms and/or owners retiring without handing over the business to a successor. However, the relatively stable sales weight and sales value of freshwater farms throughout this period indicate, that these typically small-scaled traditional pond systems make up only a small fraction of the national production volume.

Apart from these general trends, economic indicators in this chapter should be interpreted with caution, as the German survey was initiated in 2017 and is still encountering some shortcomings (cf. section Data Coverage and Data Quality).

4.11.4 Main species produced and economic performance by segment

Figure 96 shows the main species produced in the German aquaculture sector in 2022: Blue mussel (43% of total weight and 19% of total value), salmonids (40% of total weight and 64% of total value), and carp (17% of total weight and 17% of total value). While blue mussel production is highly dynamic, depending on the availability of wild seed and environmental conditions of marine aquaculture, on-land salmonid and carp production is comparatively stable. The volumes of carp and salmonids combined make up more than 85% of the total freshwater fish production in Germany (Destatis). In 2022, 11 000 tonnes of salmonids were produced, showing an increase of 500 tonnes compared to the previous year. Carp facilities produced 4 700 tonnes in 2022, marking a decrease of ~500 tonnes from 2021. Reasons for this could be a combination of different factors including a decrease in number of farms, losses due to predators and the hot and dry summer in 2022. In addition, 2 600 tonnes of other freshwater species were produced in 2022. It is important to note that high value species such as eel are not considered in reported DCF data due to low volumes. These are mainly produced in recirculating systems, which usually operate at a larger scale than the traditional pond facilities in Germany. For 2022, 9 eel farms are listed for Germany (Destatis).

Figure 96. Main species in terms of weight and value in German production: 2022.



Source: Own elaboration from EU Member States DCF data submission, 2024.

Blue mussels are produced in **on-bottom cultures** (seg. 10.11) in the Wadden Sea. Seed mussel production facilities are utilized to cultivate seed for stocking purposes and to supplement the livestock obtained from harvesting wild seed. The availability of seed is a critical factor contributing to the high fluctuations in production volumes within this segment. In response to a reduction in agricultural production areas in Schleswig-Holstein, mussel fisheries have adapted their operations by using seed mussel production facilities. These new systems require greater investments of time and capital, but they offer enhanced stability in seed availability. Factors assumedly affecting on-bottom mussel cultures

in the German North Sea include the occurrence of silt and dredged material from harbours, as well as the rivers Elbe, Weser, and Ems, and from the construction of LNG terminals and cable routes for offshore wind parks in the water column (Avdelas et al., 2021), closing fishing areas, early autumn storms and the ongoing expansion of the pacific oyster (*Crassostrea gigas*). On-bottom cultures in Lower Saxony tend to be more affected by the above-mentioned impacts than cultures in Schleswig-Holstein.

Table 52. Economic performance of main German aquaculture segments: 2017-2022.

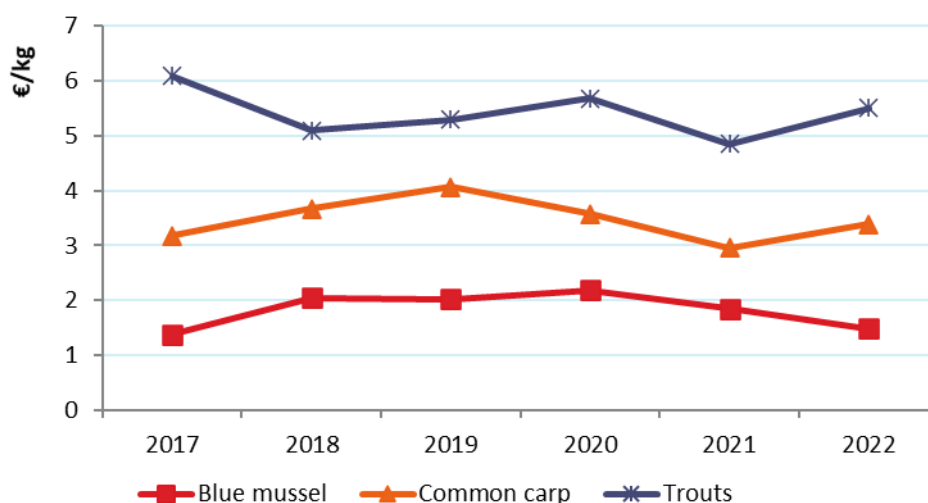
Variable	2017	2018	2019	2020	2021	2022	Change 2021-22	2017	2018	2019	2020	2021	2022	Change 2021-22
	Trout Tanks and race-ways							Trout Ponds						
Number of enterprises	169	160	151	141	342	331	▼ -3%	919	869	826	770	535	518	▼ -3%
FTE	388	363	351	322	540	530	▼ -2%	1075	1017	983	949	805	798	▼ -1%
Average wage (thousand €)	32.1	36.2	36.9	37.4	45.0	39.3	▼ -13%	30.5	27.8	28.6	32.7	28.1	31.0	▲ 11%
Labour productivity (thousand €)	58.2	88.1	47.7	65.9	16.2	11.7	▼ -28%	8.6	22.8	6.6	11.7	7.6	10.6	▲ 40%
Total sales volume (thousand tonnes)	7.4	7.1	7.2	7.0	7.1	7.6	▲ 7%	3.4	3.2	3.2	3.2	3.2	3.4	▲ 7%
Total income (million €)	47.4	52.4	35.6	40.2	37.6	45.5	▲ 21%	21.2	32.5	16.1	18.5	15.4	18.7	▲ 21%
Total operating costs (million €)	36.8	33.6	31.7	30.9	50.0	59.0	▲ 18%	44.1	37.5	37.5	38.5	32.0	35.0	▲ 10%
Gross Value Added (million €)	22.6	32.0	16.7	21.2	8.7	6.2	▼ -29%	9.3	23.2	6.5	11.1	6.1	8.4	▲ 39%
Net profit (million €)	7.5	16.4	1.5	8.1	-15.6	-17.6	▼ -13%	-25.0	-7.0	-23.8	-20.9	-17.6	-16.5	▲ 6%
Total value of assets (million €)	48.6	14.2	27.4	37.2	285.0	8.9	▼ -97%	15.7	9.9	16.2	16.8	10.9	18.2	▲ 68%
Net investments (million €)	5.1	5.3	3.4	1.2	5.8	3.2	▼ -46%	0.8	2.2	0.8	0.3	0.4	0.5	▲ 23%
Capital productivity (%)	46.5	225.6	61.0	57.1	3.1	69.2		58.8	233.7	39.8	66.1	55.9	46.3	
Return on Investment (%)	17.2	118.7	6.3	23.1	-4.8	-189.4		-157.2	-68.1	-144.3	-123.7	-160.5	-90.6	
Future Expectation Indicator (%)	5.7	22.9	4.9	1.4	1.6	-1.7		-6.6	4.2	-7.5	-3.1	-5.3	1.3	
	Carp Ponds							Mussel On-bottom						
Number of enterprises	1803	1717	1656	1483	1496	1425	▼ -5%	9	9	9	9	9	9	0%
FTE	1489	1412	1380	1276	1277	1493	▲ 17%	95	108	120	112	123	112	▼ -9%
Average wage (thousand €)	14.3	15.4	14.8	15.7	17.6	14.8	▼ -16%	55.4	48.5	36.2	38.4	29.6	21.0	▼ -29%
Labour productivity (thousand €)	4.2	7.0	7.4	6.7	6.8	6.1	▼ -10%	121.1	174.7	266.6	153.3	78.5	81.0	▲ 3%
Total sales volume (thousand tonnes)	5.6	4.7	4.6	4.8	5.5	4.7	▼ -14%	18.6	15.9	22.0	12.0	10.3	11.7	▲ 14%
Total income (million €)	19.8	19.8	20.9	21.2	22.0	23.2	▲ 6%	25.5	32.5	42.3	25.4	19.1	17.5	▼ -8%
Total operating costs (million €)	33.0	31.5	28.5	29.2	32.9	30.9	▼ -6%	19.2	18.8	14.7	12.5	13.1	10.8	▼ -18%
Gross Value Added (million €)	6.3	9.9	10.2	8.6	8.7	9.2	▲ 5%	11.5	18.9	31.9	17.2	9.6	9.1	▼ -6%
Net profit (million €)	-15.1	-13.2	-9.1	-10.3	-13.0	-9.6	▲ 27%	4.4	12.0	25.8	11.2	3.9	5.3	▲ 37%
Total value of assets (million €)	45.9	25.3	154.3	140.7	79.6	57.5	▼ -28%	45.9	18.0	111.7	84.6	116.3	105.3	▼ -9%
Net investments (million €)	1.2	2.9	15.3	11.5	5.9	3.4	▼ -42%	9.0	0.5	8.5	9.5	0.9	0.0	▼ -100%
Capital productivity (%)	13.7	39.4	6.6	6.1	11.0	15.9		25.2	105.0	28.6	20.3	8.3	8.6	
Return on Investment (%)	-32.2	-52.4	-5.8	-7.1	-16.0	-16.0		9.5	66.4	23.2	13.3	3.5	5.1	
Future Expectation Indicator (%)	-0.7	5.7	9.0	6.7	5.1	3.2		15.5	-6.7	6.0	9.3	-0.9	-1.3	

Source: Own elaboration from EU Member States DCF data submission, 2024.

Traditionally, Salmonids are produced in **trout ponds (seg. 2.1)**. It is assumed that the majority of farms (518 facilities in 2022) can still be classified within this segment. Trout ponds made up around 3 400 tonnes of the salmonid sales weight and €18.7 million of total income in 2022 (Table 52). The growing **trout tanks and raceways segment (seg. 2.2)**, consisting of only approximately 330 facilities, is much more productive in comparison. In 2022, it produced more than 7 600 tonnes of salmonids, which corresponds to nearly 70% of the total German salmonid production. The total income from this more mechanised segment was estimated at €46 million (Table 52). Only very few enterprises utilize partially recirculating systems, following the example of Danish Model Farms. Due to their small number, these farms were included in the trout tanks and raceways segment (seg. 2.2). For German standards, these systems are relatively large and often produce more than 100 tonnes per year. Consequently, these few enterprises have considerable impact on the total quantities.

Carp ponds (seg. 4.1): Nearly all carp production systems in Germany consist of earthen ponds and polycultures. Traditional secondary species in carp ponds include sturgeon (*Acipenser ruthenus*), tench (*Tinca tinca*), pike (*Esox lucius*), perch (*Perca fluviatilis*), European catfish (*Silurus glanis*) and pike perch (*Sander lucioperca*). The volume of these species is not reported in detail in official statistics, but amounts are estimated to be at least 10% of the produced carp volume and these amounts tend to increase. Carp ponds produced 4 700 tonnes of sales volume in 2022 (including secondary species), creating a total income of €23.2 million (Table 52).

Figure 97. Average prices €/kg for the main species produced in Germany: 2017-2022.



Source: Own elaboration from EU Member States DCF data submission, 2024.

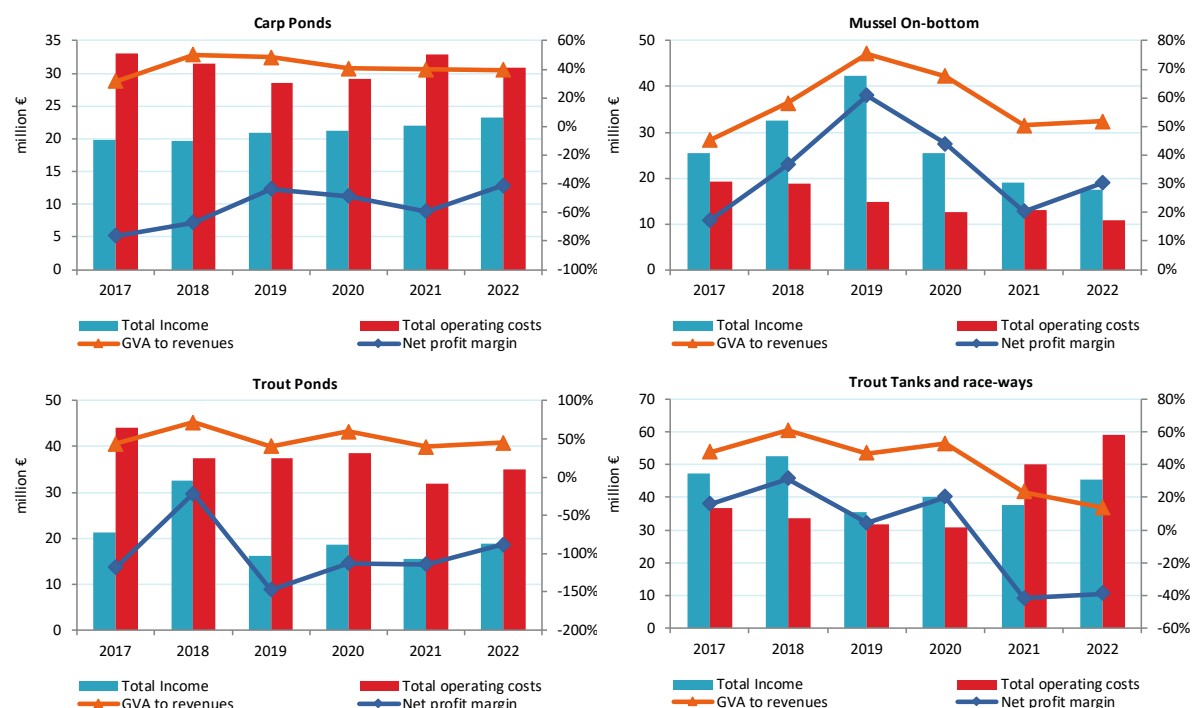
German **blue mussel** enterprises are price takers in the European market, selling mussels either directly to Dutch wholesalers or indirectly via the central mussel auction in Yerseke, Netherlands. The prices highly depend on the quality of the mussel harvest. The blue mussel market features different quality classes. Generally, larger mussels with higher flesh proportion and brighter flesh colour are assigned to higher quality classes and command higher prices. The quality of mussels depends on environmental conditions and the impacts encountered in the extensive on-bottom culture. The highest quality mussels are distributed to the gastronomy sector, with Belgium, the Netherlands, and France as key markets for German blue mussels. The lowest quality mussels are sold to discount retailers, selling for as little as a third of the price. In 2021, German mussel producers achieved an average price of about €1.80 per kg (€0.40 lower than the year before). In 2022 the price per kilo fell to €1.50 (Figure 97). This can be attributed to the smaller-sized mussels harvested in Lower Saxony and the lower meat content of early-season harvests in Schleswig-Holstein, particularly in comparison with key competitors in the Netherlands.

The prices for freshwater species strongly vary according to species, region, and final product (fresh, chilled, frozen, smoked, etc.). For the majority of small-scale **trout pond** farms, direct sales to consumers are very important and generate the highest value. Common points of sale are farmer markets and farm shops. Trout farms in the **tank and raceway segment** often integrate direct marketing into their business models, while also supplying markets with fingerlings, stocking fish, and fish for processing (e.g., for smoke houses). The retail market is not attractive for German trout entrepreneurs, due to comparatively low prices and restrictions imposed by supermarkets. Nonetheless, a price transmission from trout imports - primarily from Turkey and Denmark - can be observed in domestic trout commodities available in supermarkets. Consequently, imports from these countries indirectly influence the price development, at least on wholesale level. A mixed calculation that covers different sales channels, various salmonid species, and the aforementioned impacts on price development computes average trout prices between €4.90 per kg and €6.10 per kg in 2017 - 2022 (Figure 97).

For the **carp pond** segment, imports have a less pronounced effect on the price development compared to the trout sector. In 2022 imports of the main category “carp alive” decreased by approx. 40%, mostly due to lower imports from Czech Republic (-37%/ -832 t). The dominant sales channels for carp vary depending on the region and the quantities produced. In the main carp pond production regions such as Lusatia and the Aischgrund, a significant proportion of the carp harvest is traditionally marketed via wholesalers due to the large quantities produced in a relatively short period (Brämick and Schiewe, 2023). In other regions with a large number of small enterprises direct marketing plays a pivotal role. In addition, angling clubs and associations buy large quantities of live carp as stocking fish for their waters (including secondary species). In the previous two years, the distribution had shifted towards a greater share of direct marketing due to COVID-19-related restrictions in sales and the gastronomy sector, however this trend was no longer evident in 2022. Wholesaler prices increased considerably in 2022, reaching €3.12 – €4.01 per kg, whereas direct marketing could yield prices of up to €6.29 per kg

(Brämick and Schiewe, 2023). Between 2017 and 2022 mean prices ranged from €3.0 to 4.1 per kg (survey among freshwater producers Germany).

Figure 98. Economic performance in € million, indicators for the main German segments: 2017-2022.



Source: Own elaboration from EU Member States DCF data submission 2024.

Mussel enterprises in Schleswig-Holstein have maintained positive net profit margins since 2017. For trout tank and raceway farms this is true from 2017 to 2020 (Figure 98), but turning to negative net profit margins in 2021. The economic indicators in Table 52 clearly illustrate the structural change and economic pressure, traditional pond farms in salmonid and carp culture are experiencing for some time now as well as the changes in trout tank and raceway operations. Another indicator of a critical economic situation for part of the sector is the decreasing number of farms. However, the relative decrease in Table 52 among the trout segments is misleading due to methodical reasons. Trout farms were allocated via a fixed allocation formula towards the segment's trout ponds or trout tanks and raceways. The segment of tanks and raceways is not as harmed by the termination of businesses as the pond segment.

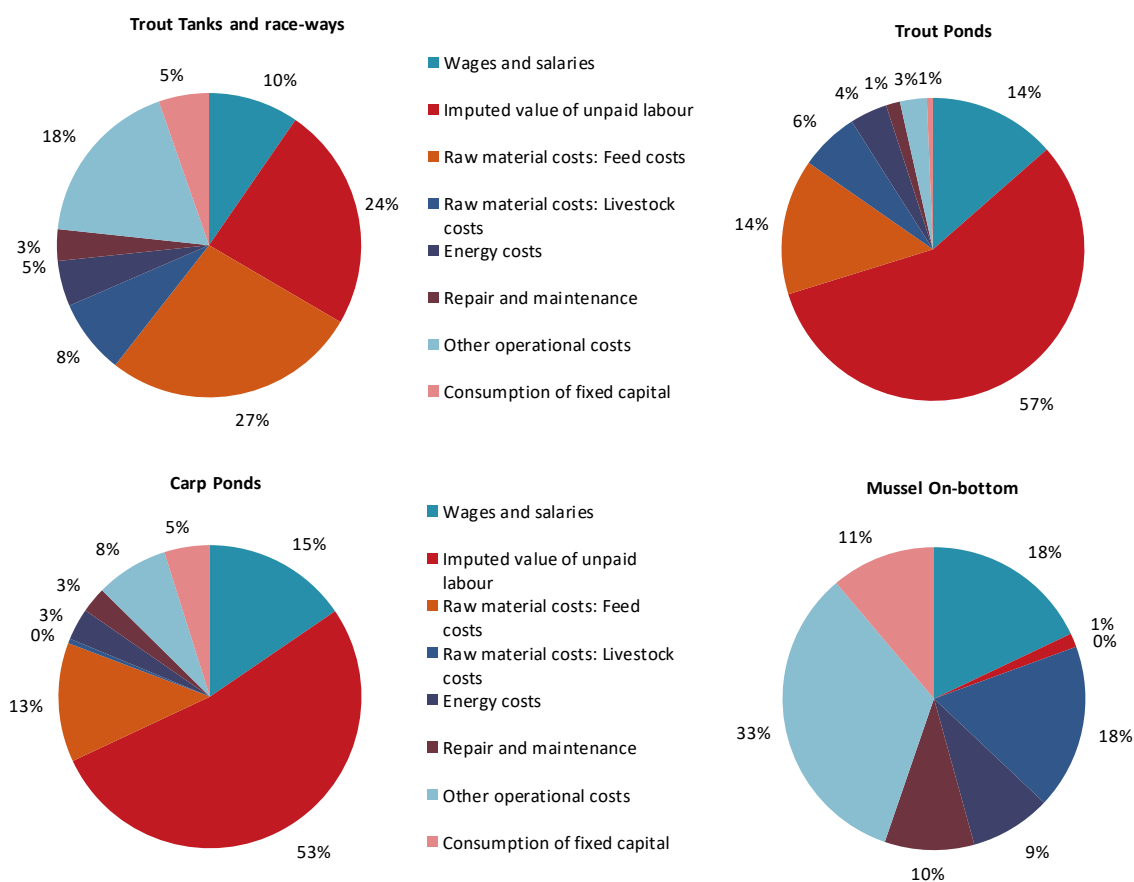
The primary cost drivers in the blue mussel on-bottom segment are other operational costs, followed by wages and salaries, and the procurement of mussel seeds. (Figure 99). Mussel seeds are obtained from seed collectors, wild catch, and long-line systems. The last two are integrated into the operating costs of mussel enterprises.

As traditional extensive or semi-intensive segments, **trout and carp ponds** have a great need for work force, which is mainly covered by unpaid labour provided by the owner himself/herself and members of his/her family. If this unpaid labour value is not considered, which is often the case in contribution margin calculations, looking at trout ponds, the costs for employed labour (wages and salaries) and feed are the most important ones. In fourth place are the costs associated with fry and fingerlings, which have to be sourced externally, as small-scale farms usually do not run their own hatcheries. Integrated, with hatchery, nursery, grow-out, and (sometimes) processing operations included within the farm. Investments in the production of eggs, fry and fingerling are included in other operational costs, which rank as the third highest expenses.

Carp typically feed on natural food resources available in the ponds (plankton) as well as on grain, which is provided as supplement by the farmers. Only very few large carp farms feed their stocks with

compound fish feed to optimize growth rates. Average feed costs were at €0.40 per kilo in 2022 corresponding to a 100% increase compared to feed costs per kg in 2021. Farms of the segment **trout tanks and raceways** tend to be larger scale and more automated, on average, labour costs were lower and feed costs were highest, making up 27% of total costs (in modern farms feed costs can have a share of more than 40%). Overall feed cost for trout production in tanks and raceways is often higher per kg fish as the more expensive feed for fry and fingerling is included. Average cost of feed for the total trout sector is €2.39 per kg feed in 2022, corresponding to a price increase of 18% compared to the previous year. The lower cost of livestock is due to the fact that farms in this segment are mostly vertically integrated, with hatchery, nursery, grow-out, and (sometimes) processing operations included within the farm. Investments in the production of eggs, fry and fingerling are included in other operational costs, which rank as the third highest expenses.

Figure 99. Cost structure of the main segments in Germany: 2022.



Source: Own elaboration from EU Member States DCF data submission 2024.

4.11.5 Outlook

Nowcasts for 2023-24

In 2023, 2 660 freshwater aquaculture facilities produced 16 800 tonnes of salmonids, carp and other freshwater species (Destatis), while mussel enterprises report a production of 14 504 tonnes in 2023 (National Sea Fishery Agency and the State Office for Agriculture, Environment and Rural Areas). 2 177 people were employed in the marine and freshwater aquaculture sector in 2023 and it can be assumed that the amount of unpaid labour, owners and family labour, is similar to 2022 with a slightly decreasing trend (cf. Trends and Triggers).

Trends and Triggers

Mussel seed: The majority of blue mussel producers obtain mussel spat with seed collectors, which provide optimal growing conditions for natural seed. The technique is becoming increasingly established but is significantly more cost-intensive compared to using wild-caught seeds or relocating wild mussel cultures from neighbouring coastal areas (imports). The installations must be dismantled in autumn to protect from extreme weather conditions and reinstalled in spring. Further, the selection of suitable locations, not only for settling but also for sustaining the young mussels, which might be lost in rough seas, is of great importance.

External impacts in the North Sea: Blue mussel producers in Lower Saxony operating in the southern North Sea are affected by climate change impacts (e.g., increased frequency of storms), as well as by increased relocation of sediments from river dredging, harbour maintenance, construction work for new offshore wind parks and the ongoing expansion of the pacific oyster (*Crassostrea gigas*). These challenges, combined with higher operating costs, led to a reduction in the number of companies in 2023, leaving only three by the end of the year, down from previously four. Despite much more favourable production conditions in Schleswig-Holstein and very good mussel quality in the early seasons of 2023 and 2024, mussel producers face regional issues including spatial restrictions due to updated reef mapping by the National Park Authority, siltation of cultures, but also structural disrepair of their quay infrastructure.

Climate change impact on-shore: Shortage of water supply and increased water temperatures put continuous economic pressure on freshwater fish producers, with carp producers being especially dependent on weather conditions. After three dry summers in 2018, 2019 and 2020, the summer of 2021 was unstable and rainy in many places in Germany leading to regional floods that also affected individual aquaculture producers. The summer of 2022 was once again marked by exceptionally warm and dry conditions, significantly affecting freshwater inland production.

Concentration process of salmonid sector: An ongoing trend of declining farm numbers was observed (-23% of salmonid farms and -27% of carp farms, each between 2017 and 2023). In particular, small-scaled farms have exited the market in the last decade. In contrast, the salmonid production is more or less stable (between -5% and +2% in that period), suggesting that this sector is becoming more concentrated (Destatis). Carp production volume, however, decreased by 18% between 2017 and 2023.

Investment backlog: Smaller farms are often less equipped to make the necessary investments in modern technologies/techniques to address current challenges (e.g. climate change impact, lack of successors).

Predators: In particular, carp farms suffer from fish loss due to protected wild fish predators like cormorants or otters. In addition, beaver damages can cause high additional costs for necessary maintenance of production systems. Mussel producers (Schleswig-Holstein) report losses due to eider ducks causing millions of euros worth of damage for the season 2023.

Diseases: Over the last years increasing cases of Infectious Hematopoietic Necrosis (IHN) were detected in the trout-producing sector (mainly south of Germany). In 2020 and 2021 this also affected larger companies, which suffered significant losses, whereas the situation improved in 2022.

Lack of successors: In particular, small traditional farms struggle in finding successors.

Price increases: Increases in electricity and fuel prices affected both the marine as well as freshwater aquaculture sectors in Germany. Considering the cost structure of the German aquaculture segments (Figure 99), freshwater producers, particularly those with highly automated production systems, are the most affected by rising electricity prices, while the mussel sector faces significant impacts from increased fuel costs. Further, a strong increase in feed prices impacts the freshwater sector. Survey results from 2023 (74 valid answers) revealed a mean price increase of 35% for carp feed and 32% for trout feed from 2022 to 2021. To balance part of these additional costs, the Federal Government grants compensation in the temporary crises' framework regulation ("Befristete Krisenrahmen Bundesregelung Kleinbeihilfen") following *de-minimis* aid. This aid was granted for the years 2022, 2023 and has been extended until the end of 2024, with a maximum total of €335 000 per company active in the fisheries and/or aquaculture sector. In addition, many aquaculture producers raised their sales prices and resorted to further strategies such as an adapted feeding regime, growing their feed (carp), implementing energy and labour saving measures and reduced stocking. These were some of the approaches mentioned by farms in the survey conducted in 2023 (74 valid answers).

Social acceptance: Germans perceive seafood in general as healthy food, independent of its origin (Krause et al., 2020, NASTAQ, 2020). According to Eurobarometer (2021), purchasing behaviour is mostly driven by the price and quality of the fish product. However, awareness of (potential) environmental impacts of aquaculture production and fishery is increasing. Newspaper articles, documentaries and fish guides from several NGO's influence how sustainability is viewed. Concerns regarding aquaculture production include e.g., the use of antibiotics or fishmeal and -oil as part of fish feed and the related (potential) impacts on wild fish populations (NASTAQ, 2020). In general, consumer perception of aquaculture production is very heterogeneous. Aquaculture production is often perceived as artificial, on the other hand, German consumers value the quality and safety of aquaculture products (NASTAQ, 2020). A survey-based study concluded that younger and female respondents had a lower perception of aquaculture's sustainability, whereas education level was positively associated with a more favourable attitude toward aquaculture (Hörterer et al., 2022).

In 2023, the highest share in German seafood consumption was salmon (18.8%) (FIZ, 2024), which is mostly imported from Norway. At the same time, the majority of Germans stated a preference for products from their own country or region, and 27% preferred products from the EU (NSC, 2019). However, overall knowledge on origin of (national) fish products and related production systems is low.

Market opportunities for German freshwater fish products are not exhausted and to exploit this potential, communication on quality, regionality, ecological and social sustainability of national products will be important. A related strategy for 2021-2030 is proposed in the German National strategic plan for sustainable Aquaculture (NASTAQ, 2020). Hörterer et al. (2022) suggest that communication strategies should be tailored to specific groups. Further, initiatives, such as the Bavarian small-scale pond landscapes being acknowledged as Nationwide Inventory of Intangible Cultural Heritage (2021) could support informing consumers as well.

4.11.6 Data Coverage and Data Quality

Until 2011, aquaculture statistics were based on (partly estimated) data from the sixteen federal states' fisheries authorities (Brämick 2013 *et seq.*). Since then, 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 in compliance with the European Regulation EC No 762/2008. In 2015, Destatis has introduced thresholds. Since then, the statistical reports only consider farms bigger than 0.3 ha or 200m³, thereby reducing bureaucratic effort for smallholders. At the same time, this leads to recent statistics not being comparable with the data from before 2015.

In terms of economic indicators for freshwater aquaculture, a reform of the national agricultural statistic law (Agrarstatistikgesetz) would be required. In contrast to production data requested by Eurostat data collection, the provision of economic and demographic data, collected under the DCF, is not mandatory for fish farmers. This results in four shortcomings. Firstly, the DCF data collecting organisation in Germany (Thünen Institute) does not have access to the national register of aquaculture firms and hence to the postal addresses of the population. Consequently, the conducted survey is based on an address register specifically researched for this purpose. Secondly, the response rate of fish farmers tends to be quite low in a written survey.

In 2022, the answers presented only 4.7% of the facility population (N=2 403), but 11% of the freshwater production volume. To achieve a holistic picture of the sector's economics, data from the sample is projected onto the entire sector. In a few cases, the coefficient of variation is quite appropriate (e.g., unpaid labour). In other cases, such as subsidies, the coefficient of variation, is much higher (> 0.8). Thirdly, the sample refers to the same sample frame, but does not necessarily cover the same farms in the sample. Only part of the farms responded to all survey years limiting the overall comparability for 2017-2022 data. However, 2021 and 2022 data are mostly based on the same farms as reminders were sent out for both years together. Fourthly, there is a tendency towards larger farms to be overrepresented within the sample as they have likely more capacities to respond to the data survey than smaller operations. Further, the presented data originates from different sources: production volume and number of facilities are transferred from Destatis census (in the case of mussels from National Sea Fishery Agency and the State Office for Agriculture, Environment and Rural Areas), data on employment is transferred from Federal Employment Agency and data on unpaid labour,

demographics and the majority of economic indicators like turnover, costs, investments etc. results from the above mentioned survey of fish farmers.

In consequence, the chapter provides a holistic picture of the sector by merging all information available about the economic structure of the sector. However, this picture can only provide a good orientation, lacking precision due to the reasons mentioned above. Germany has addressed these shortcomings in its current Strategy for Aquaculture 2021-2030 (Nationaler Strategieplan Aquakultur für Deutschland) under the EMFAF.

4.12 Greece

Overview of Greek aquaculture

Greece maintains one of the leading positions in the production of Mediterranean aquaculture species at both the European and international levels. Indicatively, it is mentioned that in 1980, when the first cage units were established, production barely reached 2 000 tonnes, whereas in the last 10 years, the production of sea bass and sea bream alone has consistently ranged between 100 000 and 120 000 tonnes.

The seabass and seabream segment constitutes the largest part of aquaculture production, followed by the mussel, trout, and other freshwater fish categories. In 2022, the sector's total sales weight and value were 137.1 thousand tonnes and €769.8 million in sales, demonstrating a 35% increase of sales value in comparison to the 2017-2021 period, while the sector's sales volume remains stable during the 2019-2022 period. Marine aquaculture was responsible of 86% of the total sales volume and almost 97% of the total sales value. Apart from aquaculture activities, the companies are involved in all activities related to aquaculture processes (production of fry, fish feed, cages, and equipment), which makes them self-sufficient in fry, fish feed, and equipment supply. Additionally, they maintain strong parallel economic activities, ensuring a relatively high alternative income.

In 2022, the aquaculture sector was comprised of 657 enterprises, and the marine fish sector employed 84.3% of the sector's total workforce in FTE terms.

4.12.1 Total Production and sales

The total sales volume of aquaculture sector in Greece, remains at the same level for the last 4 years. In 2022, while the sales weight increased only 3% from 2021, sales value demonstrated a 35% increase. The total number of enterprises during 2021-22 decreased compared to 2019-2020 period. On the other hand, total employment increased respectively by 16% (12% in FTE terms).

In Greece, seabass and seabream dominate marine aquaculture species, and in 2022 they saw a 34% increase in sales value and a 1% increase in sales volume. This growth is partly due to rising seabass and seabream prices, as well as increased sales of other high-value marine fish.

The freshwater sector also experienced growth, with sales volume and value increasing by 30% and 34%, respectively. This is also due to the fact that during the period 2021-2022, companies in the sector gained access to supermarket chains, thereby offering trout and other freshwater fish to a much larger consumer base. In contrast, the shellfish sector saw a decline of over 20% in both sales volume and value, despite a slight increase in the number of enterprises. This decline is attributed to the rise in sea surface temperatures, which negatively affected mussel production and further reduced mussel seed availability, hindering the renewal and expansion of farmed mussel populations.

4.12.2 Industry structure and total employment

Twenty percent of the aquaculture sector in Greece is made up of SA and Ltd enterprises, which account for 85% of the total sales value in the industry, primarily from seabass and seabream production. The marine fish segment has seen a 10% decrease in the number of enterprises compared to the 2017-2021 period. The seabass and seabream sector is undergoing continuous restructuring, with mergers and acquisitions leading to a reduction in the number of enterprises.

The number of freshwater enterprises remained relatively stable during the 2019-2022 period. In the shellfish segment, however, the sector saw a 9% increase in the number of enterprises in 2022. In Greece, the obligatory relocation of mussel farms is currently underway due to the implementation of the Areas of Organized Aquaculture Development Community directive.

Regarding employment in the aquaculture sector in 2022, all segments show an increase, with freshwater leading at 37%, followed by marine at 14%, and shellfish at 18%. Relevant increase is shown in FTE terms (31% for freshwater, 8% for shellfish and 10% for marine segment). The Marine sector represents 75% of total aquaculture employment.

The freshwater sector showed in the 2019-2020 period an increase in number of enterprises (mainly new small trout family firms), and the rise of employment value is attributed to the development of their economic activity.

Table 53. Production and sales, industry structure and employment for Greece: 2017-2022.

Variable	2017	2018	2019	2020	2021	2022	Change 2021-22	Devel. op. 2022/(17-21)
Sales weight (thousand tonnes)	119.6	130.8	139.2	137.5	136.4	137.1	0%	3%
Marine	98.5	105.7	111.7	113.3	116.5	117.6	1%	8%
Freshwater	4.5	4.2	4.7	3.1	3.5	4.5	30%	14%
Shellfish	16.6	20.9	22.9	21.2	16.4	15.0	-9%	-24%
Sales value (million €)	545.3	556.3	564.9	600.8	578.3	769.8	33%	35%
Marine	527.9	539.0	539.7	582.7	558.3	745.8	34%	36%
Freshwater	11.3	10.9	16.4	10.4	14.5	18.6	28%	47%
Shellfish	6.1	6.5	8.7	7.7	5.5	5.4	-2%	-22%
Number of enterprises	659	650	691	691	648	657	1%	-2%
Marine	343	347	358	358	311	309	-1%	-10%
Freshwater	115	110	132	132	130	129	-1%	4%
Shellfish	201	193	201	201	207	219	6%	9%
Employment	3,876	3,924	4,383	4,418	4,903	5,007	2%	16%
Marine	3,085	3,123	3,313	3,322	3,657	3,750	3%	14%
Freshwater	297	307	419	430	542	545	1%	37%
Shellfish	494	494	651	666	704	712	1%	18%
FTE	2,924	3,338	3,761	3,795	3,918	3,958	1%	12%
Marine	2,574	2,958	3,125	3,134	3,321	3,334	0%	10%
Freshwater	151	181	294	302	320	328	3%	31%
Shellfish	199	199	342	359	277	296	7%	8%

Source: Own elaboration from EU Member States DCF data submission, 2024.

4.12.3 Overall Economic performance

In 2022, the total income of the aquaculture sector reached its highest value of €1.27 billion, marking a 25% increase from €1.02 billion in 2021 and a 43% increase compared to the 2017-2021 period. This growth can be attributed to a significant rise in sea bream and sea bass exports in 2022, with an almost 4% increase in volume and a 20% increase in sales value. There was also an increased distribution of farmed marine fish in the Greek market through major supermarket retail chains during the 2021-22 period, responding to increased national consumption, almost to pre-pandemic levels.

The total operating costs also showed an upward trend, rising by nearly 30% in 2022 compared to 2021, and by 43% compared to the 2017-2021 period. Despite increased consumption, the war in Ukraine, and the subsequent unprecedented energy crisis, significantly affected the production and supply chain. This was due to a sharp rise in production costs, increasing interest rates, and strong inflationary pressures.

Total wages have been increasing throughout the 2017-2022 period, rising from €69 million in 2017 to €113.7 million in 2022. The year 2022 also demonstrates the highest number of employees, (3 958 in FTE terms), it produces a lower total wages value than 2019 (€78.9 million in 2020 compared to €79.1 million in 2019).

GVA shows significant increases for both 2021 and 2022, with a 39% rise compared to the 2017-2021 period. The depreciation of capital value follows the upward trend of total asset value, with both showing substantial growth (26% and 23%, respectively). Since the seabass and seabream farming sector accounts for more than 80% of the Greek aquaculture industry's production volume and value, its ongoing consolidation and company mergers are impacting the sector's economic performance, leading to increases in total assets, capital productivity, and return on investments.

Furthermore, according to the companies, the negative financial results are attributed to the challenges in fish production planning, which typically occurs 18-24 months before the fish are sold. This long lead time makes it difficult to accurately predict future fish prices. The final pricing not only impacts sales revenue but also affects the valuation of organic stocks, which are generally the most important asset for aquaculture companies. As a result, a decrease in fish prices negatively impacts the companies' financial position and overall results.

Table 54. Economic performance of the Greek aquaculture sector: 2017-2022.

Variable	2017	2018	2019	2020	2021	2022	Change 2021-22	Develop. 2022/(17-21)
Total income	835	806	813	990	1,018	1,272	▲ 25%	▲ 43%
Total operating costs	711	806	833	958	944	1,215	▲ 29%	▲ 43%
Total wages	69	62	79	79	110	114	▲ 4%	▲ 43%
Gross Value Added	194	62	60	107	178	167	▼ -6%	▲ 39%
Depreciation of capital	25	26	28	27	30	34	▲ 13%	▲ 26%
Earning before interest and taxes	100	- 26	- 47	5	45	23	▼ -47%	▲ 54%
Financial costs, net	26	26	38	22	22	25	▲ 17%	▼ -6%
Net profit	74	- 52	- 85	17	23	2	▼ -107%	▲ 85%
Total value of assets	1,375	1,362	1,297	1,485	1,672	1,769	▲ 6%	▲ 23%
Capital productivity (%)	14.1	4.5	4.6	7.2	10.6	9.4	▼ -11%	▲ 15%
Return on Investment (%)	7.3	-1.9	-3.6	0.3	2.7	1.3	▼ -50%	▲ 40%

Source: Own elaboration from EU Member States DCF data submission, 2024.

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 2022, seabream production corresponds to 51% of both total production weight and total production value. Additionally, seabass represents 35% of total production weight and 46% of total value. Mussel production corresponds to 11% of total production weight but only to 1% of total value. Other freshwater fish-Ponds category corresponds to 1% of total weight and 1% of total value. Last, trout production amounts to 2% of total weight and 1% of total aquaculture value.

Figure 100. Main species in terms of weight and value in Greek production: 2022.



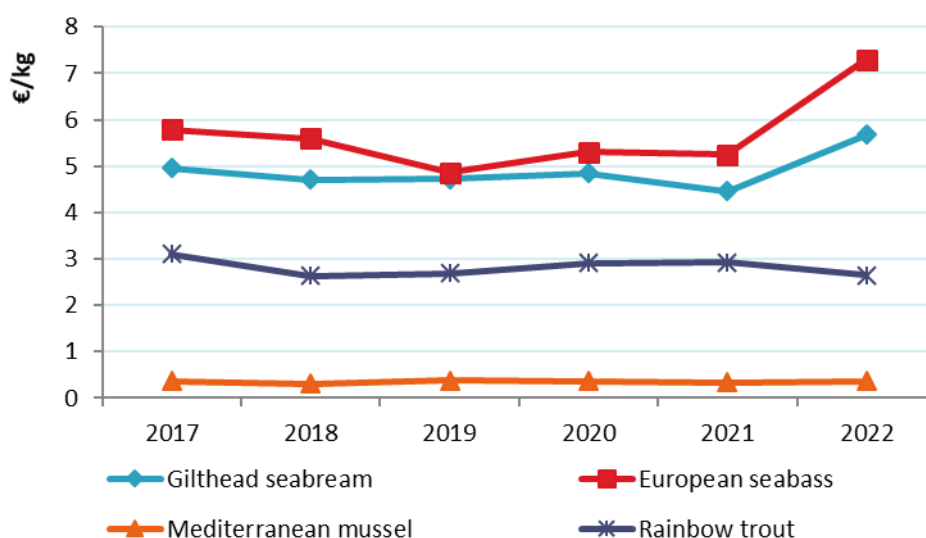
Source: Own elaboration from EU Member States DCF data submission

From 2008 to 2021, the prices of seabass and seabream in Greece remained relatively stable. However, both species saw price increases in 2022. The price of seabream rose from €4.5 to €5.7, while seabass increased from €5.3 to €7.3.

The price of Mediterranean mussels remained steady at €0.4/kg from 2017 to 2022. Since the designation of Areas of Organized Aquaculture Development (AOAD, or POAY in Greek) in 2017, new mussel farms are expected to emerge through the issuance of new farm operation licenses, the relocation and expansion of older farms, and mergers. Despite this, mussel farms experienced a significant production decline in 2021 and 2022 due to rising sea surface temperatures, with a 42% drop in production in 2022 compared to 2020.

The price of rainbow trout decreased to €2.6 per kilogram in 2022 from €2.9 in 2021, with the average price for the 2017-2022 period being €2.8 per kg.

Figure 101. Average prices €/kg for the main species produced in Greece: 2017-2022.



Source: Own elaboration from EU Member States DCF data submission

Segment 1: Seabass and Seabream Cages

The seabass & seabream cages segment is the most important in Greece in terms of sales volume and value. For the year 2022, it represented 97% of total sales value and 86% of total sales volume. The industry is still under consolidation and restructuring phase and that has an impact in its financial results. Therefore, during 2021 and 2022 the segment demonstrated a decrease in number of enterprises. Despite that, in the same period there was an increase of FTE and average wage values, partly due to the increases in the minimum wage in Greece during the period 2021-2022.

The decrease in GVA (Gross Value Added) from €330.9 million in 2020 to €156.7 million in 2022 led to a decline in labour productivity within the sector. However, during the same period, a slight increase in sales volume and rising prices for seabass and seabream resulted in a 26% increase in total income. On the other hand, a sharper 30% increase in total operating costs in 2022 caused a substantial drop in net profit, falling from €26.2 million in 2021 to just €0.9 million in 2022.

The total value of assets increased between 2021 and 2022, with 2021 showing the highest net investment value at €141.4 million, compared to an average of €57.4 million for the 2017-2022 period.

Capital productivity also declined in 2022, dropping to 9.1%, which is lower than the 2017-2021 average of 19.1%. Similarly, both return on investment and future expectation indicators experienced declines, falling to 0.1% (from 1.6%) and 1.4% (from 7%), respectively.

Segment 2: Mussel Longline

The number of enterprises engaged in mussel aquaculture increased in 2021 and 2022 after a period of stability. However, employment in FTE terms saw a sharp decline, dropping from 359 in 2020 to 277 in 2021. The sales volume also decreased in both 2021 and 2022, falling from 21.2 thousand tonnes in 2020 to 15 thousand tonnes in 2022. This reduction in sales volume resulted in a decline in total income,

while operating costs rose by 6%. In 2022, average wages dropped by 12%, and labor productivity fell by 24%. Gross value added (GVA) decreased by 19% in 2022, and the sector reported financial losses for both 2021 and 2022. There was also a decline in total asset value, capital productivity, and return on investment during this period.

Segment 3: Other freshwater fish Ponds

The "Other Freshwater Fish-Ponds" segment primarily consists of small family-run businesses in remote areas. The owners are typically farmers or fishers who rely on additional activities to supplement their main income. In previous years, no data was available for key variables such as raw material costs, livestock expenses, and fish feed costs. However, for 2021 and 2022, the segment shows an increase in almost all variables, except for the number of enterprises (a 3% decrease) and net investments (which fell from €4.7 million to €0.8 million). While this segment holds socio-economic importance due to its presence in remote areas and family-run operations, it remains small in scale compared to the overall aquaculture sector.

Segment 4: Trout Tanks and raceways

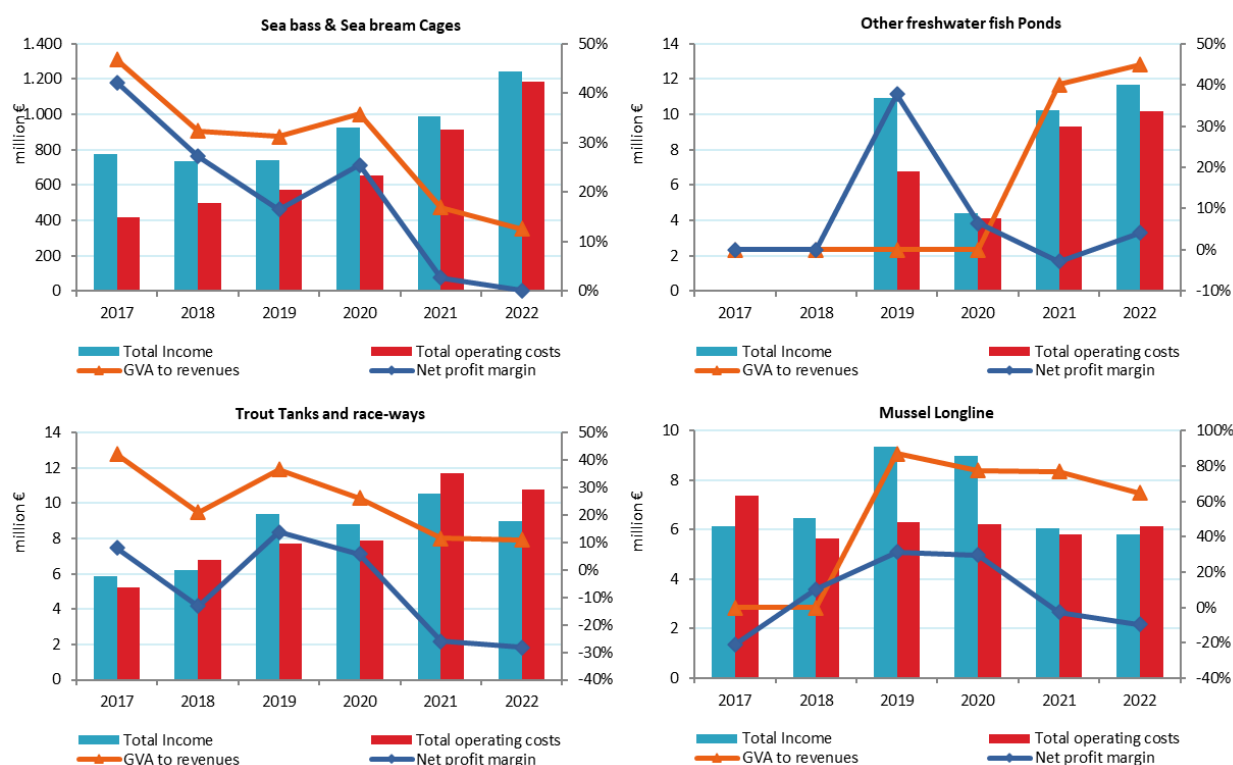
The number of enterprises and FTE in the trout tanks and raceways segment each grew by 1%. Although the average wage increased by 15% in 2022, labour productivity dropped by 18%. Despite a 30% increase in total sales volume for the year, total revenue fell by 14%, with the segment experiencing a 17% decline in gross value added (GVA) and financial losses amounting to €2.5 million. Capital productivity has continued to decline, falling from 43% in 2017 to 5.4% in 2022. Return on investment was negative for both 2021 and 2022, at -14.4% and -12.8%, respectively. Like in the Other freshwater fish category, trout farms are typically small operations located in remote mountainous areas, providing supplementary income and employment for local communities.

Table 55. Economic performance of main Greek aquaculture segments: 2017-2022.

Variable	2017	2018	2019	2020	2021	2022	Change 2021-22	2017	2018	2019	2020	2021	2022	Change 2021-22
	Sea bass & Sea bream ALL							Trout Tanks and race-ways						
Number of enterprises	343	347	358	358	311	309	▲ -1%	63	59	68	68	69	70	▲ 1%
FTE	2574	2958	3125	3134	3321	3334	▲ 0%	56	86	125	129	147	148	▲ 1%
Average wage (thousand €)	22.1	17.7	22.5	22.4	30.0	30.9	▲ 3%	32.2	21.5	14.0	10.5	16.3	18.7	▲ 15%
Labour productivity (thousand €)	141.5	80.6	74.1	105.6	50.5	47.0	▼ -7%	44.3	15.2	27.6	17.9	8.2	6.7	▼ -18%
Sales weight (thousand tonnes)	98.5	105.7	111.7	113.3	116.5	117.6	▲ 1%	1.9	2.3	2.0	2.1	2.0	2.6	▲ 30%
Total income (million €)	815.9	784.9	783.5	968.1	991.7	1245.8	▲ 26%	5.9	6.2	9.4	8.8	10.5	9.0	▼ -14%
Total operating costs (million €)	648.9	784.3	811.9	940.0	916.8	1187.5	▲ 30%	5.2	6.8	7.7	7.9	11.7	10.8	▼ -8%
Gross Value Added (million €)	364.1	238.4	231.5	330.9	167.6	156.7	▼ -6%	2.5	1.3	3.4	2.3	1.2	1.0	▼ -17%
Net profit (million €)	117.6	-50.6	-93.2	-20.4	26.2	0.9	▼ -96%	0.5	-0.8	1.3	0.5	-2.7	-2.5	▲ 7%
Total value of assets (million €)	1358.8	1347.5	1279.5	1466.3	1630.3	1726.3	▲ 6%	5.7	4.5	13.0	14.1	18.1	18.5	▲ 2%
Net investments (million €)	33.4	29.9	50.9	31.6	141.4	57.5	▼ -59%	0.9	0.1	0.3	0.5	1.2	0.6	▼ -53%
Capital productivity (%)	26.8	17.7	18.1	22.6	10.3	9.1		43.2	29.1	26.5	16.4	6.6	5.4	
Return on Investment (%)	8.7	-3.8	-7.3	-1.4	1.6	0.1		8.9	-17.1	10.7	4.3	-14.4	-12.8	
Future Expectation Indicator (%)	0.7	0.3	1.8	0.3	7.0	1.4		12.6	-2.3	0.3	1.5	-1.1	-0.1	
	Mussel Longline							Other freshwater fish Ponds						
Number of enterprises	201	193	201	201	207	219	▲ 6%			64	64	61	59	▼ -3%
FTE	199	199	342	359	277	296	▲ 7%			169	173	173	180	▲ 4%
Average wage (thousand €)	34.9	25.2	14.9	14.3	16.2	14.2	▼ -12%			12.4	12.3	18.7	20.8	▲ 11%
Labour productivity (thousand €)	28.6	29.4	23.8	19.5	16.8	12.8	▼ -24%			36.9	13.9	23.7	29.2	▲ 23%
Sales weight (thousand tonnes)	16.6	20.9	22.9	21.2	16.4	15.0	▼ -9%			2.6	1.0	1.5	1.9	▲ 30%
Total income (million €)	6.1	6.5	9.4	9.0	6.0	5.8	▼ -4%			10.9	4.4	10.2	11.7	▲ 14%
Total operating costs (million €)	7.4	5.6	6.3	6.2	5.8	6.2	▲ 6%			6.8	4.1	9.3	10.2	▲ 9%
Gross Value Added (million €)	5.7	5.8	8.1	7.0	4.7	3.8	▼ -19%			6.2	2.4	4.1	5.3	▲ 28%
Net profit (million €)	-1.3	0.7	2.9	2.7	-0.2	-0.6	▼ -236%			4.1	0.3	-0.3	0.5	▲ 264%
Total value of assets (million €)	1.0	1.2	2.5	2.4	5.1	4.6	▼ -9%			2.5	2.4	18.2	19.1	▲ 5%
Net investments (million €)	0.0	0.0	0.1	0.1	0.0	0.1				0.0	0.0	4.7	0.8	▼ -84%
Capital productivity (%)	546.5	481.0	328.2	292.6	91.7	81.7				250.9	100.3	22.5	27.6	
Return on Investment (%)	-121.8	65.8	118.7	111.7	-2.9	-11.7				166.3	11.8	-1.2	3.1	
Future Expectation Indicator (%)	-0.8	0.9	0.3	0.3	0.0	-2.7				0.0	0.0	19.7	-0.8	

Source: Own elaboration from EU Member States DCF data submission, 2024.

Figure 102. Economic performance in € million, indicators for the main Greek segments: 2017-2022.



Source: Own elaboration from EU Member States DCF data submission

Figure 103 shows the cost structure of the four main aquaculture segments in Greece.

In 2022, the primary production cost for the seabass and seabream segment was feed, accounting for 44% of total expenses, followed by other operational costs at 31%. Livestock costs made up 9%, while wages and salaries contributed 8%. Capital consumption and energy costs each represented 3%, with repair and maintenance costs at 2% and, last, the imputed value of unpaid labour (less than 1%).

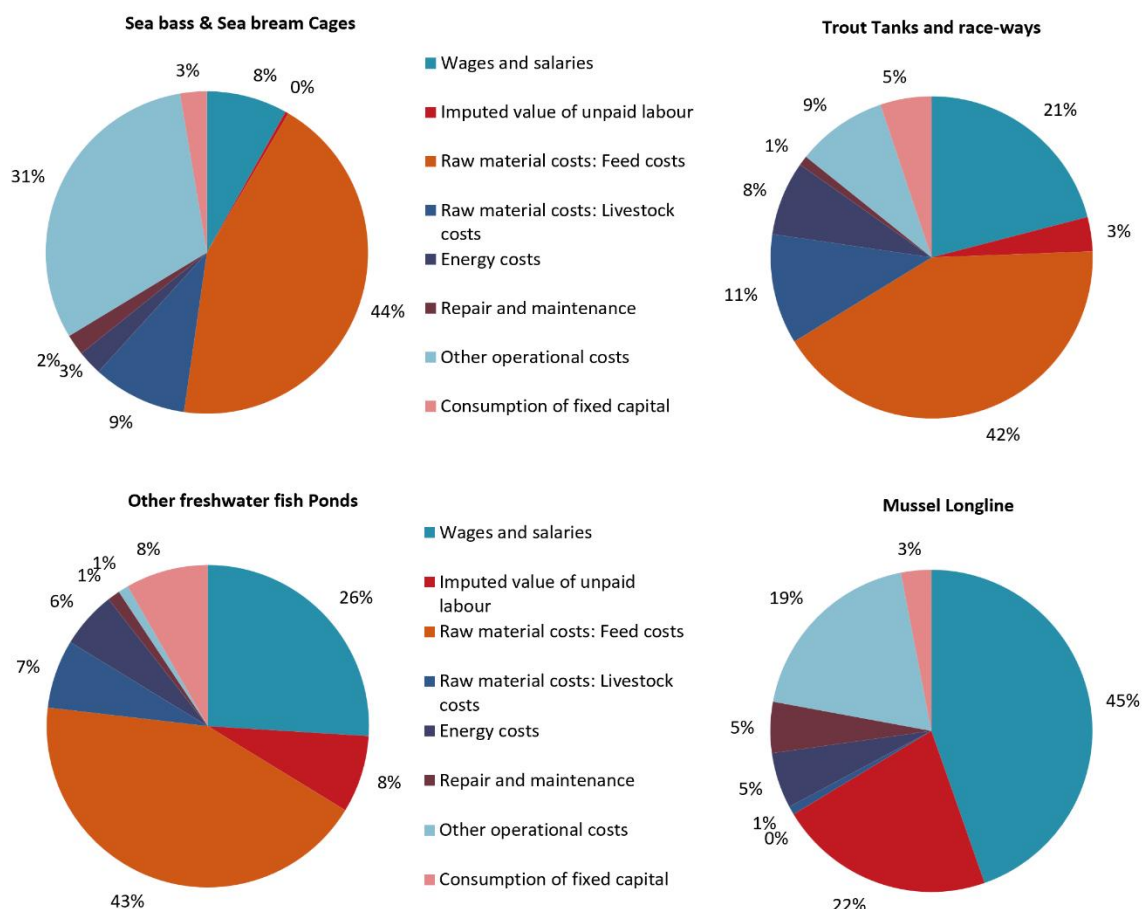
For trout tanks and raceways, the most significant costs are feed cost (42%) followed by wages at 21%, livestock cost with 11%, other operational costs (9%), energy costs (8%), consumption of capital (5%) and imputed value of unpaid labour (3%).

Regarding the mussel longline segment, the main production cost is wages and salaries (45%) followed by imputed value of unpaid labour (22%), other operational costs (19%), repair and energy costs equally at 5% each, consumption of fixed capital at 3% and last is the livestock cost at 1%.

Lastly, the cost structure for the Other freshwater fish-Ponds is composed of the following: raw material costs account for 43%, wages and salaries for 26%, while both fixed capital consumption and the imputed value of unpaid labour represent 8% each. Livestock costs make up 7%, energy costs 6%, and, finally, other operational and repair costs contribute 1% each.

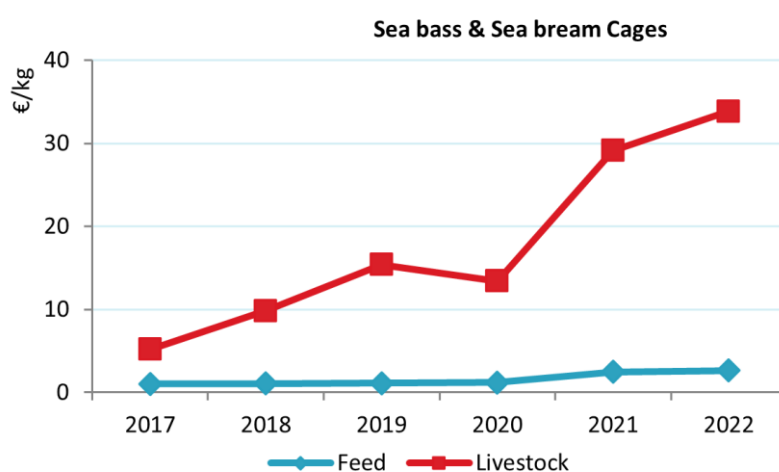
Figure 104 below shows the average prices of feed and livestock in the sea bass and sea bream segment. While feed costs remained stable from 2017 to 2020, the energy crisis and inflation have since driven up feed prices. This increase has been significant, despite many large companies operating their own fish feed production units to reduce costs.

Figure 103. Cost structure of the main segments in Greece: 2022.



Source: Own elaboration from EU Member States DCF data submission, 2024

Figure 104. Feed and livestock average prices (€/kg) for the main Greek segment: 2017-2022.



Source: Own elaboration from EU Member States DCF data submission, 2024

4.12.5 Outlook

Nowcasts for 2023-24

Preliminary data and information from company representatives for 2023 indicate stable aquaculture production, with a potential 2% increase in volume and a slight 1-2% decrease in revenue

Trends and triggers

Market structure

In Greece, the seabass and seabream sector accounts for the largest share of aquaculture production, followed by mussels, trout, and other freshwater fish. About 20% of aquaculture companies in Greece are structured as S.A. (Société Anonyme) or Ltd. (Limited) enterprises, and these companies generate over 80% of the sector's annual sales. The largest businesses are primarily active in the seabass and seabream sector.

Most aquaculture operations in Greece are not independent economic entities; in many cases, a single company owns or leases multiple fish farms, especially in the seabass-seabream sector. In 2022, the industry comprised 650 units: 364 employed fewer than 6 people, 117 had between 6 and 10 employees, and 176 employed more than 10 people.

COVID-19 impact

The impact of COVID-19 lockdown measures proved less severe for marine aquaculture companies that demonstrated stable sales volume for the period 2019-2022. There were however smaller companies in the other freshwater fish-Ponds category that were forced to stop production totally and end their economic activity due to lack of fish feed and drop of demand during the COVID-19 years.

Additionally, an effect of the COVID-19 outbreak was the increase of parallel activities in the companies, mainly processing, since the lockdown measure forced some of the producers to either establish filleting activity or stock production in the form of deep-frozen products.

High energy prices

High energy prices have a significant impact on aquaculture operations and related activities, such as product transportation and overall operating costs. Aquaculture farms rely heavily on energy for activities that include hatcheries-nurseries, fish feed production, production of aquaculture equipment and fisheries processing, as well as fish feeding systems. Rising energy costs directly increase the expenses of maintaining these systems, putting pressure on profit margins.

Additionally, high fuel prices drive up the costs of transporting aquaculture products, affecting the entire supply chain, especially in the case of Greek aquaculture since its activities take place in 10 out of the 13 regions, primarily in remote areas. This leads to higher prices for consumers and can reduce the competitiveness of aquaculture products in domestic and international markets. As energy expenses rise, aquaculture businesses must find ways to optimize efficiency and reduce energy consumption to remain economically viable.

Social acceptance

The social acceptance of aquaculture in Greece, despite the country being a leader in sea bream and sea bass farming, with top performance in the export of its products, is not always positive.

Issues such as the environmental impacts of aquaculture on marine ecosystems, the rejection of new farm installations in coastal areas due to the tourism-driven use of beaches, and the prevailing belief that farmed species are nutritionally inferior to wild-caught species all contribute to reduced social acceptance.

Nevertheless, the promotion of farmed fish by major supermarket chains at highly competitive prices over the past 3-4 years has broadened this acceptance and introduced a larger portion of the population to Greek aquaculture products. Moreover, the fact that sea bass and sea bream farming is primarily carried out by large export companies with modern facilities, the application of cutting-edge

technologies, and significant representation at international exhibitions, adds prestige to the sector that does not go unnoticed domestically.

The operation of aquaculture facilities in remote areas of Greece makes it difficult for the public to become familiar with the industry's working methods. The relatively challenging conditions of daily farm work also attract many foreign labourers. However, employment and career opportunities offered by large companies in the sector, especially in roles that involve the use of new technologies (hatcheries, nurseries, real-time aquaculture monitoring, and automated smart fish farming technologies), are considered attractive but are nonetheless aimed at specialized scientific personnel.

4.12.6 Data Coverage and Data Quality

Data quality and availability

For the 2021-2022 period, the Non-Probability Sample Survey (NPS) sampling scheme was applied, with planned sample rates ranging from 40% to 70%. This approach was taken because, for the past seven years, data collection was conducted through a census, achieving high response rates. For the social variables, the planned sample rates for 2022-2024 are based on the high response rates (ranging from 40% to 50%) observed during the previous 3-year social pilot study, despite challenges faced in the later years of the pilot study.

The data sources included questionnaires filled during onsite and online interviews and sent by mail, by post and by phone, published balance sheets and companies' financial reports. For cross checking and validation purposes, the survey used EUROSTAT and National Statistics data and the Integrated Monitoring System of Fisheries Activities (OSPA) operating under Greek Ministry of Rural Development and Food. The results of previous years' surveys and the structure of the Greek aquaculture sector, the farming species, the method used and, above all, the geographical location of the units, contributed as factors for the division of the unit population into subpopulations. Those subpopulations that share the same characteristics were used for the sampling to calculate the socio-economic variables of the whole sector. Therefore, the NPS sampling scheme was used to create subpopulations based on farmed species and geographical locations for the categories "Mussel", "Trout" and "Freshwater". For the category Seabass-Seabream, which constitutes the largest percentage of the industry (80% according to sales value), additional subpopulations were created based on the existence of the following three criteria: operation under the same company of on-growing units, hatcheries-nurseries, and fish feed production units. This is because these specific criteria affect the economic variables of the units. For example, companies that own and operate on-growing units and hatcheries nurseries, are self-sufficient regarding supply of fry and take advantage of lower production costs due to a lower fry price.

The NPS sampling scheme follows the typical quota sampling steps that include:

1. Division of the population into subpopulations according to aquaculture technique, the production capacity, the geographical location, and the operating facilities in the case of seabass-seabream companies. These subpopulations, due to their unique characteristics will be considered as separate populations, leading to four different surveys.
2. Definition of the weightage of subpopulation characteristic (production volume and number of employees)
3. Selection of the appropriate sample size, maintaining the proportion
4. Implementation of the surveys according to the defined quotas

The NPS sampling scheme for aquaculture will use four subpopulation divisions: aquaculture techniques, production capacity, geographic location, and, for seabass-seabream companies, specific activities like hatcheries and fish feed production. Additional criteria will be applied for mussel and trout companies with specialized activities. The sampling will include companies that meet certain conditions, such as having a published balance sheet, being listed in the Ministry's database, and participating in prior surveys. Data is extracted from questionnaires and balance sheets, except for some variables (e.g., other income, unpaid labour, energy costs), which are calculated. Companies with no recent activity or missing financial data are excluded. For non-responses, missing values are imputed using mean values based on subgroups and previous years' data.

Other data issues or missing data

As mentioned in the previous aquaculture data call, until 2020, the sea bass and sea bream sector was reported under three segments: Sea bass & Sea bream Cages, Sea bass & Sea bream Hatcheries & Nurseries, and Other Marine Fish Cages. However, since all three segments represent activities of the same companies and are primarily used for internal consumption, they resulted in misleading financial data and showed insignificant revenue. For 2021 and 2022, all three segments have been consolidated under the Sea Bass & Sea Bream Cages segment. In the next data call, this same method will be applied retroactively for the 2017-2020 period for compatibility purposes.

Confidentiality

As previously mentioned, the sources of data for aquaculture data collection include companies' published balance sheets and questionnaires. Since balance sheets are generally available online through companies' websites and the Ministry of Finance's databases, due to the legal obligation for enterprises to disclose them, confidentiality is primarily emphasized during pre-data collection communications and on-site interviews. During these interviews, respondents are assured of the confidentiality of the data they provide, and no personal data is collected.

4.13 Hungary

Summary

Hungary is a landlocked country producing only freshwater aquaculture products, with dominant production of common carp and North-African catfish. The basic production method is production in earthen ponds, also in polyculture with other species.

Production volume and value

The Hungarian aquaculture sector produced 18.9 thousand tonnes of fish in 2022. This production was valued at about €55.4 million (FAO, 2024). Hungary produces only freshwater species.

The production has been showed increasing trend between 2017-2022, both in terms of volume and value. The production weight in 2022 was 6% higher than previous five-year average; respective growth in value was 48%. It is worth emphasizing that the increase in value was influenced primarily by high increases in sales prices in 2022, mainly for carp - which is also reflected in other markets of Central and Eastern Europe.

Table 56. Production and sales for Hungary: 2017-2022.

Variable	2017	2018	2019	2020	2021	2022	Change 2021-22	Develop. 2022/(17-21)
Production weight (thousand tonnes)	18.3	17.9	17.3	18.4	17.8	18.9	▲ 6%	▲ 6%
Marine	0	0	0	0	0	0		
Shellfish	0	0	0	0	0	0		
Freshwater	18.3	17.9	17.3	18.4	17.8	18.9	▲ 6%	▲ 6%
Production value (million €)	38.7	38.4	36.1	35.4	38.1	55.4	▲ 45%	▲ 48%
Marine	0	0	0	0	0	0		
Shellfish	0	0	0	0	0	0		
Freshwater	38.7	38.4	36.1	35.4	38.1	55.4	▲ 45%	▲ 48%

Source: Own elaboration from FAO (2024) data.

Main segments

According to available FAO statistics, the common carp was the main specie produced by the Hungarian aquaculture sector, representing 58% in terms of volume and 64% in terms of value in 2022. Common carp is famed in earthen ponds, usually in polyculture. Some carp farms decide to be multifunctional, also offering gastronomy and tourist services.

Figure 105. Main species in terms of weight and value in Hungarian production: 2022.



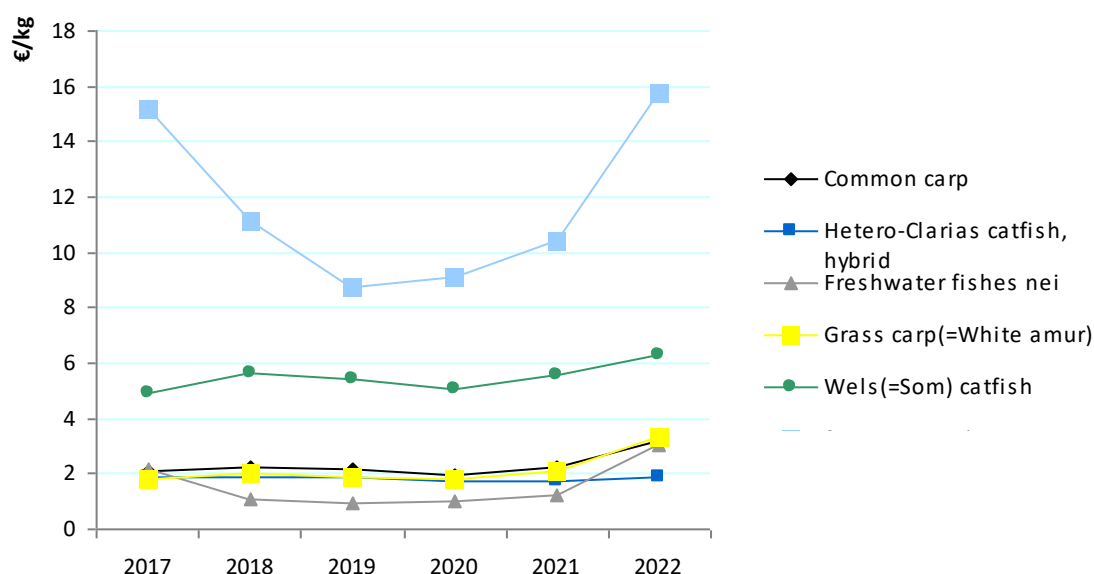
Source: Own elaboration from FAO (2024) data.

The second most important specie is the North African catfish with 24% of the total weight and 16% of the total value. North African catfish is farmed in Hungary in tanks and raceways (also using geothermal water), recirculation systems and also combined extensive-intensive systems. Hungary is one of the largest producers of African catfish in the EU. African catfish reaches the market mainly after processing, in the form of fillets and VAPs.

Herbivorous species: silver and bighead carps, together with grass carp are farmed in polyculture with common carp, and they represent 4% of production value and 7% in volume. There are also some relevant productions of Wels catfish and sturgeons.

Average prices for the main species increased in 2022. Significant increase was observed for common carp price. The common carp price in Hungary was €3.19 per Kg in 2022 (increase by 43% compare 2021). The price of North-African catfish amounted to €1.91 per Kg (increase by 8% compare 2021).

Figure 106. Average prices for the main species produced in Hungary: 2017-2022.



Source: Own elaboration from FAO (2024) data.

In 2021, the Hungarian aquaculture sector generated €61.1 million in GVA, a 12% increase from previous year. While EBIT increased 10% to reach €51.5 million.

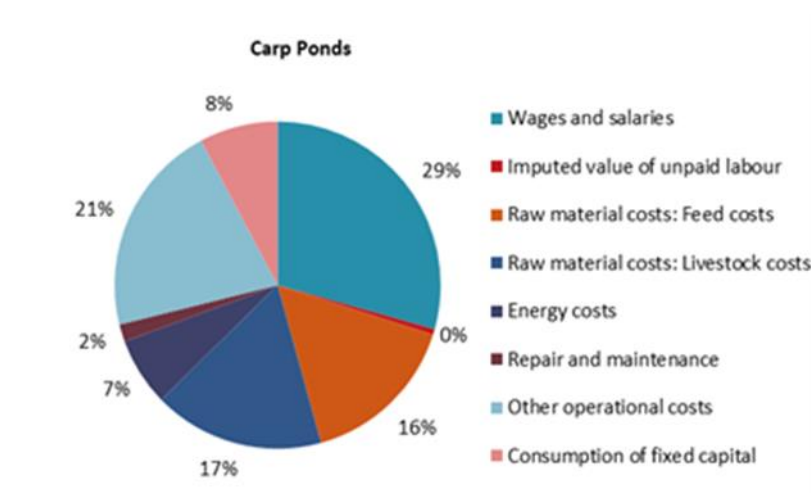
Table 57. Economic performance of the Hungarian aquaculture sector: 2017-2021.

Variable	2017	2018	2019	2020	2021	Change 2020-21
Total income	213.1	317.6		69.0	79.3	▲ 15%
Total operating costs	41.6	51.4		20.4	25.7	▲ 26%
Total wages	9.8	11.3		7.3	8.3	▲ 14%
Gross Value Added	179.8	275.4		54.4	61.1	▲ 12%
Depreciation of capital	14.5	12.3		1.9	2.2	▲ 13%
Earning before interest and taxes	157.1	253.8		46.7	51.5	▲ 10%
Financial costs, net	0.2	0.9		-0.2	0.1	▲ 146%
Net profit	156.8	252.9		46.9	51.4	▲ 10%
Total value of assets	140.1	75.0		178.3	186.1	▲ 4%
Capital productivity (%)	128.4	367.4		30.5	32.8	▲ 8%
Return on Investment (%)	112.1	338.6		26.2	27.7	▲ 6%

Source: Own elaboration from EU Member States DCF data submission

Main costs are wages and salaries with 29% of overall production costs, followed by other operational costs with 21%, livestock costs 17% and feed costs 16%.

Figure 107. Cost structure of the main segments in Hungary: 2021.



Source: Own elaboration from EU Member States DCF data submission

Data Coverage and Data Quality

The socio-economic data collection for Hungary is not mandatory under the DCF, as the share of Hungarian aquaculture is under 2.5% of total EU production and value. The analysis of the Hungarian aquaculture sector is therefore based on data extracted from FAO.

4.14 Ireland

Overview of Irish aquaculture

Irish aquaculture is mainly maritime, dominated by the at-sea production of Pinned Atlantic salmon (*Salmo salar*) and that of the bivalve mollusc species; Pacific Oyster (*Crassostrea gigas*) and Blue mussel (*Mytilus edulis*). Shellfish are cultured in both the subtidal and intertidal zones of sheltered bays and harbours of the western, North eastern and south-eastern coasts, using a combination of Off-bottom, suspended and seabed culture methods. The main cultures make up 4 of the 8 Irish EU-MAP segments. There is, in addition to the marine cultures, a small number of land-based freshwater finfish units and shellfish hatcheries.

4.14.1 Total Production and sales

Output volume at national level has increased in both years from 2020, to 44 500 tonnes in 2022. Sales value dropped from €180 million in 2020 to €179 million in 2021, then recovered to €184 million in 2022, an overall increase of €3 million or 1% for the period. The 2021 sales value decrease was caused by a drop in the unit sales value of Salmon, that year.

Finfish output volume held steady in 2021, then fell by 11% to 12 400 tonnes in 2022. Sales value dropped over both years by 16.9% to €107 million in 2022 as a result of both unit sales value and output volume decrease. The shellfish sector as a whole drove the overall 18% increase in national output volume and 2.2% increase in sales value generated since 2020. The Farmed oyster and Rope grown mussel segments in particular were the drivers. The seabed cultured mussel segment steadily increased output volume to 6 864 tonnes in 2022 though weakening unit sales price negatively impacted on the sales value of €9 million generated.

Table 58. Production and sales, industry structure and employment for Ireland: 2017-2022.

Variable	2017	2018	2019	2020	2021	2022	Change 2021-22	Develop. 2022/(17-21)
Sales weight (thousand tonnes)	45.7	37.2	38.3	37.7	42.8	44.5	▲ 4%	▲ 10%
Marine	18.9	12.2	11.7	13.3	13.4	12.0	▼ -10%	▼ -14%
Freshwater	0.6	0.6	0.6	0.6	0.5	0.4	▼ -26%	▼ -33%
Shellfish	26.2	24.4	26.0	23.8	28.9	32.1	▲ 11%	▲ 24%
	200.6	179.5	175.3	179.8	178.7	183.8	▲ 3%	▲ 1%
Marine	138.6	119.6	112.1	126.8	109.5	105.1	▼ -4%	▼ -13%
Freshwater	2.0	1.6	1.7	1.9	1.8	2.2	▲ 26%	▲ 25%
Shellfish	60.0	58.2	61.5	51.1	67.4	76.5	▲ 13%	▲ 28%
Number of enterprises	282	281	292	316	314	291	▼ -7%	▼ -2%
Marine	28	26	26	28	26	23	▼ -12%	▼ -14%
Freshwater	5	6	7	8	8	9	▲ 13%	▲ 32%
Shellfish	249	249	259	280	280	259	▼ -8%	▼ -2%
Employment	1,952	1,766	2,230	1,988	2,040	2,080	▲ 2%	▲ 4%
Marine	204	225	243	212	266	272	▲ 2%	▲ 18%
Freshwater	14	20	22	22	21	26	▲ 24%	▲ 31%
Shellfish	1733.9	1521.33	1965	1754	1753	1782	▲ 2%	▲ 2%
FTE	1,018	1,086	1,086	1,007	1,129	1,171	▲ 4%	▲ 10%
Marine	176	191	217	159	245	232	▼ -5%	▲ 17%
Freshwater	12	16	17	18	18	19	▲ 2%	▲ 14%
Shellfish	831	878	852	831	866	921	▲ 6%	▲ 8%

Source: Own elaboration from EU Member States DCF data submission

4.14.2 Industry structure and total employment

The industry generally is made up mainly of bivalve shellfish micro-businesses, employing 5 persons or less and operating on the marine intertidal or sheltered inshore subtidal zones. The finfish categories are made up mainly of Atlantic salmon producing marine units, operating along the west coast, operated by several companies. There are also a number of inland-based Salmon smolt and Rainbow trout producing micro-businesses.

The sector overall grew in terms of licenced capacity and number of operating businesses since 2018, reaching 316 fully commercial production units in 2020. Licenced sites continue to be renewed or come on-stream for the first time, along with start-up production units in the expanding oyster and seaweed segments. Amalgamation of businesses and production units also continues however in the Oyster, Mussel, Freshwater trout and salmon hatchery segments, bringing down the total number of production units nationally to 291 in 2022. The decline occurred mainly among the smallest units (Table 58).

Total employment recovered over both years from 2020 by 7.8% overall to 1 998 persons. In FTE terms, the improvement over the period was by 13.1% to 1 171 persons, reflecting a slight shift towards full-time employment. In 2022, the proportion of males to female workers was 88:12, indicating an increase in the proportion of female workers which mainly occurred in the Panned salmon segment. Growing structures and licenced hectares used for production increased to 554 142 units, over 12 250 hectares in 2022.

4.14.3 Overall Economic performance

Total income dropped in 2021 to €188 million, then recovered to €194 million in 2022, an overall €2 million decrease since 2020. Total operating costs increased in 2021 to €174 million and decreased again in 2022 to €165 million and also dropped in proportion to income, increasing profitability for the sector that year.

Table 59. Economic performance of the Irish aquaculture sector: 2017-2022.

Variable	2017	2018	2019	2020	2021	2022	Change 2021-22	Develop. 2022/(17-21)
Total income	201.7	181.2	180.0	195.9	187.8	194.1	▲ 3%	▲ 3%
Total operating costs	137.2	148.2	161.5	148.8	173.6	164.7	▼ -5%	▲ 7%
Total wages	27.7	31.8	34.0	26.8	35.9	41.0	▲ 14%	▲ 31%
Gross Value Added	92.1	64.8	51.5	72.7	48.9	70.4	▲ 44%	▲ 7%
Depreciation of capital	9.0	9.3	9.0	9.1	9.2	10.6	▲ 15%	▲ 16%
Earning before interest and taxes	55.5	23.7	9.4	38.0	4.9	18.8	▲ 282%	▼ -28%
Financial costs, net	-25.7	0.5	0.7	-2.6	8.4	0.1	▼ -98%	▼ -103%
Net profit	81.2	23.1	8.7	40.6	-3.5	18.7	▲ 636%	▼ -38%
Total value of assets	194.0	240.5	244.3	264.2	252.3	280.1	▲ 11%	▲ 17%
Capital productivity (%)	47.5	26.9	21.1	27.5	19.4	25.2	▲ 30%	▼ -12%
Return on Investment (%)	28.6	9.8	3.9	14.4	2.0	6.7	▲ 244%	▼ -43%

Source: Own elaboration from EU Member States DCF data submission

Taken over the two years, costs increased generally by 11%. The greatest increases were seen for 'Energy consumption', 'Repairs and maintenance', 'Imputed value of unpaid labour' and 'Wages and salaries'. 'Energy costs' however is only 6% of overall sectoral costs which are heavily influenced by those of the Panned salmon segment. Input costs of juveniles and feed made up 33.2% of all costs in 2022. These increased from 2020 by 38 and 12% respectively, reflecting a scarcity of smolt supply and

feed ingredients. 'Wages and salaries' is a major cost component that increased by 53%, over the two years, reflecting a sector-wide difficulty in finding and retaining staff. 'Other operational costs' is a diverse and major cost category, at 21.9% of total in 2022 that however showed a significant decrease of 36% from 2020.

Economic indicator trends followed that of costs to income. GVA fell from €72.7 million in 2020 to €48.9 million in 2021, then recovered to €70.4 million in 2022. Overall GVA decreased by €2.3 million to 2022. EBIT followed a similar pattern over the period, dropping by €19.2 million to 2022. The sector as a whole remained profitable over the two years, though not consistently across the segments.

4.14.4 Main species produced and economic performance by segment

The main Species-cultures of Irish aquaculture are: Caged (Atlantic) salmon, Farmed (Pacific cupped) oyster (Oyster other), Longline cultured and Bottom cultured (Blue) mussel. The salmon production made up 27% by sales volume and 57% by sales value of 2022 output. The two mussel segments between them accounted for 45% by sales volume and 10% of sales value of 2022 output. The farmed oyster segment made up 25% by sales volume and 30% by sales value of 2022 output.

Figure 108. Main species in terms of weight and value in Ireland: 2022.



Source: Own elaboration from EU Member States DCF data submission

Irish Farmed salmon, produced to organic certification, has seen a steady increase in average unit sales value per kilogram from €5.2 in 2008 to €9.4 in 2019. In 2020, the unit sales value slipped held at €9.4 though there was a shift to frozen products from fresh whole as the lockdown suppressed markets. Unit sales value slipped to €8 per kilo, in 2021, due to a glut of frozen products, then partially recovered to €8.6 per kilo in 2022

Similarly, average unit sales value for farmed oyster rose to €4.4 per kg in 2017, then slipped to €4.1 euros per kilo in 2020 due to sales difficulties in Lockdown. Unit sales then recovered steadily to €4.9 per kilo in 2022. The unit sales value for oysters varies greatly from Bay to bay, depending on the specific oyster product desired by the market and each Bays growing potential.

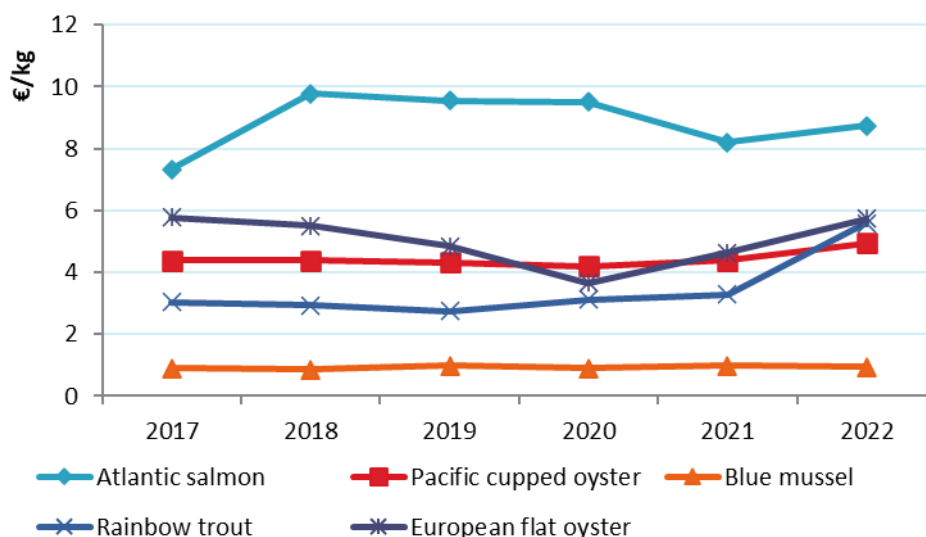
European flat oyster average unit price per kg rose from €5.2 in 2014 to €5.9 in 2016 then slipped steadily to €3.7 per kg in 2020. Average prices improved steadily thereafter to an average €5.7 per kilo in 2022. Product scarcity and erratic supply works against its profile in the market.

Blue mussel unit sales values collectively have performed relatively steadily over the time series, averaging collectively between €0.7 to €1 per kg. Bottom cultured mussels generally fetch an average value of €1 to €1.6 per kg. Prices declined from €1.6 euros per kilo in 2021 to €1.3 euros per kilo in 2022. Suspended mussels have fetched an average €0.7 euros per kg, over much of the time series,

with the fresh market product achieving an average €0.9 euros per kilogram in 2022. Mussels for the processing market achieve somewhat less per kilo, though the difference has narrowed in the last two years.

Rainbow trout fetched an average €3.1 per kg in 2022, within the time series averages varying from €3.5 to €2.7 per kg. The average price estimated does not indicate the current precarious state of the Irish Trout segment due to the inclusion of other small scale finfish production in the segment. Its small scale necessitates niche markets and high product placings to counteract the high cost of small-scale production. Product placement has lost ground in the changed marketplace post lockdown.

Figure 109. Average prices €/kg for the main species produced in Ireland: 2017-2022.



Source: Own elaboration from EU Member States DCF data submission

Segment 1: Salmon Cage

Atlantic salmon (*Salmo salar*) output volume declined by 10% between 2020 and 2022 to 11 900 tonnes (whole round). Average unit sales value also decreased by 2.0% over the period, contributing to an overall 2% decline in total income generated to 2022. Hatchery output, over the period, grew, indicating the possibility of increased output for the caged units in 2023.

6 556 tonnes of product, mainly whole round or head on gutted, was exported to France (64%), other EU states principally Poland, Germany and The Netherlands (29%) and globally (7%) in 2022. 5241 tonnes was retained in Ireland for the fresh domestic market or farther processing for the home market or for export thereafter.

Total employment increased from 2020 to 2022, from 192 to 253 persons, with an FTE increase of 156 to 217 over the period. FTE employment actually declined from a 2021 peak by 5%. The 6 year upward employment trend is in contrast to the period decline in output volume and total income -14 and -13% respectively, indicating perhaps a difficulty of determining exact employment sustained directly by production, due to the diversity of employment categories in the segment. Employment growth occurred in part-time positions in 2022, some of which were a downgrade of originally full-time positions. Full time employment declined by 16% from 2021 to 2022 mostly affecting male employees.

5 Companies operate 17 to 20 production units at any one time, varying with production cycles and organic certification requirements. 4 in-house smolt units are included within the segments production unit population as their economic activity is solely tied to that of the Caged segment. A licenced capacity of 4 000 000 m³, covering 850 hectares and utilising 280 cages was used in 2022 output. The segment is comparatively very vertically integrated.

Total income over 2020 to 2022 has been overtaken by annual increases in most costs categories. An overall decrease in overall costs from 2021 to 2022, reflects a decline in production activity, rather than a decrease in unit production costs. This is the case with unit feed cost which rose by 11.5% from 2021 to 2022 though less food was purchased. (Annual Aquaculture Report 2023).

Personnel costs rose sharply by 43.4% in 2022, making up 13% of total costs or €14.7 million. The average wage/salary per FTE has increased by 31% to €69 000. While this is a broad average, over many employment categories of the segment, increasing personnel costs are occurring significantly across this and other sectors generally. Input of juvenile stock and feed costs accounted for €55 million or 42% of the segments total, followed by other operational costs at 23.6% in 2022. This latter is a broad category, including costs from site operational services to legal, laboratory and administration office costs. Collectively all these costs are still less than that of combined inputs, which are the main determinants of profitability. Other categories also rose significantly in 2022 such as Repairs and maintenance costs (doubled) and Depreciation by 18.4%.

The economic performance of the segment has been loss making in 2021 and 2022, in synch with declining output and sales generation with increasing unit costs. The economic indicators such as GVA and Net profit reflect these contrasting trends over the 2017 to 2022 period with declining trends of -56 and -164%. Return on investment is not apparent and the future expectation indicator suggests the segment is in a non-sustainable trajectory.

The segment is constrained by a lack of capacity, which is held back more through NGO objections than by any reluctance by policymakers to grant farther licences to it. A Licence granted by the state can be made inoperable for years when an appeal against the decision can be made at that stage. The segment in 2022 faced issues with water quality, increased pathogen activity and a shift in market requirements that obliged it to sell smaller grade stock prematurely, leaving an inability to supply larger grades later on.

Segment 2: Farmed oysters

Farmed oyster (*Crassostrea gigas*) production has demonstrated steady growth, year on year, to a total output of 11 121 tonnes, worth €54.7 million in 2022, with a temporary downturn experienced during the 2020 lockdown.

Unit sales value increased in overall average to 2022, though varied among different products with consumer-ready triploid oysters selling for an average €5.28 per kg and diploid products declining slightly on average to €3.09 per kg. The top grade, equivalent to the French 'Speciales', comprising 50% of total output volume, sold for an average €6.17 per kg.

Total exports in 2022, including consumer ready and half-grown product, increased slightly to 9 288 tonnes. France continues to be the prime destination, accounting for 78%, followed by The Netherlands, taking 10% and other EU states such as Germany and Italy taking 2%. Other significant destinations are in Southeast Asia and the UK, collectively taking another 10% of 2022 export volume.

Total employment within the segment has shown a marginal increase to 1 037 or FTE of 640 persons. The positive change from 2021 to 2022 is caused by some part-time employees being made full-time and a shift away from casual labour, rather than an influx of new staff, as seen by the 7% increase in FTE, from 2021 to 2022.

No significant new business entries were observed to the segment and an increase in the larger units at the expense of the smallest, indicates some consolidation of segment enterprises in 2022. There is some horizontal Integration locally though companies mainly operate independently of each other in terms of depuration, marketing and distributing their products. There is some cooperation in product marketing.

162 production units produced over 11 000 tonnes within a licenced area 1 983 hectares and using a total of 548 038 structures.

The majority of farmed oyster culture continues to be by traditional bag and trestle although there is a steady growth in the use of alternative structures to better suit local environments, to enhance efficiency and to counter the difficulties in retaining staff and their increasing cost to do so.

Most cost categories in farmed oyster production experienced significant increases, except for 'other operational costs'. The segment costs are dominated by labour and input costs. Seed requiring units, the majority, must import from French and UK hatcheries while those taking half grown input stock can source locally. The segment is still labour intensive, notwithstanding efforts to develop labour saving culturing structures. Labour and inputs accounted for 58% of total costs in 2022. Their upward trend compared to that of unit sales values determine the level of ongoing segment profitability. Wages/salary per FTE has increased steadily to €27 000 from the 2020 lockdown crisis, though appears largely unchanged thus far on average, over the longer 2017-2022 time period

Energy costs increased by 53% in 2022 though is a relatively minor component of overall costs. Energy use in this segment is mainly that of fuel on site with some electricity use in doors. The level of unpaid labour has increased by 12% from 2021 and was estimated to be worth €1.56 million in 2022. Business owners and their family members bear this cost. Costs relative to income have decreased to 65% in 2022 from 73% in 2021 leading to improved profitability for the segment.

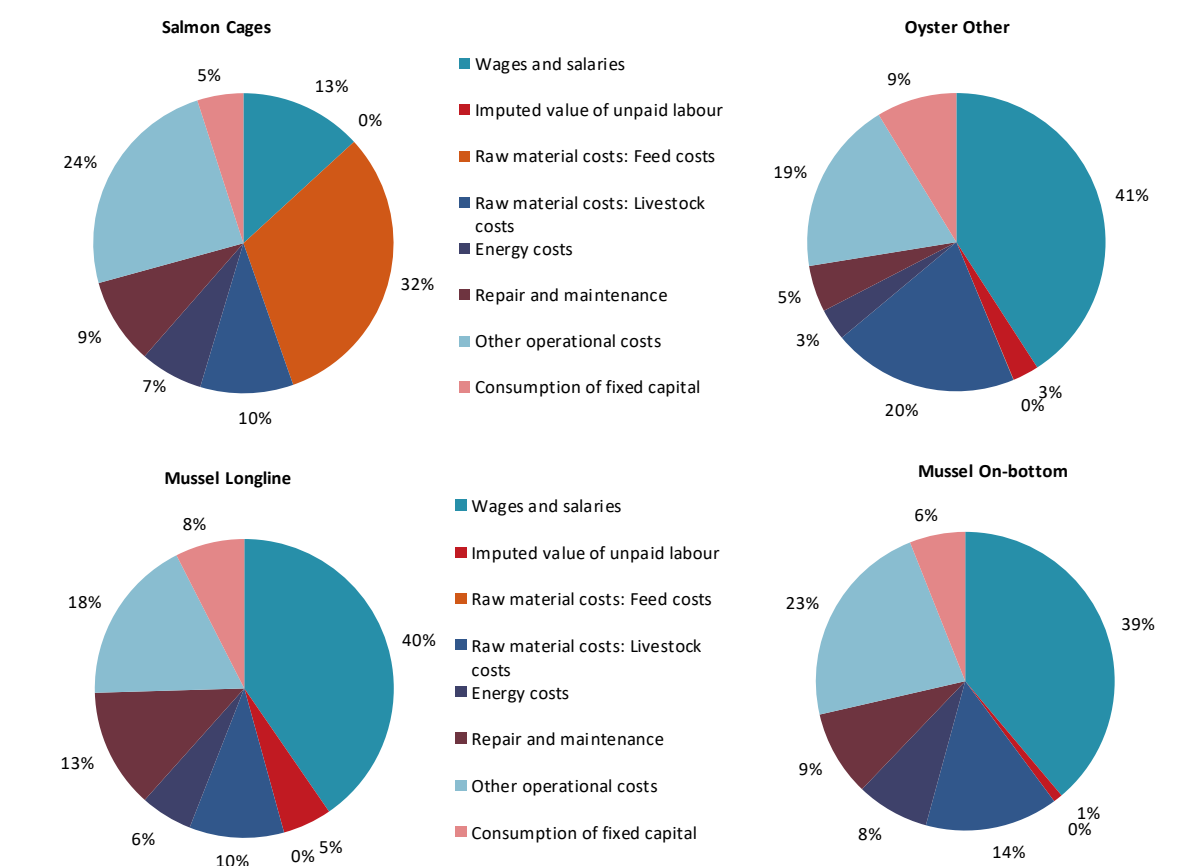
In 2022, total income increased to €63.7 million, increasing the margin from costs and increasing profitability. This increase is reflected in the economic indicators where GVA amounted to €43.6 million, and EBIT reached €21.8 million. Net profit increased significantly from €12.5 million to €20.6 million, driven by strong sales performance. There is indications of good returns on investment and the future expectation indicator reflects the segment is on a sustainable trajectory.

Table 60. Economic performance by segment in Ireland: 2017-2022.

Variable	2017	2018	2019	2020	2021	2022	Change 2021-22	2017	2018	2019	2020	2021	2022	Change 2021-22
	Salmon Cages							Oyster Other						
Number of enterprises	20	19	18	22	20	17	▼ -15%	148	148	149	160	166	162	▼ -2%
FTE	149	171	195	156	229	217	▼ -5%	519	568	541	535	599	640	▲ 7%
Average wage (thousand €)	53.1	46.5	43.3	40.1	52.6	69.1	▲ 31%	25.1	31.3	30.0	25.7	26.0	27.0	▲ 4%
Labour productivity (thousand €)	311.9	158.3	42.1	212.9	13.2	48.1	▲ 263%	60.2	43.5	53.3	46.7	53.1	63.8	▲ 20%
Sales weight (thousand tonnes)	18.7	12.0	11.6	13.2	13.2	11.9	▼ -10%	9.8	10.2	10.5	8.8	10.8	11.0	▲ 2%
Total income (million €)	135.8	116.4	109.7	125.4	106.1	103.5	▼ -2%	43.7	44.9	47.4	42.2	53.0	59.5	▲ 12%
Total operating costs (million €)	97.3	97.3	109.8	98.5	115.1	108.0	▼ -6%	25.5	37.9	34.8	30.9	35.9	36.0	▲ 0%
Gross Value Added (million €)	46.3	27.0	8.2	33.1	3.0	10.4	▲ 244%	31.3	24.7	28.8	25.0	31.8	40.8	▲ 28%
Net profit (million €)	62.5	15.4	-3.9	22.5	-13.2	-10.7	▲ 19%	14.5	3.1	8.9	8.9	12.0	20.6	▲ 72%
Total value of assets (million €)	75.4	106.5	118.3	128.8	102.6	134.0	▲ 31%	71.7	79.1	72.1	82.3	89.5	85.9	▼ -4%
Net investments (million €)	1.1	4.4	3.8	12.8	2.1	0.9	▼ -60%	5.8	3.0	4.8	2.2	3.6	5.0	▲ 39%
Capital productivity (%)	61.4	25.3	7.0	25.7	3.0	7.8		43.6	31.3	40.0	30.3	35.5	47.5	
Return on Investment (%)	46.7	14.5	-3.3	17.5	-12.6	-7.6		20.9	4.0	12.7	10.0	15.0	23.4	
Future Expectation Indicator (%)	-2.8	0.8	0.1	6.6	-1.7	-3.6		3.6	-1.1	1.9	-1.0	-0.1	1.8	
	Mussel Longline							Mussel On-bottom						
Number of enterprises	57	57	56	61	59	53	▼ -10%	25	26	32	29	27	22	▼ -19%
FTE	136	136	133	137	137	141	▲ 3%	78	74	73	75	62	64	▲ 3%
Average wage (thousand €)	17.8	19.2	28.0	24.6	23.1	25.3	▲ 10%	33.1	26.5	30.5	29.3	45.2	43.5	▼ -4%
Labour productivity (thousand €)	34.9	25.4	40.6	44.5	44.3	56.6	▲ 28%	58.6	61.0	65.2	87.7	72.4	88.6	▲ 22%
Sales weight (thousand tonnes)	8.6	9.2	10.3	10.4	11.6	13.2	▲ 14%	7.5	4.7	4.9	4.4	5.9	6.9	▲ 17%
Total income (million €)	5.8	6.6	7.8	10.0	10.4	11.6	▲ 11%	8.9	6.3	8.0	10.2	9.5	9.5	▲ 0%
Total operating costs (million €)	3.5	5.7	6.1	7.2	7.5	7.2	▼ -4%	6.9	3.8	5.4	5.8	7.8	6.6	▼ -15%
Gross Value Added (million €)	4.7	3.4	5.4	6.1	6.1	8.0	▲ 31%	4.6	4.5	4.7	6.6	4.5	5.7	▲ 26%
Net profit (million €)	1.1	0.4	0.9	2.5	2.4	3.8	▲ 58%	0.1	0.9	1.4	6.7	-2.1	2.1	▲ 198%
Total value of assets (million €)	17.8	22.6	26.5	17.9	21.2	24.6	▲ 16%	19.5	22.8	16.0	21.6	19.5	19.8	▲ 2%
Net investments (million €)	0.6	0.9	0.9	0.7	0.4	2.3	▲ 494%	0.0	1.5	1.5	0.0	0.0	0.0	
Capital productivity (%)	26.6	15.3	20.4	34.2	28.5	32.4		23.5	19.9	29.6	30.6	23.2	28.8	
Return on Investment (%)	8.1	1.6	3.4	13.2	11.4	15.5		3.8	5.9	10.7	15.5	4.5	12.5	
Future Expectation Indicator (%)	-1.8	1.8	0.6	1.9	-0.7	6.8		0.0	1.1	3.7	0.0	0.0	-2.1	▲ 0%

Source: Own elaboration from EU Member States DCF data submission

Figure 110. Cost structure of the Irish caged salmon segment: 2022.



Source: Own elaboration from EU Member States DCF data submission

Figure 111. Economic performance in € million, indicators for the main Irish segments: 2017-2022.



Source: Own elaboration from EU Member States DCF data submission

Segment 3: Suspended mussel culture

The Suspended mussel (*Mytilus edulis*) culture segment demonstrated continuous growth in production output from 2017 to 2022 of 13 200 tonnes (up 14%), worth €9.8 million across all grades. Strengthening unit sales value both for fresh market and for process product drove the trend with fresh product achieving an average €895 per tonne and processing product receiving an average €553 per tonne.

Export volume declined in 2022 to 6 607 tonnes, valued at €5 million while the growing domestic market received the balance either for home consumption or for processing before export. Exports, mainly of the relatively short shelf-life fresh product, are primarily directed to EU member states and the UK. France remains the primary destination, receiving 61%, The Netherlands received 30%, Other EU States received 5% while the UK received 4% of exports in 2022.

Employment slightly increased from 2021 to 2022 to 232 persons or by 3% to 141 in FTE terms. Full time and casual labour increased at the expense of part time. The segment recovered faster than the farmed oyster segment, post COVID-19, though generally employment trends of the segment are stable with gradual declines of total employees and number of production units.

The smallest size of production units continues to decline as the larger companies with the ability to operate large scale husbandry and harvesting equipment and keep maintenance crews continue to gradually operate and buy out the units owned by aging sole traders and smaller part time run businesses. 53 production units produced 13 200 tonnes on 940 hectares of licenced capacity, using 1 786 long line structures.

The main cost categories for the suspended mussel segment are 'wages and salaries (38.7% of total in 2022) and 'other operational costs (17.4% of total in 2022) though this latter decreased significantly by 56%. Average wage per FTE has steadily increased to €25 300 and by 10% since 2021. The sharp downward change in 'other operating costs' may be tempered by a fluctuating interpretation within the segment as to what 'other operational costs' include and may weaken the annual comparability of this variable data. All other costs increased to 2022, in particular, input costs, the 'imputed cost of unpaid labour and 'energy' costs.

A greater proportion of business owners and their families are bearing the increasing cost of unpaid labour. Energy use is a relatively minor part of the segment total cost and is primarily that of fuel for service boats and product transport. Depreciation increased between 2021 and 2022 to indicate that the main asset; the vessel fleet and associated equipment is aging. The unusually large increase in input costs for the sector to 2022 is unclear even though rising costs of the raw materials needed for seed collection, a poor seed recruitment year, rising casual labour and deployment of seed collection and transfer equipment costs have all contributed to this.

Strengthening unit sales value and output volume have been reflected in the key economic indicators. Total income increased to €11.6 million in 2022 while overall costs decreased from €7.5 million to €7.2 million in 2022, increasing the margin of profitability. GVA therefore increased from 6.1 million to €8.2 million and net profit rose from €2.4 million to €3.8 million. Investment and return on investment is positive and the future expectation indicator reflects a currently profitable, sustainable segment.

Segment 4: Seabed cultured mussels

The segment volume output increased by 17% to 6 864 tonnes worth €9 million in 2022. Sales value decreased overall by 2% due to a decrease in unit sales value from €1 559 per tonnes to €1 306 per tonne in 2022.

The Netherlands continues to be the primary destination for the mainly consumer-ready product from this export-oriented segment. In 2022, a total of 3 772 tonnes or 57% of production was sold there while 2 085 tonnes or 31.4% was sold to France. The UK received 779 or 12% while the remaining 3.3% of half-grown produce was sold locally to fattening units.

Segment total employment remained steady to 2022, employing 103 persons or 64 FTEs. The proportion of full-time workers decreased to make the majority of the workforce part-time for the first time in many years.

Consolidation within the segment is ongoing with a reduction in the number of production units. The industry is fragmented with little or no horizontal or vertical integration. Most businesses operate their own dredgers though a few still operate open traditional vessels in the southwest producing region. Production is limited not by space capacity but rather by the continued almost total dependence on wild seed beds for input stock. The quality of wild seed has been relatively poor as well as scarce for some years now. Limited amounts of half-grown stock are purchased from the rope mussel segment in extremis while other sources remain technically or economically unfeasible. 22 production units produced 6 864 tonnes upon 1 695 hectares of licenced ground in 2022.

The proportion of total cost to total income marginally decreased from 82% to 69% in 2022. This was driven by income outside of sales value generated which marginally decreased from €9.1 million in 2021 to €8.97 million in 2022. Labour costs increased overall, notwithstanding the decrease in full-time employment. The average wage per FTE in 2022 was €43 500 a marginal decrease from 2021. The largest increases in costs were observed for energy and labour costs. Energy use is in the form mainly of fuel costs for the main asset, the dredger. The costs of this segment are mainly tied up with the aggregated cost of running and crewing a dredger. 'other operational costs' representing 23% of the total in 2023, involves other vessel costs such as berthing and harbour dues, along with the usual office, professional, overheads and licencing costs associated with all segments. Input costs are in direct proportion to the time and energy put into searching for, capturing and transporting wild seed and the quality and resilience of it during and after relaying on licenced grounds. The significant drop in input cost in 2022 reflect the relatively better availability of wild seed in 2022 than in recent years.

The segment total income in 2022 of €9.5 million was a relatively positive performance, reflected in the economic indicators. GVA was 5.1 million and Net profit was €2.1 million. The profitability trend is unstable however and the lack of investment and future expectation indicator probably accurately reflects the uncertain future of this segment.

4.14.5 Outlook

Nowcasts for 2023 to 2024

The annual national survey of Irish aquaculture in 2023 indicated a decline of output volume, sales value and employment sustained while the number of production units or enterprises also declined.

Total sales value dropped from €183.4 million to €168.4 million. Output volume dropped from 44 532 to 35 294 tonnes. Total employment dropped from 2 004 to 1 954 persons and in FTE terms, from 1 171 to 1 126 persons. Production units operating dropped from 292 to 281. The decline in output volume, sales value and employment occurred throughout all the major segments except for the employment level in the rope mussel segment. Slight upward trends were observed for the minor segments such as for 'bottom cultured oysters and Seaweed.

There is no data yet for 2024 though the trend established over the last several years can provide some indication of what output and sales value is broadly likely to be. Finfish segments are expected to remain at or slightly above 2023 production and employment levels, while the shellfish sector output will stabilise before recovering to 2022 level output, where oyster producers adjust their products to the changing market and the fresh rope mussel producers will recover from stocking and market issues of 2023 and 2024. Total output volume and sales value is provisionally estimated to be 40 500 tonnes, worth €178 million and supporting 1 980 jobs in 2024.

Trends and triggers

The Irish aquaculture industry is heavily dependent on the export market. The destination countries for Irish oysters and mussels of either culture, such as France and The Netherlands, have large home productions, making the Irish product vulnerable to low prices from market over-supply and generally Irish producers receive a poorer unit sales value for their product due to this and the fact that their product must travel a greater distance to market.

The oyster segment had been steadily growing in capacity, output volume, sales value, businesses involved and employment sustained until temporarily knocked back by the lockdown period. From 2021, it has resumed growth in all areas except the average unit sales value, where only 'speciales' grades are selling. Capacity increase is also hampered in a number of bays by opposition to new licences but this depends more on the demographic make-up of local population stakeholders in an area, rather than the full-time, principled opposition directed at all times at Irish Salmon farming. Output was set back in 2023 by a collapse in the market for 'Standard' grade oysters. The segment is attempting to adjust its product profile to meet the new market conditions in 2024, though different producing bays have varying capability for 'speciales' production.

The Suspended mussel sector had also recovered its output and unit sales value for both live market and stock for processing, post lockdown by 2022. Two poor seed settlement years and a glut in the market, early in the year, set back output volume in 2023. Under normal circumstances, the segment is a steady economic performer. Sales value and volume to a limited extent is expected to gradually increase in 2024, though business number engaged and number employed may continue to decline with the amalgamation of units, increased mechanisation and emergence of roving operations crews, servicing more sites. There is little or no opportunity to increase the licenced area capacity of this segment.

The bottom cultured mussel and caged salmon segments are likely to remain below optimal capability in 2024. For bottom mussels, continuing scarce seed mussel supply and the possibility of licenced ground being reduced, threaten the future of the segment.

Caged salmon producers are struggling with water quality, stocking issues and the continuing problem of limited production capacity. The segment used to be the sole supplier to the lucrative organic certified market. The premium unit sales value obtained with this certification and for other Irish branding, mitigated for this lack of production scale. As competitors move into this space, Irish product is in danger of losing this premium unit sales price. In addition, organic certification rules, now linked to water quality classification A is a new concern in the face of deteriorating water quality. Production scale at sea is unlikely to increase significantly in the face of stiff competition for near-shore space and effective opposition to industry sea-expansion generally from certain NGOs. Therefore, the industry needs to find new ways of uniquely branding its product within the current production capacity or find a new solution to the capacity impasse.

COVID-19 and other impacts.

The shellfish segments had recovered from the market shutdowns of 2020 by late 2021 and currently face new challenges of rising costs, water quality, labour shortages and more specific market requirements. The bottom mussel segment faces the unique challenge of loss of wild seed availability and potentially licenced ground.

The salmon sector had options to mitigate against challenging market conditions in 2020 by shifting the proportion of top end product sold, towards value for money products and freeze-storing or selling frozen products. This created a glut of frozen products to sell in 2021, impacting sales then. The issues now are the same as for shellfish segments above but also that of competition in the organic market, endangering unit sales value against the backdrop of continuing limited production capacity.

Organic Products.

Currently all Caged salmon production and approximately half of longline mussel production is to organic certification, amounting to a combined 43.6% of output volume and a combined value of €104.3 million or 62% of total sales value generated in 2023.

Social acceptance

The level of social acceptance in Ireland towards aquaculture generally is poor, relative to those states where aquaculture has been long established and is a part of the cultural fabric such as oyster farming in Arcachon, France, mussel farming in Galicia, Spain or freshwater finfish culture in many parts of central Europe. The industry has a peripheral place at best in the national consciousness and indeed is practiced for the most part, in remoter areas of the country, its activity unnoticed in more populated areas. The industry comes to the attention of the public usually in the form of well aired objections to farther development in the form of new licenced production areas.

There is a strong, well organised and media-familiar anti-fish-farming lobby forming two groupings: Those who oppose salmon farming for alleged threats posed to wild salmon stocks and those who oppose new licences of any aquaculture that are seen to impact their environment, economy or aesthetics of the area. The industry and its supporters are slowly learning to articulate its case and to partner up with other industries and interests such as tourism, hospitality, the greater food industry and educationalists but the small, fragmented, unintegrated nature of the Irish industry compared to its competitors elsewhere in the EU, restricts its ability to fight its corner.

4.14.6 Data Coverage and Data Quality

Data quality and availability

Data is collected principally by census questionnaire, backed up by online survey of abridged accounts. Returns for production input and costs, output volumes and sale values, along with basic employment data tend to be of good quality with a greater than 80% response rate. Such data is available for dissemination from June of the year n+1. Returns for traditionally 'unpopular' questions on financial data have improved from 2021 onwards as survey participation has been linked to EU and state investment. Such data is available for dissemination by December of year n+1.

Data is received by a combination of interactive return, emailed pdf, post and phone call to 2025 however, the survey is moving to a fully online system by 2026. Data is still entered manually, therefore and errors submitted and uploaded are detected as anomalies in screening tables and their graphics in excel.

There remain discrepancies between data for the national report and that for this report due to the time difference between disseminations and the likelihood of new data arriving in between. A common pool of raw data supplies both reports. Discrepancies may be eliminated by online deadlines insisted upon in the near future.

4.15 Italy

Overview of Italian aquaculture

Italy provides data for all the main production sectors, encompassing marine, freshwater, and shellfish segments. In 2022, both the volume and value of aquaculture production saw notable changes compared to previous years. The overall volume decreased by 13% from 2021, reaching 123.4 thousand tonnes, and the total sales value fell by 12% to €404.1 million. The shellfish segment remains the largest in terms of volume, with 81.5 thousand tonnes, followed by freshwater (29.0 thousand tonnes) and marine (12.9 thousand tonnes). These sectors collectively supported around 7 283 jobs in 2022, indicating a slight decline in employment by 7% from the previous year, reflecting the challenges faced by the industry. The capital productivity in 2022 reached 80.6%, representing a significant improvement over previous years, driven by adjustments in operational efficiency. This trend is despite the challenging external conditions, including disruptions caused by the conflict in Ukraine, which led to increased costs for key inputs such as feed and energy. Italy's dependency on imported feed from European countries, which source raw materials from Ukraine, made the industry particularly vulnerable to these external shocks. In terms of financial performance, the profit in 2022 reached €189.3 million, showing stability compared to the 2021 results, despite the external pressures. This stability was partly achieved through strategic cost management and production adjustments. The net financial costs remained low at €1.7 million, indicating continued caution in investment practices. Meanwhile, the return on investment (ROI) in 2022 was 57.7%, a substantial improvement over the 46.4% recorded in 2020. This increase underscores the sector's resilience and ability to attract investment, even amidst market fluctuations.

4.15.1 Total Production and sales

The analysis of the Italian aquaculture sector highlights the main production segments: marine finfish, freshwater finfish and shellfish. In 2022, the total sales volume reached 123 446 thousand tonnes, a decrease of around 12.7% compared to 2021, when the sales volume reached 141 340 thousand tonnes. This represents a decrease of around 19% compared to 2017. The shellfish segment dominated in terms of production volume, with 81 500 thousand tonnes. Freshwater finfish accounted for 29 000 thousand tonnes, while marine finfish contributed 12 946 thousand tonnes. This makes shellfish the most important production segment in terms of volume. In terms of economic performance, gross sales in 2022 amounted to €404.1 million, a decrease of about 12% compared to 2021. However, this figure represents an increase of 3.4% compared to 2017, indicating some long-term growth despite the recent decline. Among the segments, shellfish once again made the largest economic contribution, with a total turnover of €215.36 million. Marine finfish followed with €95.74 million, while freshwater species generated €93 million. Although the production volume of marine finfish remained lower than that of the other segments, its economic performance remained remarkable, suggesting a relatively high market value for this category.

4.15.2 Industry structure and total employment

Between 2019 and 2022, the number of companies in the Italian aquaculture sector will remain stable at 582. Compared to 2018, this represents a decrease of 2%, and compared to the average for the period 2008-2020, a decrease of 7%. Among these entities, 51% are small enterprises with less than 5 employees, often organised as cooperatives or one-man family businesses, especially in the freshwater and shellfish sectors. In contrast, the marine sector has a higher concentration of enterprises with up to 10 employees, typically organised as limited companies. In the inland seabream and seabass farming sector, there are generally no enterprises with less than 5 employees.

In 2022, total employment in the sector was 7 283 persons, a decrease of 7% compared to 2021. The shellfish farming segment remains the largest employer with around 85% of the workforce, followed by the freshwater farming segment with 7.5% and the marine farming segment with around 7%.

Table 61. Production and sales, industry structure and employment for Italy: 2017-2022.

Variable	2017	2018	2019	2020	2021	2022	Change 2021-22	Develop. 2022/(17-21)
Sales weight (thousand tonnes)	152.1	150.3	125.7	119.5	141.3	123.4	▼ -13%	▼ -10%
Marine	14.3	13.0	11.1	10.9	15.3	12.9	▼ -15%	▼ 0%
Freshwater	33.0	41.1	36.2	33.8	41.0	29.0	▼ -29%	▼ -22%
Shellfish	104.7	96.2	78.5	74.8	85.0	81.5	▼ -4%	▼ -7%
Sales value (million €)	390.8	380.3	406.8	372.4	459.1	404.1	▼ -12%	▼ 1%
Marine	103.2	95.4	79.8	84.4	126.9	95.7	▼ -25%	▼ -2%
Freshwater	104.1	128.9	112.1	102.4	123.9	93.0	▼ -25%	▼ -19%
Shellfish	183.5	156.0	214.9	185.6	208.3	215.4	▲ 3%	▲ 14%
Number of enterprises	592	592	582	582	582	582	▲ 0%	▼ -1%
Marine	46	46	43	43	43	43	▲ 0%	▼ -3%
Freshwater	146	146	141	141	141	141	▲ 0%	▼ -1%
Shellfish	400	400	398	398	398	398	▲ 0%	▲ 0%
Employment	4,566	4,808	7,805	7,805	7,800	7,283	▼ -7%	▲ 11%
Marine	411	375	389	389	475	533	▲ 12%	▲ 31%
Freshwater	568	706	568	568	695	550	▼ -21%	▼ -11%
Shellfish	3,587	3,727	6,848	6,848	6,630	6,199	▼ -6%	▲ 12%
FTE	2,128	1,609	2,042	2,042	1,969	2,017	▲ 2%	▲ 3%
Marine	100	109	128	128	139	150	▲ 8%	▲ 24%
Freshwater	95	139	91	91	90	73	▼ -19%	▼ -28%
Shellfish	1,933	1,361	1,823	1,823	1,740	1,794	▲ 3%	▲ 3%

Source: Own elaboration from EU Member States DCF data submission

This is in line with the trend observed from 2018 to 2020, during which employment has already decreased by 8%. Compared to the average employment from 2008 to 2019, the total number of employees in 2022 represents a decrease of 12%, highlighting the ongoing challenges faced by the sector in maintaining employment levels. These data reflect a consolidation within the aquaculture industry in Italy, with smaller companies dominating certain segments and larger, more structured companies dominating others. The decline in employment underlines the impact of economic and operational challenges on the industry's ability to maintain employment levels, especially in the context of recent external pressures such as rising energy costs and increased feed prices.

4.15.3 Overall Economic performance

From 2021 to 2022, the Italian aquaculture sector faced significant economic changes. Total revenues decreased by 12%, from €459.1 million in 2021 to €404.1 million in 2022, reflecting the general challenges in the market. Operating costs also fell by 21%, helping to mitigate some losses despite the fall in revenue. Total wages increased slightly by 1%, indicating stability in labour costs. Depreciation of capital fell by 8%, reflecting adjustments in asset management.

Despite these changes, the sector showed resilience in 2022 with a net profit of €189.3 million. This represents an increase of 25% compared to the average for 2017-2021. However, the net profit remains stable compared to 2021, indicating a slowdown in the recovery from previous challenges. Return on investment (ROI) increased to 57.7% in 2022, an 11% improvement compared to 2021, suggesting more efficient use of capital in challenging conditions.

The freshwater segment continued to struggle, while the shellfish segment maintained stable profitability with a 3% increase in sales value. However, marine aquaculture suffered a significant decline, with total income in this segment falling by 25% in 2022. These fluctuations highlight the different dynamics of the main aquaculture segments, each facing unique challenges and opportunities. Overall, the sector has shown resilience, but the different impacts across segments point to ongoing challenges, including the need for strategic adjustments to changing market conditions and external pressures such as rising energy costs and supply chain disruptions.

Table 62. Economic performance of the Italian aquaculture sector: 2017-2022.

Variable	2017	2018	2019	2020	2021	2022	Change 2021-22	Develop. 2022/(17-21)
Total income	397.4	386.6	410.9	375.3	462.0	407.8	▼ -12%	0%
Total operating costs	221.2	244.4	209.7	219.8	259.9	206.0	▼ -21%	▼ -11%
Total wages	67.9	74.6	67.3	57.8	64.4	65.3	▲ 1%	▲ -2%
Gross Value Added	244.0	216.7	268.5	213.4	266.5	267.1	▲ 0%	▲ 10%
Depreciation of capital	12.1	13.8	11.5	9.9	11.6	10.7	▼ -8%	▼ -9%
Earning before interest and taxes	164.0	128.4	189.7	145.7	190.5	191.0	▲ 0%	▲ 17%
Financial costs, net	1.9	2.2	1.8	1.4	1.4	1.7	▲ 21%	▲ -1%
Net profit	162.1	126.2	187.9	144.2	189.0	189.3	▲ 0%	▲ 17%
Total value of assets	399.0	444.8	363.4	313.7	367.0	331.3	▼ -10%	▼ -12%
Capital productivity (%)	61.2	48.7	73.9	68.0	72.6	80.6	▲ 11%	▲ 24%
Return on Investment (%)	40.6	28.4	52.2	46.4	51.9	57.7	▲ 11%	▲ 31%

Source: Own elaboration from EU Member States DCF data submission

4.15.4 Main species produced and economic performance by segment

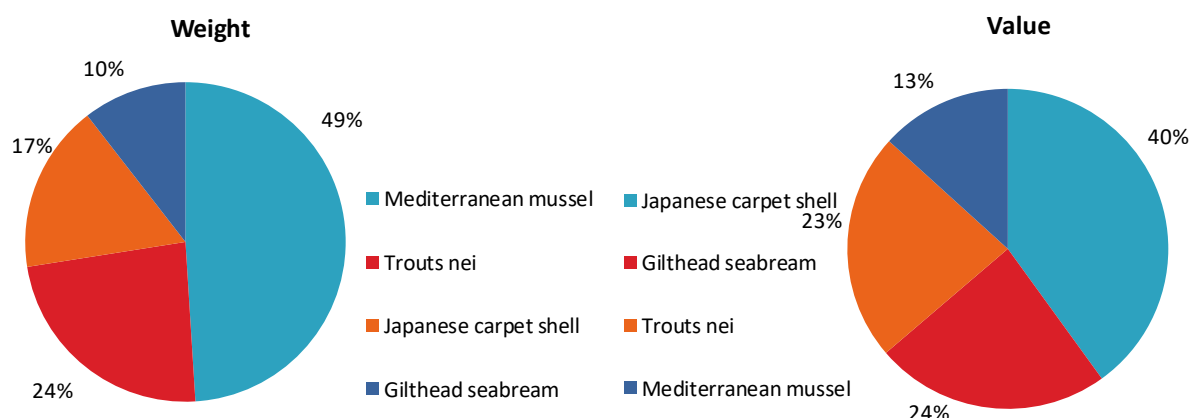
Italian aquaculture production is characterised by four main groups: Mediterranean mussels, trout, Japanese carpet-shell and seabream and seabass. In the Italian marine aquaculture sector, sea bream and sea bass (SB&SB) are almost always farmed together, with one species occasionally taking precedence in terms of volume, depending on the specific farm. Therefore, when discussing marine finfish production in Italy, both species are usually considered together. In 2022, Mediterranean mussels represent 49% of the total production volume but only 17% of the sector value, highlighting the low unit value of mussels despite their significant share in volume. Trout, including both white and pink varieties (called salmonid rainbow trout), represent 24% of the total production volume and 32% of the total value. In 2021 and 2022, the trout segment experienced a challenging performance due to severe climatic and environmental conditions, resulting in a significant loss of farmed biomass. The reduced availability of trout on the market led to price adjustments, with higher prices being recognised even for white-fleshed rainbow trout, which typically has a lower market value. This price shift indicates a reaction to the reduced supply as consumers sought alternatives to the limited availability.

As a result, even during a period of reduced overall availability, the value of rainbow trout has shown resilience due to its appeal to consumers and their willingness to pay a higher price. Japanese carpet shell accounts for 17% of the production volume and 17% of the value of the sector, indicating a balanced relationship between production volume and economic contribution. SB&SB account for 10% of the total production volume but 8% of the total value of the sector. The economic importance of these species is often greater than their volume would suggest, due to their higher market value per unit weight. Compared to 2020, the volume share of Mediterranean bivalve molluscs remains dominant, but there is a shift in the distribution of economic output between segments. This detailed comparison between production and value shares helps to understand the economic dynamics and strategic importance of each species within the Italian aquaculture industry.

Considering the different performance of the main farmed species, resulted:

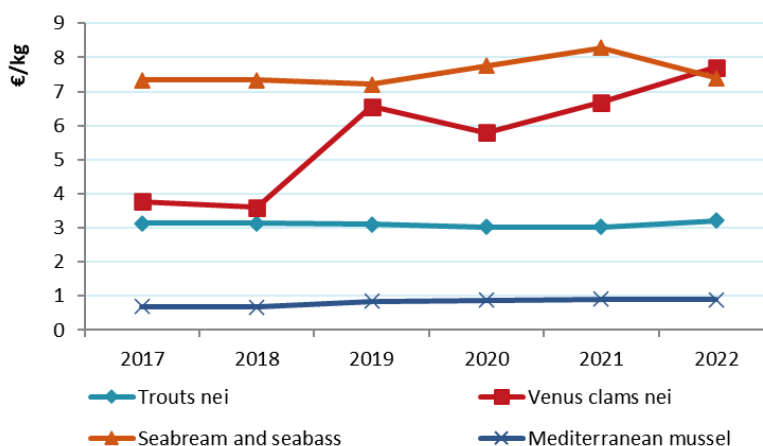
- Trout: from 2017 to 2021, the price of trout remained stable at around €/kg 3.00. There is a slight increase in the 2022, reaching €/kg 3.21. This increase reflects the market adjustment due to reduced availability due to environmental challenges, which is likely to have increased the value of the limited supply.
- Japanese carpet shell: the price showed significant volatility, peaking at €/kg 6.56 in 2019, followed by a slight decrease to €/kg 5.79 in 2020. However, prices increased again between 2021 and 2022, reaching €/kg 7.70, indicating strong demand and potential supply constraints in the market.
- Mediterranean mussels: the prices remained relatively stable, gradually increasing from €/kg 0.68 in 2017 to €/kg 0.91 in 2021, but then showing a slight decrease to €/kg 0.89 in 2022. This reflects the overall stability of the mussel market, with minor fluctuations likely to be due to changes in production or demand.
- Seabream and seabass: these species, which are often farmed together, showed an upward trend in prices until 2020, when they peaked at €/kg 8.77, driven by increased demand and limited supply. However, prices gradually decreased to €/kg 7.40 in 2022, reflecting market adjustments. Overall, the price dynamics in 2022 varied between species. While prices for trout and Japanese carpet shell increased, reflecting tighter supply or higher demand, Mediterranean mussels and SB&SB experienced slight price decreases, probably due to market stabilisation. The different trends highlight the complex interactions between supply constraints, environmental conditions and market demand in Italian aquaculture.

Figure 112. Main species in terms of weight and value in Italy: 2022.



Source: Own elaboration from EU Member States DCF data submission

Figure 113. Average prices €/kg for the main species produced in Italy: 2017-2022.



Source: Own elaboration from EU Member States DCF data submission

The following analysis examines the economic performance of four key aquaculture segments in Italy, using data from 2017 to 2022. The assessment focuses on changes in production volumes, financial results and key productivity indicators. The analysis evaluates each segment's total sales volumes, revenues, operating costs and profitability, as well as trends in capital investment and return on investment. This approach provides a comprehensive view of the strengths and challenges faced by each type of aquaculture and identifies changes in market dynamics and resource management strategies over time.

Trout tanks and raceways. This segment experienced a significant reduction in workforce (FTE, down 19%) between 2021 and 2022, closely linked to a 29% decrease in total sales volume. Despite challenges such as increased operating costs, the segment managed to improve labour productivity by 19% to €561 000 per employee. Total revenues fell by 25%, but a focus on cost management helped to stabilise net income, which grew by a modest 6%. Capital expenditure fell by 11%, suggesting potential caution in future expansion.

Clam on-bottom. In 2022, the clam on-bottom segment experienced a 7% decline in sales volumes, contributing to a cumulative 25% decline since the 2017-2021 period. This recent contraction was primarily due to the ongoing seed shortage, which limited production and drove up ex-farm prices. Despite these challenges, the segment achieved a 7% increase in total revenue and a 41% increase in net profit, reflecting effective cost management and improved productivity. Capital productivity increased to 279% while return on capital remained remarkably high.

Mussel longlines. The segment showed resilience in 2022, with a slight 1% increase in sales volume and a notable 13% increase in total income. Despite a 21% decline in net income, the segment significantly increased its capital expenditure by 33%, demonstrating a strategic focus on long-term growth. The increased investment between 2021 and 2022 was largely supported by the Structural Fund for Fisheries and Aquaculture (EMFF). This funding facilitated measures to increase production, support relaying activities and invest in technologies to mitigate blue shrimp attacks, thereby increasing the resilience and adaptability of the sector. Return on capital employed remained strong at 37.5% and capital productivity remained stable at 72.4%, demonstrating the segment's sustainable practices and potential for future profitability.

Below are the economic performances of the two main segments of marine fish farming in Italy: SB&SB offshore cages, tanks and raceways.

Sea bass and sea bream cages. This segment experienced a slight increase in labour (FTE increased by 15%) and a 17% increase in labour productivity, reaching €401.2 thousand per worker in 2022. However, total sales volume fell by 15% and total revenue by 21%, largely due to operational challenges, in particular environmental factors. Despite these declines, the segment managed to reduce operating costs by 41%, leading to a significant increase in net income of 69%. Capital expenditure grew modestly (4%) and capital productivity reached 56%, indicating an efficient use of assets. Return on investment (ROI) improved to 43.3%, but the future expectations indicator remained low at 16.8%, reflecting uncertainty about long-term growth prospects.

Sea bass & sea bream tanks and raceway. This segment experienced a 17% decline in sales volume and a 31% decline in total income in 2022, reflecting adverse environmental conditions, in particular higher temperatures, which negatively affected biomass growth. Despite this, the segment managed to keep costs under control with only a modest 1% increase in operating expenses. However, the segment experienced a significant 44% decline in net profit, highlighting the profitability challenges. Average wages fell by 12% and labour productivity also fell by 36% to €296.4 thousand per employee. Capital productivity fell to 43% and the rate of return fell to 28.3%, indicating lower returns on capital investment. The future expectations indicator was slightly higher than in the cage segment, at 18.5%, suggesting a cautious outlook for future growth.

Both segments faced challenges in maintaining sales volumes and revenues, but each approached cost management differently. The offshore cages segment showed resilience in profitability, driven by significant cost reductions and investments in productivity. In contrast, the tanks and raceways segment struggled with declining productivity and profits despite maintaining a leaner cost structure. The cages

segment's higher return on investment and stable investment growth suggest a stronger immediate financial position, while the tanks segment's cautious future outlook highlights the need for strategic adjustments to remain competitive.

Table 63. Economic performance of the main Italian aquaculture segments: 2017-2022.

Variable	2017	2018	2019	2020	2021	2022	Change 2021-22	2017	2018	2019	2020	2021	2022	Change 2021-22
Clam On-bottom								Trout Tanks and race-ways						
Number of enterprises	176	176	174	174	174	174	0%	146	146	141	141	141	141	0%
FTE	953	541	891	891	827	721	-13%	95	139	91	91	90	73	-19%
Average wage (thousand €)	32.5	61.4	35.4	28.3	27.1	39.4	45%	119.5	122.3	162.6	144.6	167.9	175.9	5%
Labour productivity (thousand €)	120.3	161.6	165.8	135.2	158.5	196.2	24%	494.6	408.2	556.4	387.8	472.4	561.0	19%
Sales weight (thousand tonnes)	36.2	31.1	26.0	24.5	22.7	21.0	-7%	33.0	41.1	36.2	33.8	41.0	29.0	-29%
Total income (million €)	140.0	115.3	172.4	143.0	152.6	163.4	7%	105.1	129.7	112.5	102.7	124.2	93.3	-25%
Total operating costs (million €)	56.3	61.1	56.2	47.8	44.1	50.3	14%	69.5	90.0	76.7	80.6	96.8	65.2	-33%
Gross Value Added (million €)	114.6	87.4	147.7	120.5	131.0	141.5	8%	47.0	56.7	50.6	35.3	42.5	40.9	-4%
Net profit (million €)	80.8	51.7	114.1	93.7	107.1	111.4	4%	31.1	33.5	30.3	17.4	22.0	23.4	6%
Total value of assets (million €)	74.0	67.8	61.0	51.2	48.7	50.6	4%	131.2	197.8	168.1	134.5	147.9	131.1	-11%
Net investments (million €)	22.9	19.5	17.6	14.1	14.1	13.9	-1%	42.3	58.6	45.1	34.3	38.8	33.9	-13%
Capital productivity (%)	155.0	128.9	242.2	235.1	269.1	279.4		35.8	28.7	30.1	26.2	28.7	31.2	
Return on Investment (%)	109.5	76.6	187.3	183.0	220.2	220.4		24.6	17.7	18.8	13.7	15.6	18.7	
Future Expectation Indicator (%)	27.4	25.4	25.7	24.5	26.1	24.4		29.7	27.2	24.3	22.8	23.3	23.1	
Mussel Longline								Sea bass & Sea bream Cages						
Number of enterprises	224	224	224	224	224	224	0%	24	24	22	22	22	22	0%
FTE	980	820	932	932	913	1073	17%	72	79	68	68	69	80	15%
Average wage (thousand €)	12.8	14.9	11.9	11.0	14.7	12.0	-19%	76.8	69.4	64.5	71.0	92.2	62.9	-32%
Labour productivity (thousand €)	24.3	25.3	28.4	28.5	40.1	29.8	-26%	513.3	384.8	387.9	159.9	344.1	401.2	17%
Sales weight (thousand tonnes)	68.5	65.1	52.5	50.3	62.3	60.5	-3%	9.6	8.4	7.4	7.7	10.2	8.7	-15%
Total income (million €)	47.5	44.8	45.2	44.3	57.1	54.2	-5%	71.6	64.0	54.5	57.1	82.6	65.4	-21%
Total operating costs (million €)	36.2	36.3	29.8	28.0	33.9	35.1	4%	40.1	39.1	32.5	51.0	65.2	38.5	-41%
Gross Value Added (million €)	23.8	20.7	26.5	26.5	36.7	31.9	-13%	37.0	30.4	26.4	10.9	23.7	31.9	34%
Net profit (million €)	7.9	5.0	12.7	13.9	20.5	16.3	-21%	29.4	22.0	19.7	3.9	14.5	24.4	69%
Total value of assets (million €)	58.3	60.6	39.4	35.9	37.3	44.1	18%	72.8	64.2	51.4	52.9	72.0	57.0	-21%
Net investments (million €)	18.9	21.4	14.3	11.2	12.4	16.5	33%	9.9	14.7	10.3	8.8	11.3	11.8	4%
Capital productivity (%)	40.9	34.2	67.2	74.0	98.3	72.4		50.8	47.3	51.4	20.5	33.0	56.0	
Return on Investment (%)	14.3	8.9	32.8	39.3	55.7	37.5		40.7	34.8	38.9	7.8	20.4	43.3	
Future Expectation Indicator (%)	27.3	30.1	30.0	25.0	26.7	31.6		11.2	18.8	16.1	13.0	11.9	16.8	

Source: Own elaboration from EU Member States DCF data submission

In general, the four segments have different strengths and weaknesses. The trout tanks and raceways segment are struggling with staff retention but has improved productivity. The clam on-bottom segment is showing resilience and strong returns on investment. Mussel longline is maintaining steady growth and focusing on future investment, while SB&SB offshore cages is balancing cost reductions with improved profitability. The key challenge for all segments is to manage operating costs, particularly labour and inputs, while maintaining growth and productivity.

Between 2021 and 2022, the aquaculture segments of mussels, trout, SB&SB in cages and mussels showed clear performance trends.

Trout tanks and raceways. The segment experienced a 29% decline in sales volume to 29 000 tonnes in 2022, reflecting a broader trend of environmental challenges. Total income decreased by 25% to €93.3 million, while operating costs decreased by 33% to €65.2 million. Despite the decline, the net profit margin improved to 25%, an increase of 6% from 2021, and labour productivity reached €561 000 per FTE (up 19%). Managing environmental impacts remains critical to maintaining profitability.

Clam on-bottom. This segment maintained a robust net profit margin of 68% in 2022 (up 2% on 2021). Total revenue rose to €163.4 million, an increase of 7% compared to 2021, while operating expenses also increased to €50.3 million (an increase of 14%). Over the 2017-2022 period, the segment showed

a high GVA-to-sales ratio, consistently around 80%, reflecting efficient value creation despite a 7% decline in sales volume in 2022. However, the ongoing seed shortage remains a key challenge.

Mussel longline. In this farming segment, sales volumes decreased by 3% to 60 500 tonnes, while total income increased by 13% to €54.2 million. Operating costs increased by 4% to €35.1 million. The segment's net profit margin fell by 21% but remained strong at 30%. The segment's GVA to sales ratio stabilised at 59%, indicating steady value creation. The segment's capital expenditure increased by 33%, driven by contributions from structural funds, reflecting a strategic focus on future growth, supported for improving production and resilience against environmental challenges.

Seabass and seabream cages. This segment faced considerable variability, with a 15% reduction in total sales volume to 8.7 thousand tonnes in 2022. Total income dropped by 21%, falling to €65.4 million. Despite the decline, a significant reduction in operating costs (down 41% to €38.5 million) allowed for a notable increase in the net profit margin, which rose to 37% (a 69% improvement). The GVA-to-revenue ratio improved to 49%, but the long-term trend indicates challenges in stabilizing profitability. Investment in assets increased modestly by 4%, reflecting a cautious approach to future expansion.

Overall, while clam and mussel segments demonstrate robust margins, trout and SB&SB segments face more variability, with the latter achieving profitability through effective cost management.

Figure 114. Economic performance in € million, indicators for the main Italian segments: 2017-2022.



Source: Own elaboration from EU Member States DCF data submission

In 2021 and 2022, the Italian aquaculture sector faced significant shifts in its cost structure, driven by rising global energy prices and changes in operational dynamics. Each aquaculture segment experienced different impacts on its main cost categories, reflecting the specific needs and challenges of its production methods.

- **Trout tanks and raceways:** in 2022, feed costs remain the largest component of operating costs, accounting for 47% of total costs, similar to 2020. Energy costs increase to 15%, reflecting increased global energy prices. Labour costs (wages and salaries) accounted for 18%, showing stability but highlighting the significant impact of energy on operating costs.
- **The Clam On-bottom segment's** cost structure is dominated by labour costs, making up 55% of expenses, with minimal unpaid labour at 3%. Energy costs represent 16%, and raw materials,

mainly for livestock, account for 14%. Maintenance costs are 9%, while other expenses are minimal, highlighting the segment's reliance on efficient labour and energy management.

- Mussel longline: the labour costs (wages and salaries) and animal costs remained the main costs, accounting for 33% and 30% respectively. Energy costs accounted for 17%, reflecting the energy requirements of the segment, while other operating costs and maintenance had a lesser impact.
- Seabass and seabream cages: for this segment, feed costs remained a significant expense, accounting for 47% of total costs. Repair and maintenance costs were also significant at 24%. Energy costs decreased slightly but still impacted on operations, accounting for 5% of costs. This reflects a stabilisation of energy costs compared to the peak years.

Thus, the increase in operational costs during 2021-2022 was primarily driven by higher feed and energy prices due to the war in Ukraine. Yet, when considering the pre-conflict period and the concurrent decrease in production, it is evident that the industry managed to adjust expenses to align with the reduced market supply. Looking forward, the transition towards renewable energy could help mitigate these external pressures, enhancing the sector's resilience to global disruptions.

Figure 115. Cost structure of the main segments in Italy: 2022.



Source: Own elaboration from EU Member States DCF data submission

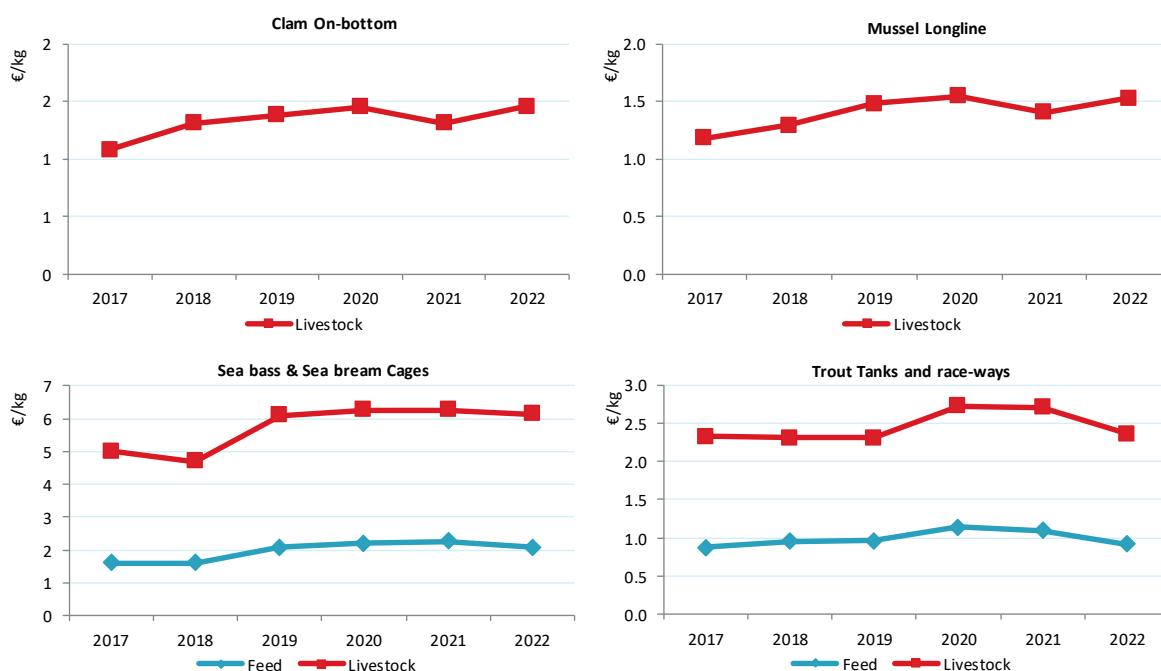
For trout tanks and raceways, feed prices remained relatively stable between 0.9 €/kg and 1.1 €/kg from 2017 to 2021, with a drop back to 0.9 €/kg in 2022. The price of trout fry remained stable at 2.3 €/kg from 2017 to 2019 but increased to 2.7 €/kg in 2020 and 2021, before decreasing again to 2.4 €/kg in 2022.

In the SB&SB cage segment, the cost of feed shows significant changes from 2017 to 2022. Starting at 1.6 €/kg in 2017, it increased significantly to 2.2 €/kg by 2020 but shows a slight decrease to 2.1 €/kg in 2022. The cost of juveniles, starting at 5.0 €/kg in 2017, peaks at 6.3 €/kg in 2020 and 2021, before decreasing slightly to 6.1 €/kg in 2022.

For the mussel longline and clam on-bottom segments, feed prices were not tracked separately, but the cost of seed is a critical factor. The cost of mussel seed was around 1.2 €/kg in 2017, gradually increasing to 1.5 €/kg in 2019 and remaining stable until 2022. The price of mussel seed follows a similar

trend, reaching 1.5 €/kg in 2022. These trends illustrate the sector's adjustment to fluctuations in market conditions and production input costs over the years.

Figure 116. Feed and livestock average prices €/kg for the main Italian segments: 2017-2022.



Source: Own elaboration from EU Member States DCF data submission

4.15.5 Outlook

Nowcasts for 2023-24

The data for 2023 and 2024 are based on forecasts from the National Association of Aquaculture Farmers (API) and insights from the Association of Mussel Farmers (AMA), as well as interviews with key informants from leading trout, clam, seabass and seabream farms. From 2023 onwards, the Italian aquaculture sector faces a significant decline, particularly in mussel production, with the situation worsening in 2024. This decline is mainly attributed to the spread of non-native species, such as the blue crab, which has invaded the Adriatic and other Italian seas, causing ecological disruptions. At the same time, inland aquaculture has been hit by rising operating costs. The ongoing conflict in Ukraine has driven up energy prices, affecting supply chains and adding to costs. Feed prices, a key expense for the industry, have also risen sharply, adding to the financial burden. These challenges are compounded by a growing sense of uncertainty within the sector, with many aquaculture companies struggling to maintain stable and continuous employment. This lack of confidence has discouraged younger generations from pursuing a career in aquaculture, even in family-run businesses. This trend poses a significant challenge to the long-term continuity and development of the sector, as it becomes increasingly difficult to attract and retain new talent.

Trends and triggers

In 2023-2024, the Italian aquaculture sector faced significant challenges and shifts in different segments. These shifts highlight the impact of environmental factors, predation and strategic adaptations within the sector.

In 2023, the clam segment reaches an estimated sales volume of 16 000 tonnes, representing a turnover of €192 million. However, the outlook for 2024 is bleak, with production expected to fall to 3 000 tonnes and turnover to €42 million. This decline is largely due to predation by the invasive blue crab, which has severely affected both production and seed availability. The significant decline in volume and revenue

poses a significant risk to the viability of many businesses in this segment. In 2023, the mussel segment will produce around 55 000 tonnes with a turnover of €60.5 million. In 2024, production is forecast to fall to 30 000 tonnes and turnover to €33 million. The decline follows a precautionary harvest in 2023, which mitigated the immediate risks from the blue crab, but created production challenges for the following year. According to EUMOFA, up to 2021 Italy imported mussels worth €37.5 million and exported €10.6 million, mainly fresh mussels (EUMOFA, 2023); also, for 2023-24, the volume of imports continues to increase, while exports could see a significant decrease. This shift highlights the challenges of maintaining domestic supply. In the comparison, both the clam and mussel segments are expected to experience significant production declines in 2024 due to environmental and predation pressures. The clam sector is particularly affected, with an expected 78% drop in turnover, highlighting its vulnerability. In contrast, the mussel segment, while facing a significant decline in volume and turnover, retains a relatively higher degree of stability, reflecting the different levels of resilience across the sectors. In this shellfish production scenario, the oyster segment has shown resilience, benefiting from farming technologies that protect against predators such as the blue crab. This stability has attracted investor interest, helping to maintain production levels despite challenges in other areas of the sector. The freshwater aquaculture segment, particularly trout farming, began to recover in the second half of 2023. Production volumes are expected to exceed 30 000 tonnes, generating revenues of around €118 million. This recovery is supported by investments in renewable energy technologies and alternative feeding practices. In parallel, marine aquaculture, in particular seabream farming, will grow, with an estimated 20% increase in value in 2022, reaching around €143 million for both seabream production systems. The traditional valliculture sector in the north-east is facing a downturn due to conservation measures that have restricted licence renewals, affecting employment in fish farming and related processing activities. In contrast, the hatchery production is growing slightly, driven by increased production of trout eggs and other salmonid species, followed by marine species such as SB&SB. In 2023, the value of the hatchery sector is estimated to exceed €41 million (API, 2024). As for salmonid and caviar production, the production of salmonid eggs for human consumption has remained stable at around 50 tonnes. Meanwhile, caviar production has grown modestly to around 65 tonnes, with significant exports to Central Europe and the Emirates. This expansion underlines the growing importance of egg production and caviar in both domestic and international markets, especially for high-value products.

As a result of the different responses of the Italian aquaculture sector to predation, environmental changes and market dynamics, the performance of the various segments has shown divergent results. While some areas are struggling to recover, others have managed to adapt and stabilise, demonstrating the complexity of the sector and the crucial role of strategic adaptation.

High energy prices

In 2023-2024, the Italian aquaculture sector, which includes both fish and shellfish production, continues to face significant challenges from rising energy costs, a trend that began in 2022 due to the Ukraine-Russia conflict. The disruption to global energy supplies has led to increased prices for natural gas, electricity and fuel, affecting production costs across the industry. For fish farming, particularly in energy-intensive sectors such as marine hatcheries, costs increased by more than 40% compared to 2021^{9,10}. This increase directly affected key inputs such as feed production, which relies on energy-intensive processes such as heating, water circulation and oxygenation in hatcheries. The shellfish sector, particularly mussel farms, also faced increased energy costs. These farms, traditionally located in coastal areas, have shifted their operations to open sea areas due to changing coastal conditions caused by flooding and storms. This shift has increased capital expenditure on equipment, such as service vessels, and fuel costs for offshore operations. The Italian government has responded with initiatives under the REPowerEU plan and the <<Decreto Blue Crescita 2023>>, which focus on supporting the sector's transition to renewable energy. These measures provide subsidies for solar, hydro and other green technologies, with the aim of reducing dependence on fossil fuels. However, the adoption of renewable energy solutions remains slow, and many farms still rely on traditional energy sources, making profitability a challenge. Some inland freshwater farms in Northeast Italy have begun experimenting with circular practices. These include anaerobic digestion processes that convert aquaculture waste and manure into biogas, offering a way to reduce energy costs and improve

⁹ <https://www.mimit.gov.it/it/incentivi/sostegno-alla-transizione-energetica-cetp> (last accessed: 24-10-2024).

¹⁰ <https://www.mase.gov.it/notizie/repower-eu-tutte-le-novita> (last accessed: 24-10-2024).

environmental sustainability. These practices demonstrate a move towards a more resilient and sustainable production model, although wider adoption across the sector is still needed.

Social acceptance

In Italy, the social acceptance of aquaculture has become a key priority, as highlighted in the National Strategic Plan for Aquaculture (NSPA) 2021-2027. The NSPA emphasises the importance of improving the public's understanding and perception of aquaculture, reflecting on lessons learned from previous strategies and setting targets for better social integration. Efforts include public information campaigns and initiatives to make aquaculture practices more transparent and sustainable, focusing on the benefits of certification, environmental awareness and waste reduction through circular economy models. Recent studies show that public attitudes towards aquaculture are complex and are influenced by geographical and cultural factors¹¹. In Italy, social acceptance of aquaculture tends to be higher in regions where the industry contributes directly to the local economy, such as in freshwater trout farming areas. The *Associazione Piscicoltori Italiani* (API) has been active in improving this through targeted training and knowledge-sharing events, with a particular focus on young farmers and new entrants to the sector. These programmes aim to build technical skills and raise awareness of sustainable practices. In addition, newer sectors, such as seaweed farming, have seen an increase in the participation of younger farmers and women, contributing positively to the acceptance of the industry in the areas where it is located. This diversification not only enhances the economic potential of aquaculture, but also increases its social acceptability by aligning with global trends towards sustainability and innovative, low impact farming practices. Such developments are supported by EU policies and funding that promote community engagement and environmental stewardship as part of sustainable blue growth strategies. While challenges remain, particularly in terms of competition for space and environmental impacts, Italy's efforts to involve local stakeholders and improve communication are helping to gradually improve the social perception of aquaculture.

4.15.6 Data Coverage and Data Quality

Data quality and availability.

The Italian data collection process for aquaculture provides comprehensive and reliable statistics for all major production segments, both in terms of volume and value. Data coverage is complete, with no segments affected by confidentiality restrictions according to statistical data protection standards. The Italian data submitted to EU-MAP are exactly the same as those reported to FAO and show consistency when compared with EUROSTAT datasets. Data are collected annually, categorised by species and production methods, and provided by the Ministries of Agriculture and Food Sovereignty. Employment data, last fully collected in 2020, will be updated triennially under the EU-MAP social data framework, with the next update expected in 2023. However, the number of persons employed, and full-time equivalents (FTE) are collected annually, providing an up-to-date reference for 2022. This systematic approach ensures a high level of data accuracy and comparability, supporting sound statistical analysis and policy decisions.

¹¹ Cavallo M. et al. (2022), <https://doi.org/10.1002/ieam.4663> (last accessed: 24-10-2024).

4.16 Latvia

Overview of Latvian aquaculture

Latvian aquaculture sector cultured mainly of freshwater aquaculture species. The primary species cultured in 2022 were Common carp, Sturgeon and Rainbow trout contributing 79% and 71% respectively to the total produced volume and value. The total sales weight in 2022 was 924 tonnes corresponding to the value of €6.2 million. The sales weight and value increased from 2021 to 2022 by 5% and 73% respectively.

4.16.1 Total Production and sales

In the period from 2017 to 2022, the development of aquaculture in Latvia shows the increasing trend, mainly due to the increase in sales value by 39% in the period from 2017 to 2022 (see Table 64). The production capacity remains rather stable in the same period. The sales value increases by 73% between 2021 and 2022, while the sales weight increase by only 5%. The annual total Gross sales of aquaculture production include sales of fish and crustaceans', sales of juveniles and prepared aquaculture production sold during the reported year, contributing 924 tonnes by volume and €6.2 million by value in 2022.

4.16.2 Industry structure and total employment

For Latvian countryside aquaculture is important business activity and is the employment provision field in a small town and villages. The 69 economically active aquaculture enterprises employed 310 persons in 2022 (see Table 64). 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 15% between 2017 and 2022. 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 2022 was 310, corresponding to 202 FTE. From 2017 to 2022, the number of employees increased by 8%, whereas the number of FTE increased by 5%.

Table 64. Production and sales, industry structure and employment for Latvia: 2017-2022.

Variable	2017	2018	2019	2020	2021	2022	Change 2021-22	Develop. 2022/(17-21)
Sales weight (thousand tonnes)	0.9	1.0	0.7	0.8	1.1	0.9	▲ 5%	▲ 3%
Sales value (million €)	3.6	4.4	4.4	4.3	5.7	6.2	▲ 73%	▲ 39%
Number of enterprises	88	87	79	78	75	69	▼ -22%	▼ -15%
Employment	245	235	323	330	307	310	▲ 27%	▲ 8%
FTE	173	182	175	223	206	202	▲ 17%	▲ 5%

Source: Own elaboration from EU Member States DCF data submission

The information is presented under one segment according to EU-MAP classification: "Other freshwater fish Other methods" 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.

4.16.3 Overall Economic performance

The total income from the aquaculture generated by the Latvian aquaculture enterprises increased by 18% to €7.1 million between 2017 and 2022, including €6.2 million from gross sales per species, €32.5 thousand from the other income and €0.8 million of subsidies. In its turn, the total operating costs increased by 17% during the same period and was €6.7 million in 2022.

The total wages were increased by 22% from 2017 to 2022 and contribute the largest share to the costs structure or 39% in 2022 (see Table 65 and Figure 117). The depreciation of capital decreased by 39% from 2017 to 2022, in its turn the financial income increases significantly from 2021 to 2022 by 42%, resulted the highest net profit of €2.1 million in 2022 (see Figure 119).

The total value of assets decreased by 32% during the period of analysis, reflecting less investments. ROI remained negative at the end of the reference period with decrease of 34% in 2022 compared to 2017, it implies the inefficient use of companies' asset base to generate sales.

Table 65. Economic performance of the Latvian aquaculture sector: 2017-2022.

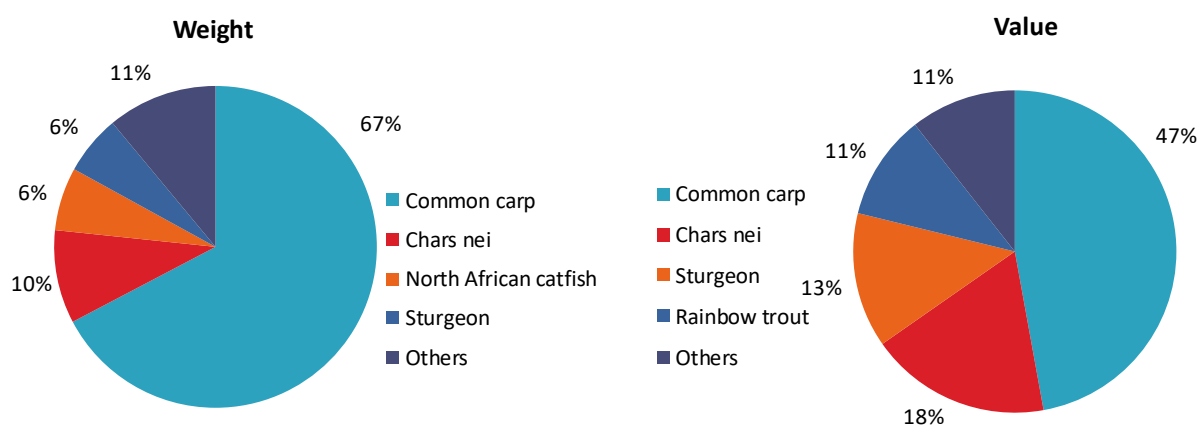
Variable	2017	2018	2019	2020	2021	2022	Change 2021-22	Develop. 2022/(17-21)
Total income	5.3	6.0	6.1	5.8	6.8	7.1	▲ 4%	▲ 18%
Total operating costs	4.9	5.7	5.6	6.3	5.9	6.7	▲ 13%	▲ 17%
Total wages	2.1	2.5	2.4	2.5	2.7	3.0	▲ 10%	▲ 22%
Gross Value Added	0.9	1.4	1.2	0.6	2.6	2.6	▼ -2%	▲ 94%
Depreciation of capital	1.7	1.7	1.7	1.6	0.7	0.9	▲ 28%	▼ -39%
Earning before interest and taxes	-1.3	-1.5	-1.3	-2.1	0.2	-0.5	▼ -437%	▲ 56%
Financial costs, net	0.0	0.1	0.3	-1.4	-1.4	-2.6	▼ -85%	▼ -448%
Net profit	-1.3	-1.6	-1.5	-0.7	1.5	2.1	▲ 33%	▲ 385%
Total value of assets	28.1	28.2	25.7	24.0	22.1	17.5	▼ -21%	▼ -32%
Capital productivity (%)	3.1	4.8	4.7	2.3	11.9	14.7	▲ 24%	▲ 175%
Return on Investment (%)	-4.7	-5.2	-4.9	-8.7	0.7	-3.0	▼ -527%	▲ 34%

Source: Own elaboration from EU Member States DCF data submission

4.16.4 Main species produced and economic performance by segment

Common carp was the main species produced by the Latvian aquaculture sector representing 67% in weight and 47% in value of the total production in 2022 (Figure 117). Second important species is Sturgeon covering 6% and 13% of weight and value respectively in 2022.

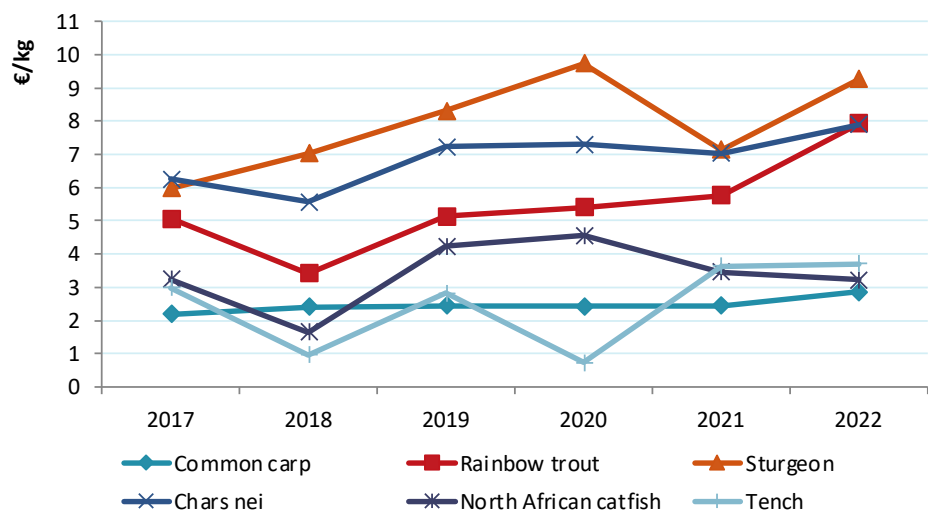
Figure 117. Main species in terms of weight and value in Latvia: 2022.



Source: Own elaboration from EU Member States DCF data submission, 2024

The average prices for Common carp demonstrate an increasing trend between 2017-2022. Compared to 2017, the average first-sale price for Common carp and Sturgeon in Latvia has been increased by 24% and 35%, respectively and was €2.9 per Kg and €9.3 per Kg, respectively in 2022 (see Figure 118).

Figure 118. Average prices €/kg for the main species produced in Latvia: 2017-2022.

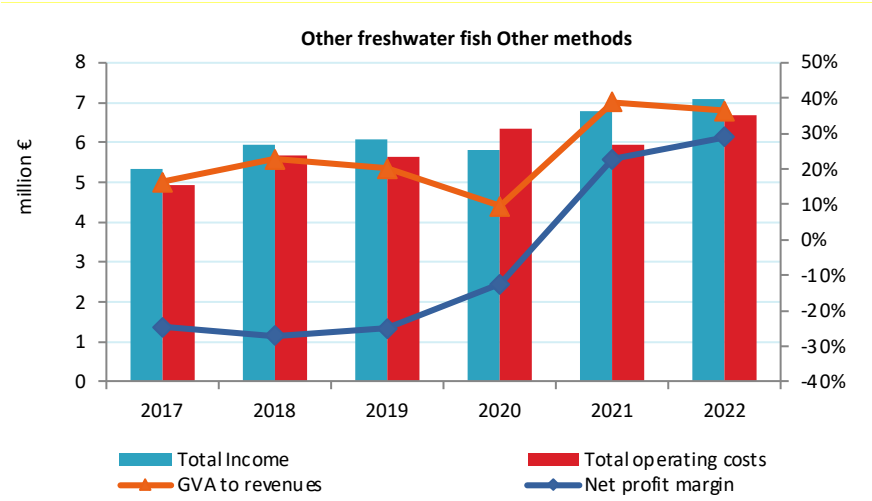


Source: Own elaboration from EU Member States DCF data submission, 2024

The section cannot be provided by the segment in whole detail due to the small number of enterprises in the aquaculture sector. The data was submitted according to the EU-MAP segmentation as one segment “Other freshwater fish Other methods (seg.8.5)”, as in Table 65.

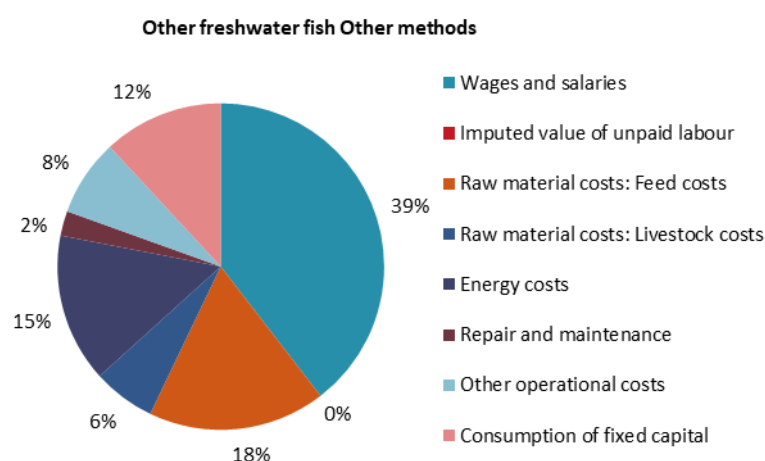
Full description and information with the relevant references to the tables and figures are provided under main section.

Figure 119. Economic performance indicators (in € million) for the main Latvian segments: 2017-2022.



Source: Own elaboration from EU Member States DCF data submission, 2024

Figure 120. Cost structure of the main segments in Latvia: 2022.



Source: Own elaboration from EU Member States DCF data submission, 2024

4.16.5 Outlook

Trends and triggers

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.

Production amount of aquaculture products is not restricted with quota or other restrictions, thus, in comparison to fishing, the initiation of business in this sector is simpler.

Market structure

The aquaculture sector is largely hindered by the high production costs of the breeding and the problems with the sales of final products at the market. The main item offered at the market – trade size carps during relatively short summer can usually be grown only in the long three- summer. Only a few big farms can afford to ensure the supply of products on a constant basis. However, aquaculture companies' owners in a constant search for new opportunities and markets for their products, working on development of the production processes and are not afraid to experiment with growing new species. The recirculation systems are becoming increasingly popular in aquaculture sector.

COVID-19 impact

The COVID-19 crisis have not had a significant impact, as the sector is focused on local markets. Quarantine and preventive anti-COVID restrictions contributed to the rise in prices, which in turn affected the sharp increase in financial income since 2020.

4.16.6 Data Coverage and Data Quality

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)".

4.17 Lithuania

Overview of Lithuanian aquaculture

In 2022, Lithuanian aquaculture industry produced 4.9 thousand tonnes of freshwater fish production corresponding to €19.7 million. Compared to 2021, weight of production declined by 5%, whereas value increased by 30%. Total number of employees increased to 431, corresponding to 306 FTE.

4.17.1 Total Production and sales

In 2022, the Lithuanian aquaculture industry produced 4.9 thousand tonnes of freshwater fish, valued at €19.7 million (FAO, 2024). Compared to 2021, the total value of aquaculture production increased by 30%, despite a 5% decrease in weight. Compared to 2017-2021 multiannual average the weight and value of the aquaculture production increased by 14% and 54% respectively (FAO data). The main part of aquaculture production is generated from the ponds, tanks and raceways – 75% of total quantity produced. However, the share of total production from ponds has a decreasing trend. Total weight of pond production, compared to 2021 declined by 10% whereas value increased by 24%. RAS aquaculture production maintained the growth trend in 2022 with 13.7% annual increase in weight and 40% increase in value.

Table 66. Production and sales for Lithuania: 2017-2022.

Variable	2017	2018	2019	2020	2021	2022	Change 2021-22	Develop. 2022/(17-21)
Production weight (thousand tonnes)	3.7	3.7	4.2	4.5	5.1	4.9	▼ -5%	▲ 14%
Marine	0	0	0	0	0	0		
Shellfish	0	0	0	0	0	0		
Freshwater	3.7	3.7	4.2	4.5	5.1	4.9	▼ -5%	▲ 14%
Production value (million €)	11.8	11.9	12.5	12.9	15.1	19.7	▲ 30%	▲ 54%
Marine	0	0	0	0	0	0		
Shellfish	0	0	0	0	0	0		
Freshwater	11.8	11.9	12.5	12.9	15.1	19.7	▲ 30%	▲ 54%

Source: Own elaboration from FAO (2024) data

In 2022, 14% of the total production was exported, maintaining the same share as in 2021. Although the weight of exported production decreased by 6% annually, its value increased by 48%. Poland was the largest export market, accounting for 71% of total exports, followed by Latvia with 23%.

4.17.2 Main species produced and economic performance by segment

Main segments

In 2022, the Lithuanian aquaculture sector comprised 60 producers, marking an 8% decrease from 2021. Of these, 45 were micro enterprises (including farmers), and 15% were small enterprises. The sector is divided into three main segments. The largest segment consists of freshwater species produced in ponds (including tanks and raceways) and it represents the largest share of national production – 75% of total weight and 73% of total value. It targets mainly carp, sturgeon, rainbow trout as main species and other freshwater species in less extent and contributed to the 78% of national production in terms of value. Around 16% of total pond production was certified as organically produced with a 7% decline, compared to 2021. The total capacity of ponds consisted of an area of 10.3 thousand ha from which 6.0 thousand ha were used for regular production and 4.3 thousand ha were certified for

organic production. Compared to 2021, the total area of ponds increased by 1%. In 2022, pond aquaculture enterprises generated around €847 thousand net profit with 5.5% net profit margin, returning to the pre-pandemic level when the multiannual 2017-2021 average net profit margin for this segment was 4.3%.

African catfish produced in RAS is the second largest segment, accounting for 18% of the national aquaculture production by weight and 15% of the total production value in 2022. Although the African catfish segment accounts for 70% of all RAS producers, its total capacity only contributes 23% (3 280 m³ in 2022). Compared to 2021, size of RAS for African catfish production decreased by 12.4% in 2022 but was 8.4% higher than 2017-2021 multiannual average. African catfish RAS segment generated €-123 thousand net loss, however in the long run returns of this segment is increasing compared to €-185 thousand net loss in 2021 and €-371 thousand as 2017-2021 multiannual average.

Other freshwater species produced in RAS make up the third segment, contributing 7% to the national production weight and 12% to the production value. This segment offers a diverse range of high-value species, including rainbow trout, European eel, tilapia, and Alpine char. This segment accounts for 30% of RAS producers and 77% of the total RAS capacity (10 965 m³ in 2022). Compared to 2021, the size of RAS in this segment grew by 3.7% and was 157% higher than the 2017-2021 multiannual average. In 2022, RAS enterprises producing species other than African catfish reported a net loss of approximately €-1.3 million. Negative returns in the last few years are related to new establishments and increase of RAS capacity. According to the latest trends of segment development and increasing investments in the segment (high capital and marketing costs) are delaying the breakeven point for profitability.

In 2022, the aquaculture sector employed 431 people, equivalent to 306 full-time equivalents (FTE). This represents an increase of 1.9% in total employees and 8% in FTE compared to 2021. Pond aquaculture units employed 304 people, corresponding to 225 FTE, with increases of 1.7% and 9% respectively compared to 2021. The number of employees in RAS in 2022 increased by 2.4%, corresponding to 81.6 FTE.

The age distribution of employees was predominantly in the 40-64 age group, which represented 65% of the total workforce. About 26% of employees were in the 25-39 age group, 3% were in the 15-24 age group, and 6% were over 65. The gender distribution was 74% male and 26% female. Based on the employment status survey, in 2022 around 91% of total employees are involved in the activity as main employment and 9% as non-main employment including seasonal work.

Main species produced

In 2022, carp production (for consumption and sales for stocking) dominated in terms of both weight and value, making up 62% and 56% of the national totals, respectively. Compared to 2021, carp production decreased by 16% to 3.0 thousand tonnes, while its value rose by 15.2% to €11.7 million. Approximately 68% of carp from aquaculture units were sold chilled for consumption, 25% were processed, and 7% were sold as juveniles for stocking. The average first-sale price for fresh common carp for consumption increased by 42% to €3.63/kg (excluding VAT) in 2022. Carps are typically grown in polyculture with other cyprinids like bighead carp, white amur, tench, and other freshwater species such as European pike and European catfish. The value of carp production tends to rise due to investments in fish processing at aquaculture farms, which generate higher-value products compared to fresh production. However, the share of value from carp production in total production is declining. For example, in 2017, carp accounted for 65% of the value, but this share dropped to 58% in 2022.

In 2022, African catfish was the second most significant species in terms of production weight, totalling 0.89 thousand tonnes. Compared to 2021, both the total weight and value of African catfish production increased by 5.2% and 13.7%, respectively. Approximately 48% of African catfish from aquaculture units were sold chilled for consumption, 51% were processed, and less than 1% were sold as juveniles for stocking. The average market price for fresh-chilled African catfish in 2022 decreased by 5.2% to

€2.56/kg (excluding VAT), while the average price for processed African catfish rose by 13.2% compared to 2021.

Rainbow trout was the third largest species produced by the aquaculture industry, with an annual production of 223.4 tonnes. Compared to 2021, the production weight and value of rainbow trout surged by 71.1% and 50%, respectively. In 2022, 94% of total rainbow trout was sold chilled for consumption, 5% was processed, and 1% was sold for stocking purposes. The average price for fresh-chilled rainbow trout declined by 11% to €4.25/kg (excluding VAT), while the average price for processed trout increased by 1%. Of the total rainbow trout production in 2022, 87% was produced in RAS, with the remainder coming from ponds, open raceways, and tanks.

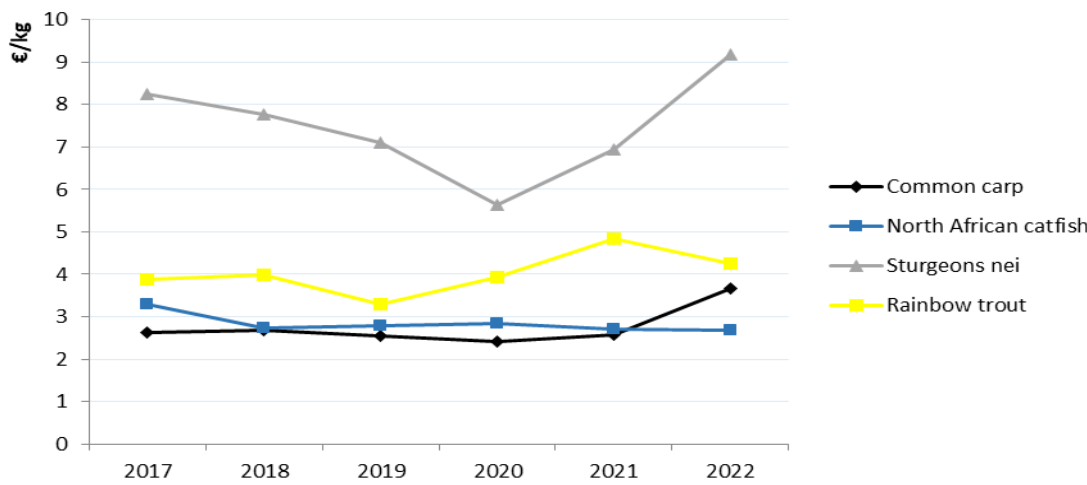
In 2022, Lithuanian aquaculture farms produced 207.5 tonnes of sturgeons and compared to 2021 weight and value of production improved by 29.3% and 78.1% respectively. In 2022, the average price for fresh-chilled sturgeon in the internal market for consumption increased by 32.6% to €8.83/Kg (excluding VAT).

Figure 121. Main species produced in terms of weight and value in Lithuania: 2022.



Source: Own elaboration from FAO (2024) data

Figure 122. Average prices for the main species produced in Lithuania: 2022.



Source: Own elaboration from FAO (2024) data

4.17.3 Outlook

Nowcast for 2023-24

According to official LAFPMIS data, the total weight of aquaculture production in 2023 fell by 12.4% to 4.3 thousand tonnes, with a corresponding value of €19.5 million, marking a 7.3% decrease compared to 2022. The weight of RAS production dropped by 7.4% in 2023, while its value rose by 5.2%. This outcome was influenced by the addition of new producers and increased sales in large-scale RAS units. Pond, tank, and raceway aquaculture production saw declines of 14% in weight and 11.8% in value. Despite the reduction in sold quantities, average prices for major species tended to rise in 2023. For example, the average price of chilled carp increased by 6% to €3.84/kg, rainbow trout by 20% to €5.11/kg, and African catfish produced in RAS by 22% to €3.11/kg. The number of employees in 2023 decreased by 2.8%, and full-time equivalents (FTE) declined by 5.4% compared to 2022.

Based on primary official LAFPMIS data, weight of aquaculture production sales is tending to decrease in 2024. For instance, comparing the period from January to June 2024 with the same period in 2023, the weight of aquaculture production decreased by 5%, while the value of production declined by 10%. During the 2022-2023 period, average prices for main species significantly increased compared to the 2017-2021 multiannual average. For example, the price of carp in 2022 was 41% higher than the 2017-2021 average, and in 2023, it was 51% higher. Following record-high aquaculture prices, a slight correction was observed in 2024. Compared to 2023, the average prices for trout and sturgeon declined by around 17% in 2024. However, preliminary data indicates that the average price for African catfish remained stable in 2024.

Trends and triggers

Pond aquaculture has a developed stable production capacity which results in constant production quantities with increasing diversification to processed fish production. RAS segments constantly increasing capacity and increasing sales in the internal market, whereas exports do not show a growing trend. RAS segments are highly diversified. The major quantities are produced by African catfish and trout producers, whereas remaining part targets a niche market for Alpine char, red claw crayfish and tilapia. In 2022 the main triggers were observed through the limitations of feed (grains and fish feed) supply after the market disruptions impacted by war in Ukraine. Scarcity of feed and related inflation in grain prices led to an increase in operating costs and difficulties to maintain aquaculture operations. Rising energy costs, exacerbated by the conflict, have also impacted the cost of aquaculture production especially in RAS systems where energy costs are an important element in cost structure.

Main drivers for growth:

- Investments in aquaculture to build new systems as well as enhance capacities of RAS introduction of innovative aquaculture equipment for modernization and increase of efficiency. For these activities, support from EMFAF is provided.
- Increasing quality of aquaculture products, growth of added value and diversification of supply.
- Diversification of income by vertical integration through fish processing facilities, catering 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.

Main challenges:

- Pond aquaculture face challenges from the climate change. High risk of short term losses due to extreme droughts or floods the occurrence of algal blooms, and long term impact from new pathogens and parasites.
- Insufficient export trends of aquaculture production.
- Increase of energy prices and inflated other operational costs.
- Shortage of qualified employees, due to the insufficient involvement of younger generation with qualified skills and education.
- Competition from imported aquaculture production.

COVID-19 impact

During the COVID-19 period sales of production in 2020 and 2021 tended to increase compared to the previous years. Market access issues were not significant to the large producers as the main part of production is sold to the large-scale food operators. Economic impact was observed in the drop of net profit for pond and RAS aquaculture. The dip of net profitability in 2020 during the 2017-2022 period is most likely related to the additional costs to the industry affected by the pandemic restrictions and imposed additional requirements. For small businesses, the market access was more significant as closure of local markets and the restriction of the movement of buyers had an impact on the sales of products to smaller aquaculture farms, which mainly produce African catfish and rainbow trout in small scale RAS systems. Companies in this segment depend on direct consumers who buy products directly from companies or in the local markets.

4.17.4 Data Coverage and Data Quality

Aquaculture sector in Lithuania consists only of the freshwater aquaculture. For the analysis FAO data was used. Data for 2023 and 2024 is taken from Lithuanian Agricultural and Food market Information System (LAFPMIS), data is included in the Official Statistics Programme of Lithuania.

4.18 Malta

Overview of Maltese aquaculture

The Maltese aquaculture sector remains solely marine-based, focusing entirely on marine fish production. The primary species produced is Atlantic Bluefin Tuna, which accounts for the majority of the sector's output and value. In 2021, the sector produced 16.4 thousand tonnes of marine fish, generating €210 million in gross sales, with 371 employees and 318 FTEs. In 2022, production slightly increased to 16.6 thousand tonnes, with gross sales rising to €286 million, while employment remained stable at 370 employees and 315 FTEs.

In terms of industry structure, there exist 7 enterprises in Malta. Most of these enterprises specialize in tuna fattening operations, though a small amount carries out mixed operations having activities in Gilthead seabream and European seabass, and other marine species. Atlantic Bluefin Tuna dominates production, accounting for circa 86% of total output. Other species produced in smaller quantities include Gilthead seabream and European seabass (13%) and other marine species (such as Amberjack), though their contributions to total production and value are minor compared to Bluefin Tuna.

The industry continues to maintain its focus on the export market, particularly targeting high-value markets in Asia, where Bluefin Tuna is in high demand. Despite global market disruptions and increasing operational costs, the Maltese aquaculture sector remains resilient, with modest production increases and significant turnover growth in 2022.

4.18.1 Total Production and sales

The sector is solely dependent on marine fish aquaculture. In 2021, the Maltese aquaculture sector produced a total of 16.4 thousand tonnes of marine fish, marking a 17% decrease from 2020's production levels. Despite the drop in production volume, the sector generated €210 million in gross sales, a relatively modest decrease of around 2% compared to 2020, reflecting sustained market demand.

In 2022, production volumes increased slightly by 1.3% to 16.6 thousand tonnes. The most notable development was the significant increase in gross sales, which rose by 36% to reach €286 million. This sharp rise in turnover, despite only a modest increase in production, was largely driven by a recovery in the market prices of Atlantic Bluefin Tuna, the primary species produced in Malta. The sector also maintained stable production volumes across its other marine fish species, contributing to overall resilience in the face of fluctuating global market conditions.

Table 67. Production and sales, industry structure and employment for Malta: 2017-2022.

Variable	2017	2018	2019	2020	2021	2022	Change 2021-22	Develop. 2022/(17-21)
Sales weight (thousand tonnes)	15.7	19.3	13.8	19.8	16.4	16.6	1%	-2%
Sales value (million €)	180.4	242.7	161.9	215.4	210.4	286.1	36%	42%
Number of enterprises	7	7	9	9	9	10	11%	22%
Employment	256	320	341	410	371	370	0%	9%
FTE	216	258	293	300	318	315	-1%	14%

Source: Own elaboration from EU Member States DCF data submission

4.18.2 Overall Economic performance

In 2021, the Maltese aquaculture sector recorded a strong recovery, with a Gross Value Added (GVA) of €61.3 million, a notable improvement over previous year (excl. 2020). However, by 2022, GVA had

decreased significantly to €42.3 million, reflecting a 31% decline compared to 2021. This drop, despite increased income, suggests that rising operational costs negatively impacted profitability. Nevertheless, over the long term, GVA has developed positively, with an overall 76% increase compared to the 2017-2021 period, indicating that the sector continues to create significant value in the long run.

Capital productivity, on the other hand, saw a remarkable improvement in 2022, rising from 20.5% in 2021 to 36.8%, representing a 79% increase. This improvement underscores the sector's growing efficiency in using its capital assets to generate output. This suggests that recent investments in the sector have started yielding strong returns, particularly in terms of resource optimization.

Similarly, the Return on Investment (ROI) improved significantly, rising from 15.3% in 2021 to 22.4% in 2022, reflecting a 47% increase. This increase highlights the sector's growing profitability and its ability to generate higher returns on invested capital. However, when viewed in the context of the longer-term trend, ROI has still developed by -208% relative to the 2017-2021 average, indicating that while there have been recent gains, the sector is still recovering from historically low returns in previous years.

While key profitability indicators like Net Profit and Earnings Before Interest and Taxes (EBIT) provide insight into the sector's outlook, 2022 saw a decline in both metrics. EBIT dropped by 44%, from €45.5 million in 2021 to €25.7 million in 2022. Similarly, Net Profit fell by 17%, down to €32 million from €38.5 million the year before. These declines, driven by rising operational costs such as wages and energy, suggest that while the sector remains profitable, margins have come under pressure, leading to cautious optimism about future performance.

With the regards to operating costs, one of the most significant challenges faced by the Maltese aquaculture sector in recent years has been the sharp rise in operational costs. In 2021, total operating costs amounted to €162.1 million, and by 2022, they had surged by 59%, reaching €258.4 million. This substantial increase in costs has put considerable pressure on profit margins, despite the sector's success in generating higher turnover. The sector unfortunately is vulnerable to fluctuations in global prices, exacerbated by the ongoing energy crisis and rising transportation costs, partly due to geopolitical instability such as the Ukraine-Russia conflict.

One of the key drivers of rising operational expenses in the Maltese aquaculture sector has been energy costs, which have fluctuated significantly in recent years. In 2021, energy costs amounted to €1.99 million, but by 2022, they surged to €3.26 million, representing a 64% increase. This sharp rise is reflective of the global energy crisis, which has been exacerbated by geopolitical tensions, such as the Ukraine-Russia conflict, leading to soaring fuel and electricity prices.

The cost of capital maintenance and depreciation has remained a notable factor. Although the depreciation of capital decreased slightly by 5% in 2022, falling to €4.9 million, the sector's heavy reliance on capital-intensive infrastructure such as offshore cages, feeding systems, and vessels continues to require ongoing investment. The rapid depreciation of assets in previous years, particularly due to investments made in the late 2010s, has forced businesses to focus on sustaining operational assets while managing high financial costs.

Additionally, the cost of livestock, which includes the purchase and transportation of juvenile fish or captured tuna for fattening, has been another contributing factor to the increased operational burden. While the sector has benefited from rising Bluefin Tuna market prices, the cost of acquiring livestock has remained volatile, adding to the financial pressure. The increased transportation costs associated with importing livestock from other regions further compound these expenses.

A closer look at wages also highlights the impact of rising labour costs. Total wages increased from €10.6 million in 2021 to €11.7 million in 2022, marking a 10% rise. While this increase reflects improved compensation for employees, it also adds to the financial burden on aquaculture enterprises, especially when paired with the stable employment levels in the sector. With FTEs remaining stable at 315, the rising wage bill without significant changes in employment levels indicates that higher salaries or adjustments for inflation have contributed to overall cost growth.

Labour productivity also saw improvements during this period. With total income increasing by 36% to €289 million in 2022, and FTEs remaining stable at 315, labour productivity per employee improved as the sector generated significantly more income with a stable workforce. This growth in efficiency is further reflected in the 10% increase in total wages and a 33% increase compared to the 2017-2021 average, signalling both higher workforce compensation and improved productivity.

Summarising the above, the Maltese aquaculture sector experienced a mix of strong turnover growth and rising capital efficiency in 2022, balanced against declining profitability indicators due to rising costs. While the sector remains resilient, these trends suggest a need for continued focus on managing operational expenses to maintain profitability in the coming years.

Table 68. Economic performance of the Maltese aquaculture sector: 2017-2022.

Variable	2017	2018	2019	2020	2021	2022	Change 2021-22	Develop. 2022/(17-21)
Total income	180.4	242.7	164.9	217.6	212.8	289.0	▲ 36%	▲ 42%
Total operating costs	210.2	236.2	202.3	140.8	162.1	258.4	▲ 59%	▲ 36%
Total wages	4.9	8.6	9.5	10.1	10.6	11.7	▲ 10%	▲ 33%
Gross Value Added	-24.8	15.1	-27.8	86.8	61.3	42.3	▼ -31%	▲ 91%
Depreciation of capital	2.0	4.2	4.7	4.4	5.2	4.9	▼ -5%	▲ 19%
Earning before interest and taxes	-31.8	2.3	-42.0	72.4	45.5	25.7	▼ -44%	▲ 177%
Financial costs, net	0.0	0.0	0.9	1.6	7.0	-6.3	▼ -189%	▼ -431%
Net profit	-31.8	2.3	-43.0	70.8	38.5	32.0	▼ -17%	▲ 334%
Total value of assets	41.5	44.9	57.4	274.0	298.5	114.9	▼ -62%	▼ -20%
Capital productivity (%)	-59.9	33.7	-48.4	31.7	20.5	36.8	▲ 79%	▼ -920%
Return on Investment (%)	-76.7	5.1	-73.3	26.4	15.3	22.4	▲ 47%	▼ -208%

Source: Own elaboration from EU Member States DCF data submission

4.18.3 Employment and socio-demographics

In 2021, the Maltese aquaculture sector employed 371 individuals, which decreased slightly to 370 employees in 2022. The sector also maintained a stable number of Full-Time Equivalents (FTEs), with 318 FTEs in 2021 and 315 FTEs in 2022, reflecting a consistent and largely full-time workforce over these two years. The slight reduction in total employment, combined with stable FTE figures, suggests that the sector's focus has been on optimizing its workforce while maintaining productivity levels, especially in light of rising operational costs.

Wages within the sector have seen steady growth over the years. In 2021, the total wage bill stood at €10.6 million, increasing to €11.7 million in 2022, marking a 10% rise. This increase is consistent with broader wage inflation trends as businesses seek to retain skilled employees in a competitive labour market. The average wage per employee in 2022 was approximately €31.6 thousand, up from €28.6 thousand in 2021. This rise in average wages reflects both inflationary pressures and the sector's efforts to maintain competitive compensation, particularly in the face of rising living costs and the need to attract skilled labour.

The employment structure within the aquaculture industry in Malta shows a considerable variation by gender. As of 2022, the number of male workers was significantly higher than female workers, reflecting a traditionally male-dominated sector. This trend has persisted over the years, with males consistently occupying more positions in technical and operational roles. There has been a slight increase in female participation, but it remains below 20% of the workforce, which highlights the industry's slow adaptation to gender parity.

In terms of education, a large portion of the workforce in aquaculture has secondary-level education or vocational training. This educational profile aligns with the nature of the jobs in the sector, which are often hands-on and practical rather than requiring higher education degrees. There is, however, an

observable trend where higher-educated individuals are entering managerial and research-based positions. This is reflective of Malta’s broader aim to integrate more scientific and technological advancements into its aquaculture industry. In fact, over the past five years, the proportion of workers with tertiary education has increased by approximately 10%.

Nationality plays a significant role in the composition of Malta's aquaculture workforce. Maltese nationals make up the majority of the workforce, but there is a noticeable increase in foreign labour, particularly from other EU countries. This influx is driven by both the availability of specialized skills in other parts of Europe and the increasing demand for labour in Malta's growing aquaculture industry. Non-Maltese workers are more often found in seasonal or lower-wage positions, while managerial roles continue to be dominated by local Maltese.

4.18.4 Main species produced and economic performance by segment

The aquaculture industry in Malta is solely marine-based with all species being grown in offshore cages in Maltese waters. The industry primarily includes three key categories of fish: Bluefin tuna, seabass and seabream, and a smaller share of other marine species such as meagre and amberjack. The greatest part of production volume and value is by far attributed to the capture-based aquaculture for Atlantic Bluefin tuna since it represents around 86% and 96% of the entire sector’s output in terms of output and sales volume respectively.

Following this, other important segment is Gilthead seabream, which in 2022 accounted for around 13% of total production volume and 3% of the total value. Other species include the European seabass, brown meagre, and amberjack which all together account only for 1% of total volume and circa 0.5% of 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. This activity’s product receives attains high prices especially in the Japanese and South-Korean markets, which remain the main markets for such produce. It is noted however, that since 2011 the average price had been showing a marginal decreasing trend, though since 2021 the average price of BFT per kg has been increasing, recording €14.70/kg in 2021 and €19.20/kg in 2022. The lowest average price per kilogram remained for the Gilthead seabream, the second most produced specie. In 2021, the price decreased to €3.90/kg (-2.1% over 2020) and bounced back to €4.40/kg in 2022. The trend in the prices of Gilthead seabream has shown a stable trend across the time series assessed, with 2022 prices being circa 7% below the 2017-2021 average price.

Figure 123. Main species in terms of weight and value in Malta: 2022.



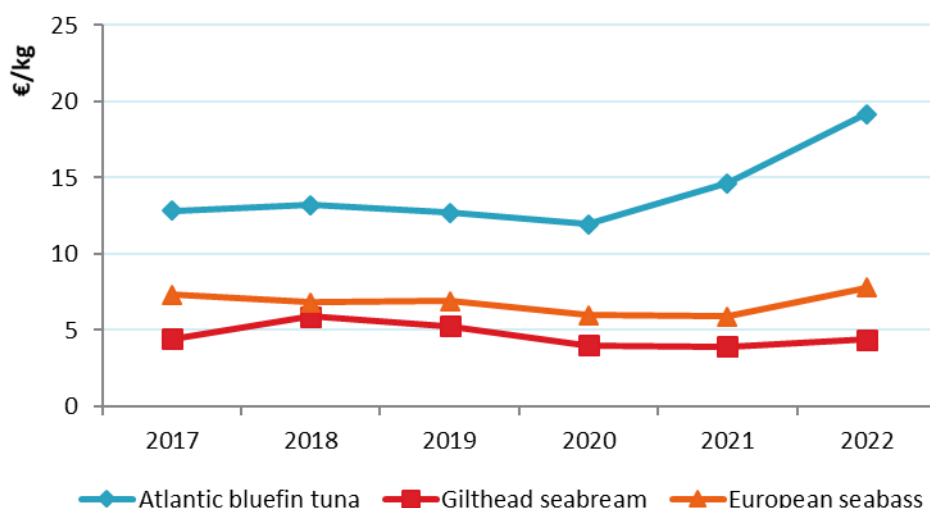
Source: Own elaboration from EU Member States DCF data submission, 2024

The price of European seabass has declined during the pandemic years as prices kept decreasing in 2021 to €5.90/kg, a 14% drop from pre-pandemic average (2017-2019). Data for 2022 though shows a significant turnaround with prices increases by 33% over the previous year to €7.80/kg.

A key point to mention is that aquaculture operators in Malta also produce a mix of brown meagre and amberjack. While produced in much smaller quantities than the other marine species above, they tend to sell for a price that competes with prices of the European Seabass activity. Particularly brown meagre which in 2021 and 2022 yielded a price per kg of €15.90 and €14.40 respectively.

The average prices for bluefin tuna shows an increasing trend in recent years (see Figure 124).

Figure 124. Average prices €/kg for the main species produced in Malta: 2017-2022.



Source: Own elaboration from EU Member States DCF data submission, 2024

Bluefin tuna cages segment

The Tuna Cages segment experienced some notable shifts in performance between 2021 and 2020. In 2021, total income for the segment decreased slightly to €201 million, compared to €206.2 million in 2020. Operating costs, however, rose from €131.8 million in 2020 to €152.9 million in 2021, which significantly impacted profitability.

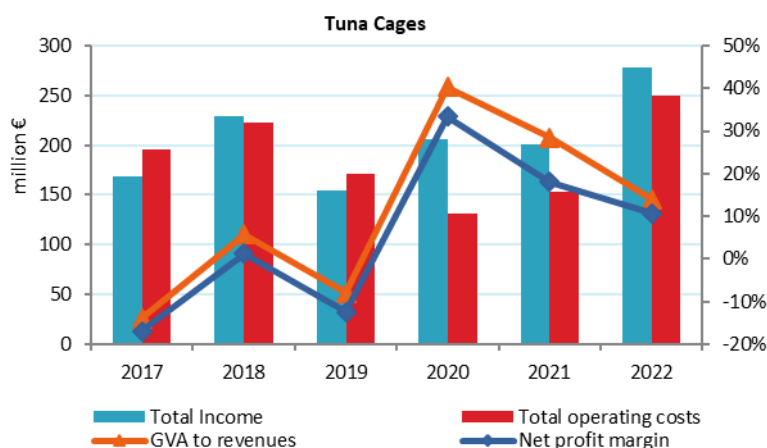
Table 69. Economic performance of main Maltese tuna cages aquaculture segments: 2017-2022.

Variable	2017	2018	2019	2020	2021	2022	Change 2021-22	Develop. 2022/(17-21)
Tuna Cages								
Number of enterprises	6	6	6	6	6	6	0%	0%
FTE	153	198	144	257	275	283	3%	38%
Average wage (thousand €)	22.5	33.1	32.5	34.2	33.8	37.0	9%	18%
Labour productivity (thousand €)	-	-	-	85.1	323.3	208.5	-34%	53%
Total sales volume (thousand tonnes)	13.1	17.3	12.0	17.1	13548.8	14369.2	6%	428%
Total income (million €)	168.4	228.6	154.2	206.2	201.0	278.2	38%	45%
Total operating costs (million €)	195.3	222.2	171.2	131.8	152.9	249.8	63%	43%
Gross Value Added (million €)	0.0	0.0	-12.3	83.1	57.3	38.8	-32%	51%
Net profit (million €)	-28.5	2.8	-19.1	68.7	36.2	29.7	-18%	147%
Total value of assets (million €)	33.4	37.8	31.8	260.8	285.9	108.3	-62%	-17%
Net investments (million €)	7.8	9.6	1.5	1.2	7.7	6.1	-21%	10%
Capital productivity (%)	0.0	0.0	-38.6	31.9	20.0	35.8		
Return on Investment (%)	-85.3	7.3	-61.5	27.0	15.1	21.9		
Future Expectation Indicator (%)	18.6	15.9	-3.4	-1.1	1.1	1.4		

Source: Own elaboration from EU Member States DCF data submission

Consequently, Earnings Before Interest and Tax (EBIT) dropped from €70.3 million in 2020 to €43.3 million in 2021. The Gross Value Added (GVA) to revenues ratio also declined from 40% in 2020 to 29% in 2021, indicating a reduced capacity to generate value from revenues. The net profit margin followed a similar trend, falling from 33% in 2020 to 18% in 2021. Furthermore, labour productivity dropped from €323 331 per employee in 2020 to €208 516 in 2021, indicating a notable decline in operational efficiency. Despite these setbacks, Return on Investment (ROI) remained stable, albeit lower, at 15% in 2021 compared to 26.3% in 2020, while capital productivity decreased slightly to 20 from 32 in 2020.

Figure 125. Economic performance indicators (in € million) for the tuna cages segment in Malta: 2017-2022.



Source: Own elaboration from EU Member States DCF data submission, 2024

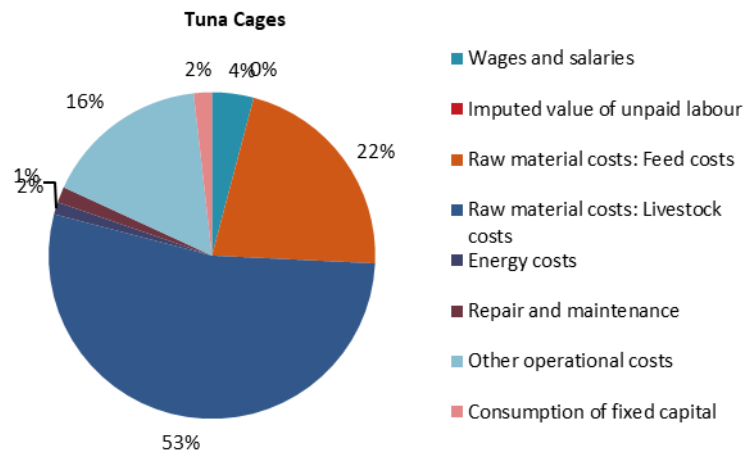
Comparing 2022 performance to 2021, the Tuna Cages segment saw a rebound in total income, which surged to €278.2 million, a 38% increase from €201 million in 2021. However, this revenue growth was accompanied by a sharp rise in operating costs, which escalated to €249.8 million in 2022, a 63% increase from €152.9 million the year prior. As a result, EBIT decreased to €23.7 million in 2022, down from €43.3 million in 2021, illustrating the adverse impact of higher costs despite increased revenue. GVA to revenues also fell further, declining to 14% in 2022 from 29% in 2021, highlighting continued challenges in value creation. Similarly, the net profit margin dropped to 11%, compared to 18% in 2021, reflecting reduced profitability. Full-Time Equivalent (FTE) employment increased to 283, continuing its steady increase from 275 in 2021 and 257 in 2020. Despite this growth in workforce, labour productivity dropped to €136 849 per employee from €208 516 in 2021, indicating some operational inefficiencies in generating revenue relative to the expanding labour force. Meanwhile, net investments decreased slightly to €6.1 million from €7.7 million in 2021, reflecting more cautious capital deployment, while the total value of assets fell dramatically to €108.3 million from €285.9 million in 2021, possibly pointing to asset depreciation or adjustments in capital allocation. Despite these challenges, ROI improved slightly to 22%, up from 15% in 2021, while capital productivity increased to 36, reflecting more efficient use of assets in 2022.

For the Tuna Cages segment in 2022, wages and salaries amounted to €10.48 million (4.12% of total costs), with raw material costs for feed at €55.08 million (21.65%) and livestock costs at €135.65 million (53.32%). Energy costs were €3.1 million (1.22%), and other operational costs totalled €41.56 million (16.34%). Repair and maintenance accounted for €3.98 million (1.56%), while fixed capital consumption was €4.56 million (1.79%). These figures highlight the significant share of raw material costs, particularly for livestock, which dominated the segment's expenditure.

When comparing the 2022 performance of the Tuna Cages segment to the 2017-2021 average, total income in 2022 was significantly higher at €278.2 million, a 45% increase over the five-year average of €191.6 million. However, operating costs also rose sharply, with 2022 costs of €249.8 million being 43% higher than the average of €174.7 million for the 2017-2021 period. Despite the increase in income, EBIT in 2022 was €23.7 million, which, although lower than 2021, represented a substantial 75%

improvement over the five-year average of €13.5 million. The GVA to revenues ratio in 2022 stood at 14%, slightly higher than the average of 12% recorded from 2017 to 2021, reflecting modest gains in value-added performance. Furthermore, the net profit margin of 11% in 2022 was more than double the five-year average of 4.6%, showing improved profitability compared to historical performance.

Figure 126. Cost structure of the tuna cages segment in Malta: 2022.



Source: Own elaboration from EU Member States DCF data submission, 2024

Other Marine Fish Cages segment

For the Other Marine Fish Cages segment, performance improved significantly between 2021 and 2020. In 2021, total income remained stable at €0.1 million, but the EBIT rose dramatically to €37 796, up from just €2 662 in 2020. The GVA to revenues ratio remained strong at 54% in 2021, slightly lower than the 56% recorded in 2020, indicating continued high levels of value-added output relative to revenue. The net profit margin for the segment fell slightly from 47% in 2020 to 43% in 2021, while labour productivity improved considerably, reaching €292 749 per employee in 2021.

In 2022, the Other Marine Fish Cages segment experienced a further boost in performance compared to 2021. Total income increased to €0.4 million, a fourfold rise from €0.1 million in 2021, while operating costs remained low at €0.2 million. As a result, EBIT surged to €233 687, a six-fold increase from €37 796 in 2021, reflecting much-improved earnings. The GVA to revenues ratio also increased to 65%, up from 54% in 2021, indicating better value creation relative to income. Capital productivity improved dramatically, rising to 120 from 75 in 2021, reflecting much more efficient use of capital in 2022. Similarly, ROI jumped to 107%, up from 61% in 2021, showing excellent returns on investment. Labour productivity also improved significantly in 2022, reaching €497 870 per employee, up from €292 749 in 2021, demonstrating improved operational efficiency.

When comparing 2022 performance with the 2017-2021 average, the Other Marine Fish Cages segment saw mixed results. Total income in 2022 was 56% lower than the five-year average of €0.92 million, while operating costs were significantly higher. However, EBIT in 2022 was a dramatic improvement compared to the five-year average of -€75 402. The GVA to revenues ratio in 2022 was 65%, a significant improvement compared to the average of just 2.2% from 2017 to 2021, reflecting much stronger value-added performance. Furthermore, the net profit margin of 63% in 2022 was a major improvement over the five-year average of 0%, indicating far greater profitability.

Sea Bass and Sea Bream Cages segment

The Sea Bass and Sea Bream Cages segment showed modest growth between 2021 and 2020. In 2021, total income increased to €11.7 million, up from €11.4 million in 2020. Operating costs also rose slightly, from €8.9 million in 2020 to €9.1 million in 2021. As a result, EBIT increased marginally, rising from €2.07 million in 2020 to €2.2 million in 2021. The GVA to revenues ratio improved slightly, from

33% in 2020 to 34% in 2021, showing marginal gains in value-added output. The net profit margin remained stable at 19% in both 2020 and 2021, reflecting consistent profitability, while labour productivity increased to €92 079 per employee in 2021, up from €86 658 in 2020.

In 2022, total income in the Sea Bass and Sea Bream Cages segment fell to €10.4 million, a decline from €11.7 million in 2021. However, operating costs also decreased, dropping to €8.4 million from €9.1 million in 2021, which helped to stabilize profitability. EBIT stood at €1.7 million, down from €2.2 million in 2021, reflecting lower earnings despite reduced costs. GVA to revenues was 31%, down from 34% in 2021, showing a slight drop in value-added performance. However, capital productivity improved to 50 in 2022, up from 32 in 2021, indicating better asset utilization. ROI also rose to 27%, compared to 18% in 2021, reflecting improved returns on investment. FTEs in this segment decrease to 31 from the 43 observed in the year prior. However, labour productivity improved, reaching €104 011 per employee in 2022, up from €92 079 the previous year, suggesting a better use of the smaller workforce. Net investments in this segment also dropped, amounting to just €0.3 million in 2022, down from €0.9 million in 2021, while the total value of assets saw a substantial reduction, falling to €6.4 million from €12.5 million in 2021, potentially indicating reduced capital investments or asset depreciation. Despite the smaller scale of operations, this segment exhibited improved productivity and investment returns.

4.18.5 Outlook

The data for 2023 and 2024, based on the results of the nowcasts, show that the aquaculture sector's total output in terms of volume (tonnes) is expected to increase by approximately 17% and 6% over the previous year, respectively. However, this increase does not translate directly into higher sales revenue. In 2023, despite a relatively significant rise in production volume, revenues are expected to decline by approximately 36%, likely due to a notable decrease in the market price per kilogram of the species produced.

By contrast, revenues are anticipated to recover in 2024, increasing by approximately 15%. This suggests that the price per kilogram of the species produced is expected to rebound from the previous year's low, driving revenue growth that slightly outpaces the marginal increase in output. This recovery implies that market conditions, including demand and pricing, may stabilize or improve after the challenging year of 2023.

This trend highlights the sensitivity of the aquaculture sector's financial performance to fluctuations in market prices, even when production volumes are rising. The sharp revenue decline in 2023 underscores the importance of monitoring global market dynamics and addressing factors influencing pricing, such as supply chain disruptions, competition, or changes in consumer demand. The modest recovery in 2024 reflects the resilience of the sector, suggesting the potential for future growth if market stability continues.

Trends and triggers

The Maltese aquaculture sector is facing a dynamic and challenging future, shaped by several key factors, including rising global demand for seafood, energy cost pressures, technological innovations, and evolving regulatory frameworks. Globally, the demand for seafood has increased significantly, driven by the growing human population and the shift toward more sustainable protein sources, such as fish. As wild fish stocks depletion is a global challenge, aquaculture has become crucial to meeting the world's protein needs, particularly for high-value species like Bluefin Tuna, which is a cornerstone of Maltese aquaculture. This global trend presents an opportunity for Malta to expand its aquaculture industry further, focusing on its already established export markets in Asia, where demand for Bluefin Tuna is particularly strong. However, the industry must also grapple with the pressing need for sustainable practices, as the environmental impact of traditional aquaculture methods continues to draw scrutiny.

Energy prices have emerged as one of the most significant challenges for the sector, exacerbated by the geopolitical fallout from the Russian invasion of Ukraine. The dramatic surge in fuel costs, which rose by as much as 60% between 2021 and 2022, has put considerable pressure on Maltese aquaculture operations, especially given the sector's reliance on energy-intensive activities such as transportation, feed logistics and others. Unlike other industries that benefit from government subsidies on non-duty-free fuel, Maltese aquaculture operators are exposed to market fluctuations, making energy one of the largest and most unpredictable components of operational costs. This will intensify the need for energy-efficient technologies and practices within the industry.

Labour dynamics within the sector are also evolving, with a trend toward full-time employment and a focus on increasing productivity. Rising labour costs, driven by inflation and competition for skilled workers, have added another layer of financial strain for Maltese aquaculture operators. The sector has relied increasingly on foreign workers, particularly for lower-wage positions, though this comes with challenges related to training and workforce retention. As the industry continues to modernise, investments in skills and training will be essential, particularly as new technologies demand a more technically proficient workforce.

At the policy level, Malta's aquaculture sector is aligned with broader European Union strategies for sustainable growth. The European Maritime, Fisheries and Aquaculture Fund (EMFAF) provides crucial financial support to promote innovation, competitiveness, and environmental sustainability in aquaculture. Malta's Multiannual National Strategic Plan for Aquaculture (MNPSA), which runs until 2030, incorporates these EU objectives, focusing on fostering environmentally sustainable practices while ensuring that the sector remains economically competitive. This framework emphasizes the need for improved governance, stakeholder engagement, and public awareness about the benefits of sustainable aquaculture. Educational campaigns aimed at improving consumer perception of farmed fish, highlighting its nutritional and environmental benefits, are central to this effort, particularly as Malta seeks to position itself as a leader in sustainable aquaculture.

One of the specified objectives of the MNPSA 2022-2030 is 'Ensuring social acceptance and consumer information'. The MNPSA identifies the following challenges:

- *Communication*
 - Lack of consumer understanding with respect to the health and environmental benefits of aquaculture.
 - Improving public perception, building trust and address issues on food security through educational campaigns.
 - Involvement of local stakeholder in the planning of aquaculture activities.
 - More synergies are required with existing and potential ancillary services (both directly/indirectly related to aquaculture).
- *Nutritional value, quality, and safety of aquaculture products*
 - Lack of understanding of the quality and nutritional value of aquaculture produce and the advantages of consuming short supply chain produce on health and the environment.
 - Lack of understanding of the environmental protection, animal health and welfare involved in the industry.
- *Stakeholder involvement*
 - The need for more involvement of stakeholder in the sustainable development of the aquaculture industry
- *Monitoring statistics and information*
 - Ensure that the collection of aquaculture data (economic, environmental, operation etc.) is of the highest quality

- The need to develop a legal framework to ensure the collection of quality data.

The COVID-19 pandemic had a notable impact on the sector, disrupting supply chains and temporarily reducing demand for high-value species like Bluefin Tuna. However, the market has since rebounded, with prices recovering as global demand picks up again, particularly in Asian markets. Despite the initial setbacks, Malta's aquaculture industry demonstrated resilience during the pandemic, and its recovery has been supported by increasing prices for farmed species. This recovery highlights the importance of maintaining strong export markets and diversifying production to mitigate the risks of future disruptions.

Looking ahead, Malta's aquaculture sector is well-positioned to capitalise on global trends favouring sustainable seafood production. By continuing to invest in research and development, particularly in areas such as alternative feed sources and energy-efficient systems, the industry can reduce its environmental footprint while remaining competitive in the global market. The European Commission's push for a carbon-neutral fisheries and aquaculture sector, through initiatives aimed at promoting clean energy technologies and improving operational efficiency, will likely further shape the future of the industry. However, achieving these goals will require overcoming significant challenges, including financial barriers to technology adoption and the need for regulatory reforms that facilitate a smoother transition to sustainable practices.

4.18.6 Data Coverage and Data Quality

Data quality is assured given that data collected through surveys is also cross-checked not only by the Aquatic Resource Malta agency, responsible for collecting the data under the EU-MAP from aquaculture operators but also by Malta's National Statistics Office (NSO). Any query raised by the Agency/NSO with respect to the data submitted is re-checked with the aquaculture operators.

4.19 The Netherlands

Overview of Dutch aquaculture

The Dutch aquaculture sector is dominated by shellfish (blue mussel and oysters) produced in marine coastal waters. Furthermore freshwater fish is produced by a rather small group of companies growing different kind of species like eel, yellowtail kingfish, turbot, catfish, sturgeon, pike perch, rainbow trout and arctic char. These fresh water species are the minority in terms of production volumes and are all land-based cultivated. On the contrary to the Dutch marine shellfish aquaculture, there is only production volumes and sales data available (FAO data) for these land based cultivated fresh water species. No other socio economic performance data is collected for the land based aquaculture with the DCF yet. Marine aquaculture fish (finfish) is not produced in the Netherlands.

The aquaculture sector produced around 39.4 thousand tonnes of fish in 2022 and value was around €109 million including freshwater (DCF figures 2022 and FAO figures 2022). Blue mussel was by far the largest of produced species with a 75% (29.6 thousand tonnes) of the total live weight sales and 49% (€53.3 million) of total gross sales in 2022 determined by FAO data. After difficult years with varying net profits between €2.5 million (2017) and €9.3 million (2018), the years of 2020-2022 resulted into higher net profits with €18.4 million, €48.7 million and €30.2 million respectively for the Dutch mussel sector. The net profit margin increased from 7% (2019) to 19% (2020) and 36% (2021). However, in 2022 the net profit margins decreased to 5% due to less total income (-28%) and higher total operating costs (+6%) compared to 2021. For 2023, it is expected that economic performance by the Dutch shellfish aquaculture will increase compared to 2022. It is expected that production volume will increase to a similar level as in 2021. However, total sales are much lower than 2021 (€54 million versus €66 million) due to a lower price per kilogram of sales (€1.66 versus €1.97 per kilogram) for blue mussel from the Netherlands. It is a trend of last five years that production volumes are decreasing from around 49 000 tonnes (2018) to 28 000-33 000 tonnes per year. Production is not growing, 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.

In the Netherlands, there is also some production of land based freshwater aquaculture fish as described in the first paragraph of this national chapter. The number of companies producing aquaculture fresh fish is limited. Until now there was no data collection programme to gather economic data for this segment and it is an issue how to present performance of this subsector of aquaculture, taking into account privacy. Only a few companies are involved in this segment. In order to get a “best practice” total overview of the aquaculture sector in the Netherlands, FAO data are used to estimate production volume and value for this segment, which was approximately 6.3 thousand tonnes volume and sales are estimated at €42.5 million in 2022.

For the economic structure (cost and income indicators) only data for segment 10.11 (mussels on-bottom) were included for 2021 and 2022. The financial (operating) costs for segment 11.11 (oysters on-bottom) was limited available for these both years and therefore excluded for the economic performance indicators in this report. For the Dutch eel production there was only sales weight and sales value known and therefore not taken into account as well for the economic performance indicators. The segment of freshwater aquaculture is not included as this segment is not participating in the DCF for the Netherlands. Therefore, figures and tables should be interpreted with caution. The years 2018-2022 are just about shellfish, in this case only blue mussels.

4.19.1 Total Production and sales

According to FAO statistics the Dutch aquaculture sector produced a total of 39.4 thousand tonnes of shellfish and fish in 2022, which corresponded to a decrease of 2% compared to 2020 and -3% from 2021. The total production value was around €108.7 million in 2022 (+6% from 2021). The average annually production of last five years (2018-2022) was around 44 000 tonnes live weight. The decrease

was mainly caused by decreasing shell fish production as marine aquaculture which represents the majority for the Netherlands aquaculture. The average sales value of aquaculture for similar period (2018-2022) was around €100.4 million annually. Despite decreased production volumes the prices per kilogram were often higher due to less supply from local shellfish producers. This economic law of scarcity principle does not always hold. In a year of lower quality or smaller blue mussels (less mussel meat) prices often drop.

4.19.2 Industry structure and total employment

In 2022 (Table 70), the total population of mussel and oyster aquaculture farms was 79, with 41 of it were mussel companies and the other 38 oyster companies. The Dutch aquaculture sector is dominated by small enterprises (97%) with less than 5 employees. In total 243 persons were active within the Dutch shellfish producing companies in 2022. This was slightly less (-5%) to the previous year. Most of the persons were employed in the mussel producing companies (168 employees) in 2022. In total 19 persons were registered as unpaid labour. The other 56 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 (2019-2022) 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 70. Production and sales, industry structure and employment for the Netherlands: 2017-2022.

Variable	2017	2018	2019	2020	2021	2022	Change 2021-22	Develop. 2022/(17-21)
Sales weight (thousand tonnes)	46.5	51.9	35.7	31.5	33.4		▼ -100%	▼ -100%
Freshwater								
Shellfish	46.5	51.9	35.7	31.5	33.4		▼ -100%	▼ -100%
Sales value (million €)	60.7	67.5	49.0	45.3	94.6	88.0	▼ -7%	▲ 39%
Freshwater					18.5	25.0	▲ 35%	▲ 35%
Shellfish	60.7	67.5	49.0	45.3	76.1	63.0	▼ -17%	▲ 5%
Number of enterprises	69	69	64	42	80	79	▼ -1%	▲ 22%
Freshwater								
Shellfish	69	69	64	42	80	79	▼ -1%	▲ 22%
Employment	249	243	224	187	235	224	▼ -5%	▼ -2%
Freshwater								
Shellfish	249	243	224	187	235	224	▼ -5%	▼ -2%
FTE	234	231	213	187	235	224	▼ -5%	▼ 2%
Freshwater								
Shellfish	234	231	213	187	235	224	▼ -5%	▼ 2%

Source: Own elaboration from EU Member States DCF data submission, 2024

4.19.3 Overall Economic performance

For the economic performance the data of financial (operating) costs for segment 11.11 (oysters on-bottom) were only for some indicators available for 2021 and 2022. Therefore only segment 10.11 (mussels on-bottom) was included for the economic performance. The DCF data were used to analyse these results.

From 2021 to 2022, total income (excluding oysters) decreased by 28% to a total of €56.2 million. Main reasons were lower sales price for mussels per kilogram and decreased sales volumes (-16%). Majority of total income (90%) consisted of gross sales where the rest (10%) was contributed by other income.

Table 71. Economic performance of the Dutch aquaculture sector: 2017-2022.

Variable	2017	2018	2019	2020	2021	2022	Change 2021-22	Develop. 2022/(17-21)
Total income	52.3	57.2	47.0	52.8	108.0	94.4	▼ -13%	▲ 49%
Total operating costs	44.3	41.7	40.1	38.1	54.7	59.3	▲ 8%	▲ 36%
Total wages	15.0	14.3	13.1	13.9	16.9	18.1	▲ 7%	▲ 24%
Gross Value Added	23.1	29.9	19.9	28.6	70.2	53.2	▼ -24%	▲ 55%
Depreciation of capital	3.3	3.8	2.2	2.8	2.7	2.9	▲ 10%	■ -1%
Earning before interest and taxes	4.7	11.8	4.7	11.9	50.6	32.2	▼ -36%	▲ 92%
Financial costs, net	2.3	2.5	1.5	1.8	1.9	1.9	▲ 5%	▼ -3%
Net profit	2.5	9.3	3.1	10.1	48.7	30.2	▼ -38%	▲ 105%
Total value of assets	97.4	104.3	115.2	108.6	116.8	109.5	▼ -6%	■ 1%
Capital productivity (%)	23.7	28.7	17.3	26.3	60.1	48.6	▼ -19%	▲ 56%
Return on Investment (%)	4.9	11.3	4.1	10.9	43.3	29.4	▼ -32%	▲ 97%

Source: Own elaboration from EU Member States DCF data submission, 2024.

The expenditures (excluding oysters) also known as total operating costs were in total €48.9 million in 2022. This was a 6% increase from 2021. In 2022 expenditures were dominated by other operational costs (36%), wages and salaries (25%), repair and maintenance (17%) and energy costs (14%). Regarding energy prices, this was mainly affected by the increase in fuel prices as mussel cutters use gas oil. In Table 71, total wages is demonstrated with an increase of 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) decreased by 52% from 2021 to 2022. This large decrease could be explained by lower income (-28%). Net profit was much lower (-89%) to a total of €3.0 million in 2022 compared to the previous year (€27.7 million). The total value of assets decreased with 6% to €109.5 million in 2022. The total level of debts decreased with 6% (to a total of €48 million) over the same period.

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*). European eel is the included land based fresh water species that is in particular by value of importance for the Dutch aquaculture. Production of shellfish takes place in the coastal areas with a concentration in the South-Western province of Zeeland and the Wadden Sea.

In 2022, total sales weight of Dutch shellfish and European eel decreased (-10%) in one year to 33.6 thousand tonnes. Compared to last five years on average this was a decrease of 13%. In terms of value, total sales decreased (6%) to €84 million in 2022. Total sales increased with 22% compared to a five years average.

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, yellowtail kingfish 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 2022, the blue mussel had a share of 89% of the total shellfish weight of production and 85% of total sales (value) (Figure 127). 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 (28.2 thousand tonnes) is by far larger than the oyster sector (3.5 thousand tonnes) in total sales volume in 2022.

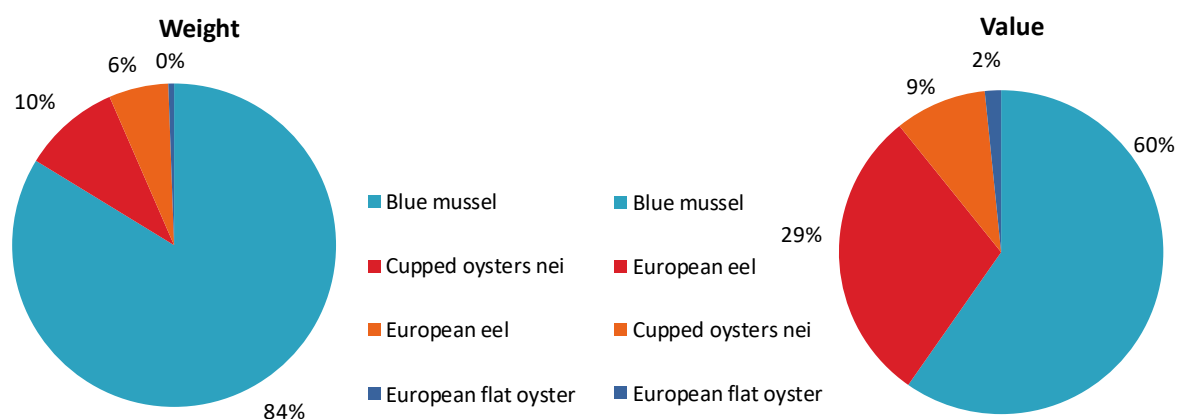
Segment 2: Oyster production had a share of 11% (3.5 thousand tonnes) of the total sales of weight in 2022 (Figure 127). The sales of volume in 2022 from national statistics (Eurostat) for the oyster production is perceived as an overestimation by the enterprises themselves. Precaution is recommended with applying the sales volumes for oysters within this year.

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 and FAO data. In 2022, there were an estimated 25 companies active in this segment with estimated total sales volume of 6.3 thousand tonnes and an estimated total sales value of €42.3 million in 2022.

The average price for mussels in 2022 was €1.80 (-9% compared to 2021). The average annual price (euro/kilogram) for Dutch blue mussel fluctuated the years from 2017-2022 (Figure 128). Highest average price was in 2021 with a price of €1.97 per kg, the lowest was €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 net profit margin was high (59%) 2021, it decreased to a very small profit of 5% in 2022. In particular, higher costs like investments for mussel seed collectors and high mortality rate were reasons of lower profit margins.

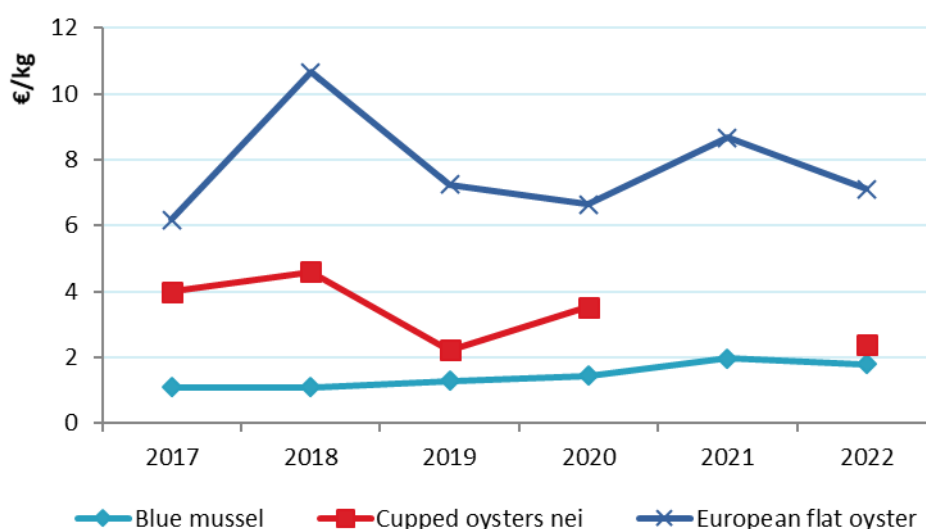
The average price of cupped oysters was estimated at around €2-2.50 per kg in 2021-2022, while the price of the European flat oyster is estimated at more than €7-9 per kg in similar period. The production volume of this species however is on a rather low level, in the last few years around 0.2 thousand tonnes and also in 2022. It is needed to be cautious with the sales value and volumes of the oyster produced in the Netherlands within 2022. According to the national statistician agent (CBS) and the oyster producing companies themselves are the production volumes and sales overestimated in the estimated numbers. Comparing oyster sales prices per kilogram between 2017-2022 with previous periods shows an increase. 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.

Figure 127. Main species in terms of weight and value in the Netherlands: 2022.



Source: Own elaboration from EU Member States DCF data submission, 2024.

Figure 128. Average prices €/kg for the main species produced in the Netherlands: 2017-2022.



Source: own elaboration from EU Member States DCF data submission, 2024.

Segment: Mussel on bottom

In Table 72, it is shown that there were 41 Dutch mussel enterprises in 2022. One less than in 2022. In particular single family owned companies are vulnerable to consolidation by larger companies in the sector.

The profitability of the Dutch mussel sector deteriorated in 2022 compared to 2021 with a decrease of 89% of net profit to a total of rounded €3.0 million. The average wage rose by 12% and net investments were at €3.6 million (-23% to 2021). As lower sales volume in 2022 (-16%) total income decreased by 28% to €56.2 million. The average price/kg decreased by 9% (Figure 128). In Figure 129 it is shown that the GVA to revenues decreased by 52%. The net profit margin was slightly positive with 5% (in 2021 it was 36%).

Table 72. Economic performance of main Dutch aquaculture segments: 2017-2022.

Variable	2017	2018	2019	2020	2021	2022	Change 2021-22	Develop. 2022/(17-21)
Mussel On-bottom								
Number of enterprises	48	48	43	42	42	41	▼ -2%	▼ -8%
FTE	184	181	163	187	179	168	▼ -6%	▼ -6%
Average wage (thousand €)	81.4	79.2	80.1	74.3	77.6	86.6	▲ 12%	▲ 10%
Labour productivity (thousand €)	125.1	165.1	122.0	153.0	255.3	129.7	▼ -49%	▼ -21%
Total sales volume (thousand tonnes)	43.9	49.3	33.2	31.5	33.4	0.0	▼ -100%	▼ -100%
Total income (million €)	52.3	57.2	47.0	52.8	77.9	56.2	▼ -28%	▼ -2%
Total operating costs (million €)	44.3	41.7	40.1	38.1	46.1	48.9	▲ 6%	▲ 16%
Gross Value Added (million €)	23.1	29.9	19.9	28.6	45.6	21.7	▼ -52%	▼ -26%
Net profit (million €)	2.5	9.3	3.1	10.1	27.7	3.0	▼ -89%	▼ -72%
Total value of assets (million €)	97.4	104.3	115.2	108.6	116.8	109.5	▼ -6%	■ 1%
Net investments (million €)	5.8	1.2	0.3	1.3	4.7	3.6	▼ -23%	▲ 33%
Capital productivity (%)	23.7	28.7	17.3	26.3	39.0	19.8		
Return on Investment (%)	4.9	11.3	4.1	10.9	25.3	4.5		
Future Expectation Indicator (%)	2.6	-2.4	-1.6	-1.4	2.1	1.1		

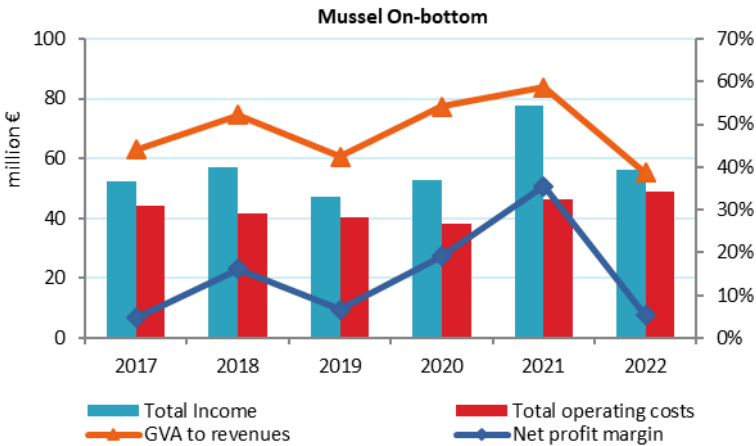
Source: own elaboration from EU Member States DCF data submission, 2024.

Figure 130 provides an overview of the cost structure (including consumption of fixed capital). The main costs were other operational costs (36%) and wages and salaries (25%) in 2022. 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. Besides that, the costs are rather high to collect the seed and innovation projects must result in cheaper alternatives to collect seed.

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”.

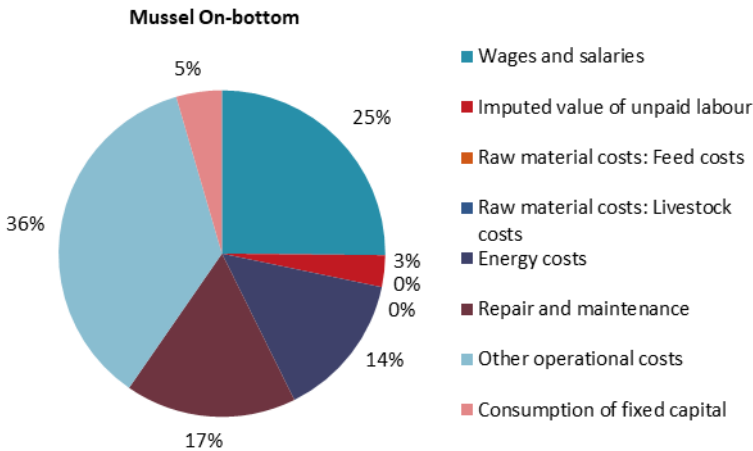
Table 129 includes only segment of mussel on bottom (segment 10.11). For the year 2022 as well as for previous years, hardly or no data about costs were available for the segment of oysters on bottom (segment 11.11).

Figure 129. Economic performance in € million, indicators for the main Dutch segment: 2017-2022.



Source: Own elaboration from EU Member States DCF data submission, 2024.

Figure 130. Cost structure of the main segment in the Netherlands: 2022.



Source: Own elaboration from EU Member States DCF data submission, 2024.

4.19.5 Outlook

Nowcasts for 2023

For shellfish (marine aquaculture) in the Netherlands, sales weight is expected to be around 32.5 thousand tonnes of shellfish in 2023. This means an increase (+15%) of sales volume compared to previous year (2022). The total sales value is expected to increase to a total of €53.9 million (+7%) in 2022. A lower average price/kg is expected (-8%) with previous year. The total supply of mussel seed in 2023 at 35.7 mln kg was almost 19% higher than last year. With a 32% increase, availability of bottom seed in particular was better this year than last year. The production of mussel seed from mussel seed capture installations (MZIs) also increased, but slightly less significantly at 13%. With this, the proportion of seed obtained using MZIs was 66%. This share was slightly lower than in the previous year (70%).

Due to higher sales volumes expected in 2023 compared to 2022, the economic performances will likely improve.

In particular, (small) family businesses that are not vertically integrated have been under pressure in recent years. In periods when mussel prices are relatively high, the trade branch of integrated companies prefers to buy mussels that come from their own mussel plots. During periods of relatively low mussel prices, mussels are purchased more from plots belonging to other growers. Trade outside the auction has increased in recent years and since season 2020/2021 all mussels are traded through private transactions.

It is expected that the combination of mussel seed collection by bottom trawling and other technologies will improve the seed supply in future. In the last 10 years production of seed by collection-technique is a growing trend and because of increasing profit in 2023, investment in new techniques is expected to be increased.

Family enterprises that are less profitable and solvable may be forced by their financial institutes (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.

The profitability of the Dutch 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 still face financial problems in the coming years. It is likely that the larger enterprises will take over the smaller family enterprises that cannot survive or which have no successors.

For oysters the sales weight and prices will remain about the same. High mortality rates and more competition from other MS with faster growing oysters and therefore more price competitive to the EU market is stagnating the production in the Netherlands.

Mortality from the Japanese oyster drill and the herpes virus may be less in the near future because of a trawl is invented that 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. The Dutch government has to decide whether it is sustainable and acceptable to provide more permits for upscaling off bottom oyster production.

For the freshwater sector, no other data than FAO is available.

Trends and triggers

Current production trends and main drivers

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 can be under pressure.

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 which asks for investments.

For the freshwater sector, no data is available other than FAO data.

Market structure

The market structure of the mussel sector changed over the last few years. For mussel production, the number of producing companies is quite steady now because some profit is made in recent years. Smaller family companies have been taken over 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 than just FAO statistics.

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, research and knowledge sharing and increased technical innovation. Recently, interest for aquaculture in combination with offshore wind energy is stimulated. This might be partly a solution to spatial conflicts in the heavily used North Sea, which will be even more used by newcomers with economic activities (windfarms), 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.

For most of the aquaculture companies, energy costs are a big part of total costs. Stagnation of supply of gas, especially to Europe, in 2022 caused a tremendous increase of energy prices. Prices of gas and oil (fuel) and electricity (energy) increased starting February 2022 and as a result of the rising energy prices it can be expected that costs for energy, and therefore total costs, will rise importantly, which will affect net profit in 2022. In 2021 and 2022 energy prices (fuel, gas and electricity) were already rather high compared to prices in 2020-2021 (+30%). In 2023 prices it is expected to decrease but stay higher than the average price per liter of fuel in the period 2017-2020. In 2023 it is expected that price of gas oil per liter (€0.75) is still the double from 2020.

For the fresh water sector, information is not available.

4.19.6 Data Coverage and Data Quality

Data quality

The account statistic for 2022 is based on a sample of marine aquaculture companies (shellfish), which covers around 20-25% of the total population of around 70 farms. These sampled 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 freshwater sector, only FAO production data is available for 2021 and 2022. 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. For 2023 and 2024, we hope to gather economic information by interviews and questionnaires which will be held and sent at the end of the year 2024.

Data availability

Data of land-based aquaculture is not collected as planned. Land based aquaculture in the Netherlands is a relatively small (around 25 companies/farms), reluctant, fragmented, highly competitive and dynamic part of the fish producing sector. 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 and reported to the sector and the ministry.

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 different aquaculture segments.

Differences in DCF data compared with other official data sources

In general, the DCF and EUROSTAT data are 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 2021 and 2022, data on oyster (11.11, oysters) and freshwater aquaculture was lacking about the cost structures. Therefore, no economic performance indicators could be calculated.

4.20 Poland

Overview of Polish aquaculture

Polish aquaculture is exclusively inland, focusing on freshwater production, with no mariculture practices or established licensing systems for potential future mariculture. Polish aquaculture production is based on two main segments: traditional, low-intensity pond farming, which has been practiced since the Middle Ages (with carp as the dominant species, along with smaller quantities of bighead carp, grass carp, tench and predatory fish, like pike and pike-perch), and intensive production, where trout (primarily rainbow trout) is the dominant species. On a smaller scale, sturgeons, African catfish, and others are also produced in intensive aquaculture (none of these species accounted for 5% of total value or volume in 2020, which is why economic and social data on these species were not collected under the DCF). Intensive aquaculture primarily utilizes tanks and raceways (with enclosures and pens on the channels present in a few farms), with a growing share of recirculation systems.

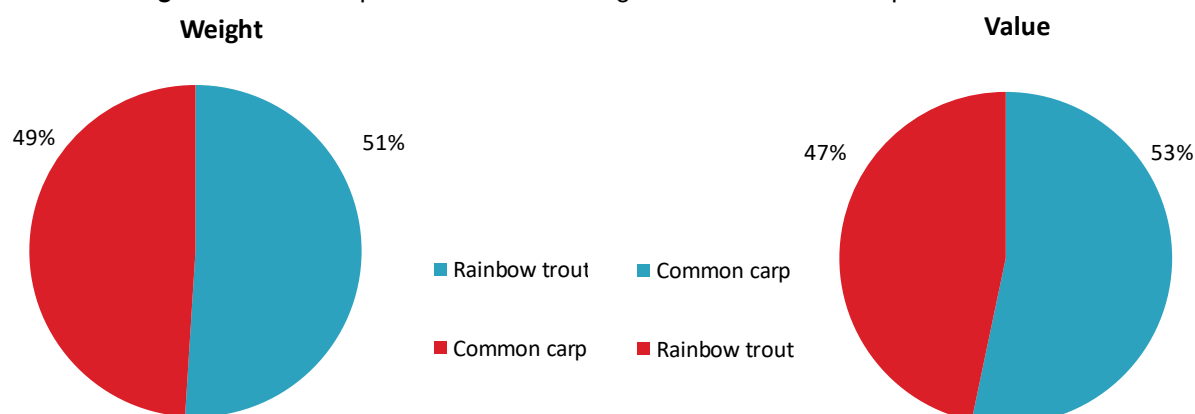
4.20.1 Total production and sales

According to DCF data, total fish production in 2022 amounted to 46.9 thousand tonnes, which was 3.0% higher than in 2021. These figures refer exclusively to companies where carp or trout were the predominant species. In carp-producing farms, the total production includes supplementary species, which contribute a few percentage points to the overall output. For trout production, the output is homogeneous, primarily consisting of rainbow trout, with minimal inclusion of other trout species and hybrids.

For comparison, FAO data shows that in 2022, production reached 46.1 thousand tonnes, which was 2.9% higher than in 2021. Both FAO and Eurostat data show a steady growth in Polish aquaculture production, peaking in 2020 at 47.7 thousand tonnes.). Since 2021, production has stabilized just below this record level.

In 2022, Poland experienced high inflation in 2022, with inflation rates exceeding 16% and food prices rate increasing by more than 22% (Statistics Poland). Prices for both carp and trout rose faster than inflation, partly due to the exceptionally low prices and highly increasing production costs in 2021/2022. As a result, despite a slight increase in production, significant price increases pushed the value of carp and trout production sold to €191.9 million in 2022, an increase of 60% compared to 2021.

Figure 131. Main species in terms of weight and value in Polish production: 2022



Source: Own elaboration from EU Member States DCF data submission

Carp production

The sold production in carp ponds aquaculture in 2022 amounted to 23.0 thousand tonnes, which was 1.3% higher than in 2021. There was a significant increase in the price of carps, which, in euro terms, rose by as much as 67%. However, it is important to note that the reference price (from 2021) was the lowest in the past decade. As a result, in 2022 the total production value of carp ponds reached €119.8 million, an impressive 58% increase over the previous year. The exceptionally high price increase in

2022 led to a substantial increase of value in retail with fresh carp prices rising by 49%, as confirmed by Statistics Poland.

Trout production

In 2022, the sold production of trout amounted to 23.9 thousand tonnes, which was 5.3% higher than in 2021. The price of trout rose significantly, with a 43% increase in euro terms. Consequently, the gross value of trout sales amounted to €89.6 million, which was a 51% higher than the previous year.

Trout sold production in tanks and raceways amounted to 18.8 thousand tonnes, corresponding to 79% total trout production in 2022 (slight decrease from 81% share in 2021), with value of €70.7 million.

Trout sold production in recirculation systems amounted to 5.1 thousand tonnes, corresponding to 21% total trout production in 2022 (slight increase from 19% share in 2021), with value of €18.9 million.

4.20.2 Industry structure and total employment

The total employment in carp and trout aquaculture in Poland amounted to 3 649 paid employees (both full-time and seasonal). Unpaid work was provided by 1 557, primarily business owners, but also including their family members). Total workload (including unpaid workers) amounted to 3 888 FTE in 2022. These values were slightly (approx. 1% increase) higher than for 2021.

Despite the similar production levels of both carp and trout, the share of people employed in carp production accounted for 82% of the total workforce involved in the production of these two species in 2022.

Table 73. Production and sales and employment for Poland: 2021-2022.

Variable	2021	2022	Change 2021-22	
Sales weight (thousand tonnes)	45.4	46.9	▲	3%
Sales value (million €)	119.8	191.9	▲	60%
Number of enterprises	1,012	1,012	▬	0%
Employment	5,148	5,206	▲	1%
FTE	3,844	3,888	▲	1%

Source: Own elaboration from EU Member States DCF data submission

Carp production

Carp aquaculture in ponds was conducted by 894 enterprises during 2021-2022. Carp is farmed in Poland in earthen ponds, usually in a three-year cycle (the target fish size is approximately 1.3-1.6 kg per fish). The farming is typically conducted with a small percentage of additional species production (such as silver carp, grass carp, tench and predatory fish). Most medium and large fish farms handle spawning and the production of stocking material independently. Farms that produce carp in ponds are mainly located in Southern, South-Western, South-Eastern and Middle Poland. These farms are situated in areas with few natural water bodies, such as lakes. More than 85% of the carp volume reaches the consumer market in December, as demand is generated by the preparation of the traditional Christmas Eve supper, in which carp is a traditional dish. This creates specific challenges in processing and logistics. For two decades, there has been a growing share of carp processing and a decreasing importance of the sale of live and whole carp. The share of sales through HoReCa still plays a role only locally. Many carp farms are developing sales in short supply chains and providing additional services (direct sales, fishing grounds, gastronomy, tourism, and education). Carp producers are relatively well organised within the recognised Producer Organisations (two organisations have 250 members and their total production is close to 60%).

Employment in carp production

In carp farms, employment reached 3 199 full-time equivalents (FTE) in 2022. Labour intensity is significantly higher in carp production than in trout farms with an average sold carp production per FTE of 7 177 kg- in 2022. The structure of employees (paid workers) is dominated by men - constituting 74%

of employees. The age structure is different from the age structure of all employees in the national economy. Employees aged 40 and over constitute 72% of all employees (aged 50 and over - 48% of employees). Only 7% of employees are under the age of 29.

In 2022, 1 481 people performed unpaid work on carp farms, 69% of whom were men. Unpaid work is mainly performed on the smallest farms, while on larger farms, especially those organized as legal entities, it is significantly less important.

According to the declarations of the survey respondents, 100% of those employed on carp farms are Polish nationals. However, this data is questionable in the light of individual interviews and the structure of employment in the national economy in Poland, where non-EU workers constitute 6.5% of those employed.

In the employment structure of carp production by education level, individuals with low education dominate, accounting for 57%. Another 24% have secondary education, while 19% hold higher education qualifications. On average, every second fish farm employs at least one person with a higher education degree.

Employment in trout production

In trout farms, employment amounted to 689 full-time equivalents (FTE) in 2022. Labour intensity is much lower than on carp farms, with the average sold trout production per FTE reaching 34 688 kg in 2022. The structure of employees (paid workers) is dominated by men - constituting 79% of employees. Employees aged 40 and over constitute 62% of all employees (aged 50 and over - 37% of employees). Only 10% of employees are under the age of 29.

In 2022, 76 people performed unpaid work on trout farms, 72% of whom were men. Unpaid work is mainly performed on the smallest farms, while on larger farms, especially those organized as legal entities, it is significantly less important.

According to the declarations of the survey respondents, 94% of those employed on trout farms are Polish nationals. Non-EU workers constitute 6% of employed.

In the employment structure of trout production by education level, individuals with low education dominate, accounting for 70%. Another 19% have secondary education, while 11% hold higher education qualifications. On average, most of trout farm employs at least one person with a higher education degree.

Trout production

Trout farming is generally placed in northern Poland (Pomeranian and West Pomeranian voivodeships), due to the availability of water from small rivers with strong flow. 104 farms have been classified as tanks and raceways, and 14 as recirculation systems (farms with a high degree of water recirculation, involving both mechanical and biological filtration). Recirculation systems include both indoor and open facilities, and water supply may come from underground sources or flowing water (rivers). It should be noted, however, that many tanks and raceways farms also utilise water semi-recirculation (with mechanical filtration). Production is varied: around 69% is for portion-sized trout (350-500 g), while the remaining 31% is for the longer production of large trout (from 750 to 2500 g, fish intended for filleting, referred to as salmon trout). Few farms carry out the full production cycle with their own spawning. Most farms operate from purchased eyed eggs to market-size fish. Some farms specialise in the production of large fish, starting from heavy fry or even portion-sized fish (e.g., 200-300 g). Most trout farms sell fish to fish processing plants, few farms have developed their own processing or sales in short supply chains. Due to the high concentration of processing (a few dominant trout processing entities) and competition from imported fish (close substitutability of trout from Turkey and Italy, among others, and distant substitutability of salmonids from Norway), trout producers describe their negotiating power in the market as weak. They also consider the sale prices to be too low in relation to their production costs, creating additional financial pressure on their operations.

4.20.3 Overall economic performance

During the period under review, the economic situation of the sector (Table 74) was highly volatile despite stable production. Performance was mainly determined by price and operating cost volatility,

particularly due to the ongoing war in Ukraine. In 2021, the overall performance of the aquaculture sector was negative with a return on investment (ROI) of -2%. This initial data collection marks the first instance of recorded results, and thus, it does not provide a comparative analysis with earlier periods. In 2022, the financial result improved due to price increases (mainly carp) and government subsidies aimed at offsetting the dynamic fluctuations in energy and feed prices. Consequently, the return on investment for 2022 reached a positive 3.8%.

Table 74. Economic performance of the Polish aquaculture sector: 2021-2022.

Variable	2021	2022	Change 2021-22
Total income	135.5	211.5	▲ 56%
Total operating costs	130.5	173.1	▲ 33%
Total wages	58.6	64.8	▲ 11%
Gross Value Added	51.4	87.7	▲ 71%
Depreciation of capital	16.3	16.8	▲ 3%
Earning before interest and taxes	-11.3	21.5	▲ 290%
Financial costs, net	-1.2	0.2	▲ 114%
Net profit	-10.1	21.3	▲ 311%
Total value of assets	555.5	566.2	▲ 2%
Capital productivity (%)	9.2	15.5	▲ 67%
Return on Investment (%)	-2.0	3.8	▲ 286%

Source: own elaboration from EU Member States DCF data submission

Notably, the carp production sector demonstrates resilience despite its low intensity. Producers have successfully maintained stable production levels while also delivering significant environmental benefits, such as habitat preservation, biodiversity enhancement, and water retention. Additionally, the sector contributes valuable social services, including the preservation of farming traditions and the provision of local, healthy food sources. However, it is important to note that the value of these benefits is not included in the overall assessment of the sector's performance.

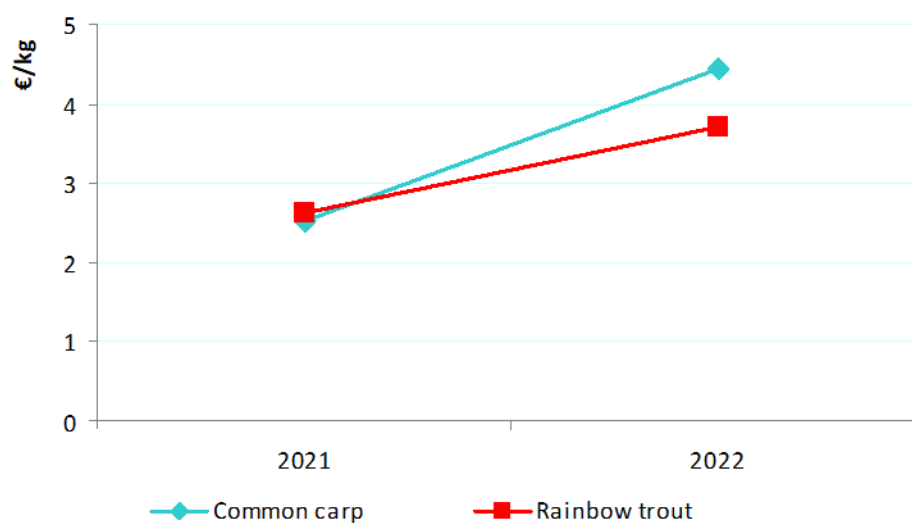
4.20.4 Main species produced and economic performance by segment

The relative stability in production volumes for both carp and trout means that revenues changes are predominantly influenced by market prices, and in the case of carp production, also by operational subsidies. In years with low market prices, operational subsidies for carp production can account for up to 16% of total revenues (as seen in 2021). These are mainly water-environmental compensations. Market prices in 2022 rose sharply, driven by sustained high production costs in 2021 and further increases in 2021/2022, as well as generally high inflation. Carp prices, in particular, saw a significant rise; however, it should be noted that the reference price in 2021 was the lowest in the past decade.

The cost structure depends strongly on the production technology and is different in ponds, tanks raceways and recirculation systems (Figure 132).

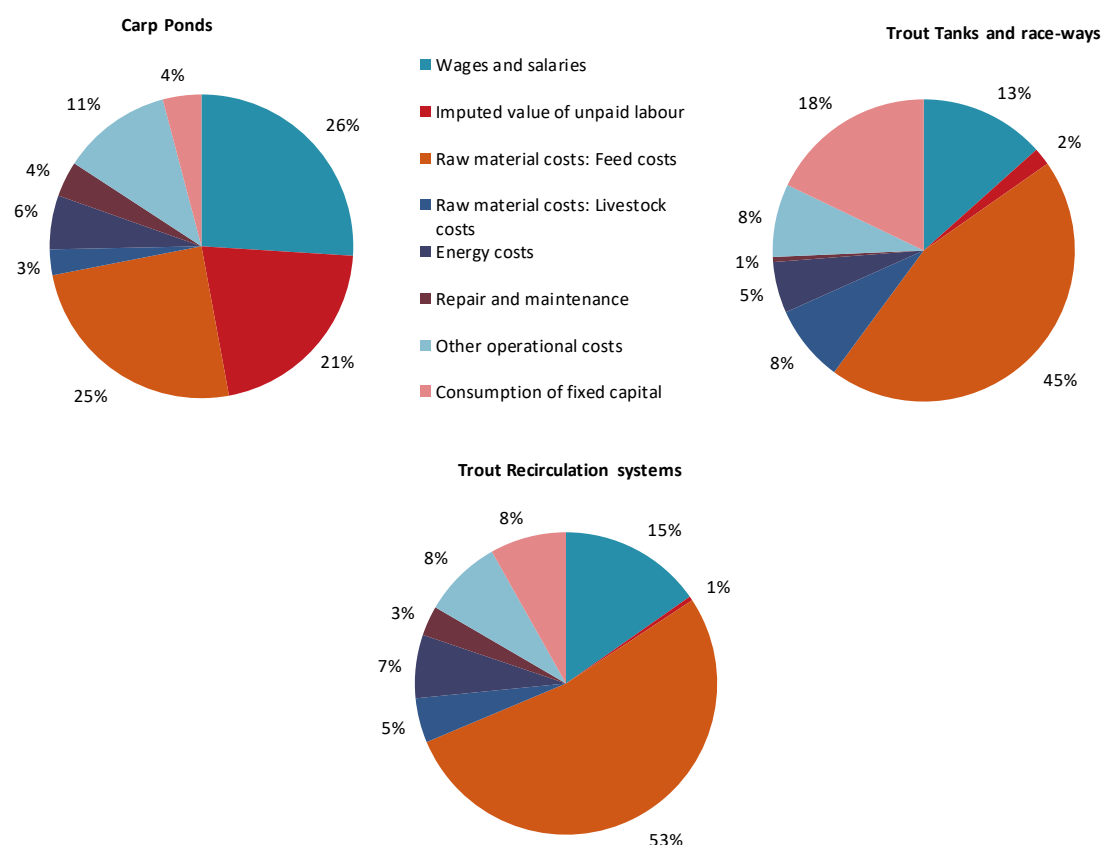
As described carp production is traditional (mostly 3 years cycle), extensive and not always business orientated production. In the case of small farms <5ha, these are often entities operating as additional/supplementary activities and hobbies. They also use different strategies in terms of supply, production and distribution. Traditional carp production has the largest share of labour costs (especially including unpaid labour, which accounted for more than 21% in 2022). The valuation of unpaid labour costs (mainly owners and families) in this segment has a significant impact on the level of profitability. Carp production also has the lowest level of dependence on feed costs. Carp farms use cereals to feed the fish - mainly from local sources. Due to the low level of mechanised production (land is the main asset), the share of fixed capital consumption is the lowest in relation to other Polish segments. As more than 90% of domestic production is sold on the domestic market, the sector shows complete independence from fluctuations of the Polish currency in relation to the Euro. In production, there were temporary or regional problems with water supply in the period under review, but the scale of the problem was not significant.

Figure 132. Average prices €/kg for the main species produced in Poland: 2021-2022.



Source: Own elaboration from EU Member States DCF data submission

Figure 133. Cost structure of the main segments in Poland: 2022.



Source: Own elaboration from EU Member States DCF data submission

Trout production is characterized by medium or high intensity, high mechanization of production and a highly business orientation. The length of the full production cycle from roe depends on the type of market fish – from a minimum of 12 months for portion-sized trout (up to 350 g) to even 3 years for larger fish (e.g., salmon trout weighing over 2500 g). Trout production in both tanks and raceways, as well as in recirculation systems, is primarily influenced by the costs of extruded feeds. In 2022, feed costs

constituted 45% of operating costs for tanks and raceways and 53% for recirculation systems. Additionally, trout farms are typically situated near rivers, facilitating a natural flow of water. In the period under review, there were no disruptions related to water supply but the problem is raising water temperature.

Recirculation systems represent the most intensive form of trout production in Poland. In 2022, there were 14 farms using this method for production. The key advantages of recirculation systems include their independence from natural water sources, reduced vulnerability to climate change, and enhanced productivity resulting from increased intensity and automation. Notably, these systems maintain comparable energy consumption levels to traditional production methods. The results from RAS in 2022 show the lowest share of labour costs in the total cost among the sectors. The share of unpaid labour is also negligible due to the commerciality and scale of these projects. Recirculating systems showed the highest reliance on extruded feed costs (53% of operating cost).

In pond-based carp production, wages account for 25% of production costs. When unpaid labour is included, total labour costs rise to 41% of overall costs, making them the primary cost driver. This is due to the labour-intensive nature of carp production and relatively low mechanisation, with many operations, such as feeding and harvesting, performed manually. Wage costs in Poland continued to increase in 2022, and they were the main factor driving up production costs. The second significant cost factor was the purchase of feed. According to the data obtained, 90% of the feed used in carp production in Poland is plant-based (mainly cereals). In 2022, their price was unstable but remained attractive compared to extruded feed. Among various operational costs, energy carriers represent a notable expense, accounting for 6% of total costs in trout production. For carp-producing farms, this mainly refers to the purchase of diesel fuel for agricultural tractors, as one of the key operations is ploughing pond bottoms after they have been drained.

In trout production, both in tanks and raceways as well as recirculation systems, wage costs (mainly for paid employees) account for 15% of overall costs. The highest cost is the purchase of extruded feed, which constitutes 45% of total costs in tanks and raceways and 54% in recirculation systems, determining the economic viability of trout farming. Energy costs (primarily electricity for pumping, aeration, and compressors) make up 5% for flow-through systems and 7% for recirculation systems. Unlike carp production, where fry purchase costs are low, in trout farming, they play a significant role, reaching up to 8% for tanks and raceway facilities. This cost increases for facilities producing from heavy fry and those raising larger fish beyond portion size.

The DCF economic study in Poland considered two main species with similar production volumes, but with different levels of intensity, cost structure, distribution channels and prices obtained. Based on a two-year period, it is not possible to determine definitive trends in production costs; however, it should be noted that after 2022, there has been a continued sharp increase in labour and energy costs, while feed prices (grains and extruded feeds) have stabilised.

An important issue for the carp sector economic performance is predator activity. On the one hand, carp ponds are a source of food for them, however, due to species protection (e.g., cormorants) there is no way to control the unrestricted access of these predators to fish. This is especially the case during fishing periods where losses from their activities can reach up to 60% of the catch volume (Lasner, 2020).

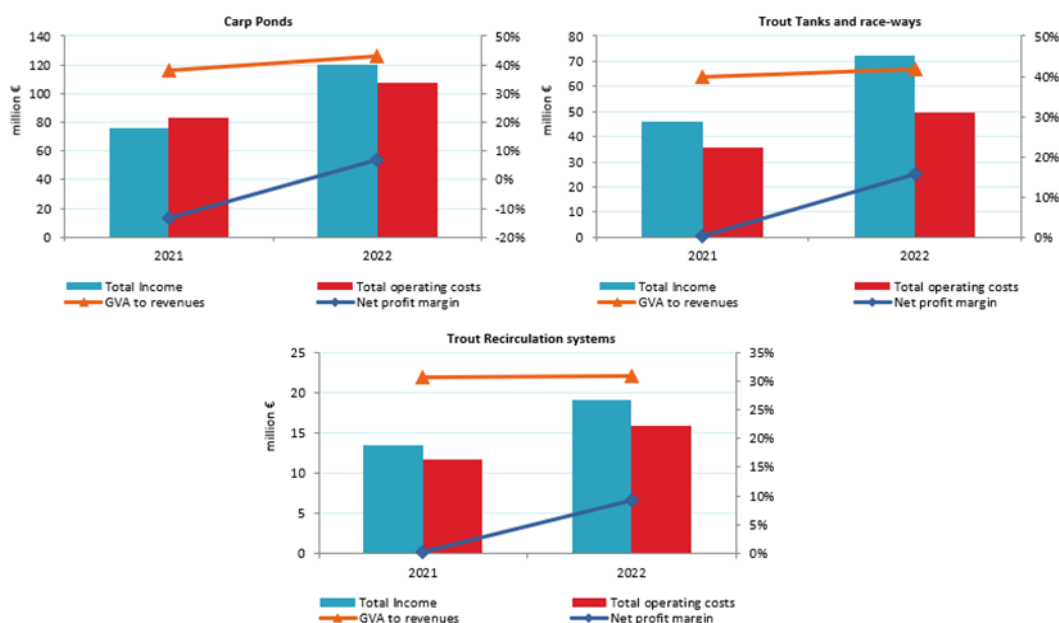
Economic indicators

Trend analysis of economic indicators is hampered by the two-year time series. There were year-on-year improvements in labour productivity, GVA to sales ratio and net profit margin (Figure 134). This was true for all sectors. Labour productivity was, however, 3.5 times higher in the trout sector as a result of high production intensity and better mechanisation of the process.

The best returns on investment over the period considered were for trout production in raceways (average 7.5%) and recirculating systems (average 4.1%), mainly due to lower exposure to cost fluctuations and less capital in used. In the case of carp, the ROI during the period was negative at -0.4%, mainly due to the scale of unpaid labour costs.

Capital productivity was also higher in the trout sectors (average 30.2 for raceways and 22.1 for recirculating) than in the carp sector (average 8.8%). This difference was mainly due to the high capital commitment (land) involved in running a carp farm and the low leverage of the industry's operations (debts). Detailed data presented in Table 75.

Figure 134. Economic performance in € million, indicators for the main Polish segments: 2021-2022



Source: Own elaboration from EU Member States DCF data submission

Table 75. Economic performance of main Polish aquaculture segments: 2021-2022.

Variable	2021	2022	Change 2021-22	2021	2022	Change 2021-22	2021	2022	Change 2021-22
	Carp Ponds			Trout Tanks and race-ways			Carp Ponds		
Number of enterprises									
FTE	3195	3199	▲ 0%	545	582	▲ 7%	3195	3199	▲ 0%
Average wage (thousand €)	15.0	16.5	▲ 10%	14.9	15.9	▲ 6%	15.0	16.5	▲ 10%
Labour productivity (thousand €)	9.1	16.1	▲ 77%	33.5	52.2	▲ 56%	9.1	16.1	▲ 77%
Sales weight (thousand tonnes)	22.7	23.0	▲ 1%	18.3	18.8	▲ 3%	22.7	23.0	▲ 1%
Total income (million €)	76.1	119.8	▲ 58%	45.9	72.5	▲ 58%	76.1	119.8	▲ 58%
Total operating costs (million €)	83.0	107.5	▲ 30%	35.8	49.7	▲ 39%	83.0	107.5	▲ 30%
Gross Value Added (million €)	29.0	51.4	▲ 77%	18.2	30.4	▲ 67%	29.0	51.4	▲ 77%
Net profit (million €)	-10.2	8.2	▼ -181%	0.1	11.3	▲ 9876%	-10.2	8.2	▼ -181%
Total value of assets (million €)	453.6	462.0	▲ 2%	79.7	80.9	▲ 2%	453.6	462.0	▲ 2%
Net investments (million €)	18.4	6.0	▼ -67%	1.6	1.6	▲ 0%	18.4	6.0	▼ -67%
Capital productivity (%)	6.4	11.1		22.9	37.6		6.4	11.1	
Return on Investment (%)	-2.6	1.7		0.2	14.9		-2.6	1.7	
Future Expectation Indicator (%)	3.0	0.3		-10.5	-11.4		3.0	0.3	

Source: Own elaboration from EU Member States DCF data submission

4.20.5 Outlook

Nowcasts for 2023-24

In 2023, freshwater aquaculture facilities are estimated to have produced 42 000 tonnes of salmonids, carp, and other freshwater species. This gave a turnover value of approximately €166 million. The sector employed nearly 6 000 people including unpaid labour. For 2024, assume a greater stabilisation in the scale of production and output with a slight upward trend of 5% for all sectors discussed. For the determinants of this scenario, see Trends and triggers.

Trends and triggers

Polish aquaculture has reached a level of 42-46 thousand tonnes of sold production annually, after which we can expect medium-term stabilisation with minor yearly fluctuations. In the long term, certain factors will stimulate production growth, but many others will have a limiting effect.

Factors driving production growth include:

- Low production intensity in carp farming allowing production per hectare to increase without new investment;
- **Investment funds from EMFAF**, which will continue to be directed towards increasing the production capacity of intensive aquaculture, primarily trout and sturgeon farming, both in tanks and raceways, as well as in recirculation systems;
- **Demand from the strong domestic processing sector**, mainly focused on large trout (salmon trout). However, the impact of this demand on aquaculture development will depend on the competitiveness of domestic aquaculture compared to the import of substitute products.

Factors limiting production growth include:

- **Climate change impact:** Shortage of water, increased water temperatures limit production potential (periods without fish feeding, higher mortality), they force lower stocking densities and new investments. High water temperatures in Northern Poland mean that trout farming will be very difficult in some streams in the future. In 2023, one of the largest trout facilities changed owners and will be converted to sturgeon production from 2024/2025, which is more resistant to rising temperatures and oxygen deficiencies. On the other hand, climate change may cause the RAS sector to grow.
- **Predators:** Uncontrolled growth of the black cormorant population (both nesting and migrating) causes great damage, especially to carp fry. Locally, damage can reach several dozen percent of the original stock. Additional losses are caused by beavers (damage to embankments), otters (eating fish) and other bird species (including swans - eating feed). However, there is no scientifically recognized, quantitative estimate of the damage.
- **Over-aging and lack of successors:** The problem of aging owners and employees of fish farms is visible in both carp and trout production. In many cases, there is a fear of lack of succession. This may cause consolidation processes in the future - purchase of some facilities by capital groups.
- **Concentration the distribution on supply side:** Despite the activities of recognized Producer Organizations and the development (mainly by carp farms) of their own short supply chains, the market position of aquaculture producers is weak. Retail chains have a strong position on the market - especially the dominant discount supermarkets. Pressure from imports is also felt, especially in years with high sales prices from domestic farms.

4.20.6 Data Coverage and Data Quality

The data for the DCF are collected using a questionnaire-based method on a randomly selected sample of farms. Data collection took place for the first time in 2021. In 2022, there was significant progress in data collection. So far, the data have been obtained from a relatively small sample of farms (n = 50), which is why some figures were subject to additional verification through in-depth individual interviews with typical farms.

4.21 Portugal

Overview of Portuguese aquaculture

The Portuguese aquaculture sector consist of freshwater, brackish and marine aquaculture, that sold 16.2 thousand tonnes in 2022, maintaining the production level of 2021. The total value of production was €160 million, corresponding to a 17% increase in value over the same period.

In 2022, the Portuguese aquaculture sector was composed of 731 companies employing 2 014 workers: 874 of them worked in marine aquaculture, 1 080 in shellfish aquaculture and 27 in freshwater aquaculture. However, the magnitude of employment measured as FTE is lower. In total, the number of full-time employees was 1 511. This decrease is reflected in all three sectors but is most evident in the shellfish sector (FTE for marine aquaculture is 811, 647 for shellfish and 24 for freshwater aquaculture).

Regarding the business structure of the aquaculture sector in Portugal, which is composed of 731 companies in 2022, this is mostly composed of small companies (≤ 5 employees) representing 93% of the sector, followed by companies with more than 10 employees (4%) and companies with between 6 to 10 employees (3.4%).

4.21.1 Total production and sales

Aquaculture production in 2022 was 16.2 thousand tonnes and generated revenues of €160 million. These results reflect a maintenance of production levels, but an increase of 17% in value compared to 2021. It corresponds to a higher production of grooved carpet shell, the most produced species (26%), which represents 52% of the total value of Portuguese aquaculture. Gilthead seabream is the second most important species in terms of production volume (20%), but the third in value (11%). Turbot is the second most important species in terms of value (19%) but the third in production volume (17%).

Production in brackish and marine waters remained the most important: total sales value has grown by 2% between 2021 and 2022 and accounted for 98% of total production in 2022.

On the other hand, freshwater aquaculture has suffered a sharp drop in terms of production (-53%) and value (-48%) from 2020 to 2021. However, during this period there was a growth in the number of employees in this sector. This sector has a low representativeness in Portugal, which is combined with a low acceptance of this type of product in the domestic market and with difficulties of competitiveness with other countries in foreign markets.

Since 2017, sales have been increasing over the years, despite the drop observed in 2020, motivated by the COVID-19 pandemic. The peak in sales value was reached in 2022, mainly due to the increase in production of one of the highest value species (grooved carpet shell). It is worth noting that in 2022, the production in weight and value in the marine sector were 98% and 47% above the 2017-2021 average, respectively. It is worth noting that in 2022, the production in weight and value in the marine sector were 98% and 47% above the 2017-2021 average, respectively, reflecting an increase in the value of aquaculture products on the market.

Table 76. Production and sales, industry structure and employment for Portugal: 2017-2022.

Variable	2017	2018	2019	2020	2021	2022	Change 2021-22	Develop. 2022/(17-21)
Sales weight (thousand tonnes)	10.9	11.7	12.9	13.6	16.1	16.2	0%	24%
Marine	3.8	3.9	6.4	6.6	7.4	8.3	12%	47%
Freshwater	0.7	0.7	0.7	0.6	0.6	0.3	-53%	-59%
Shellfish	6.4	7.1	5.8	6.5	8.1	7.5	-6%	11%
Others					0.1	0.1	-17%	-17%
Sales value (million €)	81.5	96.5	118.5	100.0	136.8	160.1	17%	50%
Marine	26.0	29.8	46.0	41.3	59.4	80.4	35%	98%
Freshwater	1.9	1.9	1.9	1.8	1.6	0.9	-48%	-54%
Shellfish	53.5	64.8	70.3	56.9	73.9	76.9	4%	20%
Others					1.9	1.9	2%	2%
Number of enterprises	868	845	727	721	687	731	6%	-5%
Marine	15	18	50	46	33	51	55%	57%
Freshwater	8	8	38	21	2	3	50%	-81%
Shellfish	845	819	639	654	645	661	2%	-8%
Others					7	16	129%	129%
Employment	1,968	2,366	1,731	1,837	1,597	2,014	26%	6%
Marine	72	279	287	501	578	874	51%	155%
Freshwater	44	44	80	37	13	27	108%	-38%
Shellfish	1,852	2,043	1,363	1,299	988	1,080	9%	-28%
Others					18	33	83%	83%
FTE	960	781	1,237	987	1,169	1,511	29%	47%
Marine	54	266	483	481	557	811	46%	120%
Freshwater	35	35	78	31		24	#DIV/0!	-46%
Shellfish	871	480	676	475	598	647	8%	4%
Others					14	29	107%	-95%

Source: Own elaboration from EU Member States DCF data submission

4.21.2 Industry structure and total employment

At the end of 2022, there were 731 aquaculture enterprises engaged in freshwater, brackish or marine aquaculture. This represents an increase of 44 units compared to 2021.

Employees in the sector, in absolute values, increased to 2014, of which approximately 54% are employed in the shellfish sector and 43% are employed in marine aquaculture. In terms of employees, compared to the changes recorded on average between 2017/2021, the number of workers increased by 6%. This trend is related to the increase of establishments producing sea bass and sea bream.

A comparison of the data between the number of employees and the number of FTEs provides insight into the employment dynamics of the macro-aggregates. Regarding the total number of FTEs, an increase in the number of part-time jobs was detected. This trend is led by the increase in the total number of FTE in shellfish and marine aquaculture, with an increase in this variable of 107% and 46%, respectively.

4.21.3 Overall Economic performance

The economic performance of the Portuguese aquaculture sector improved between 2017 and 2022. The amount of total income generated by the Portuguese aquaculture sector in 2022 was €220 million.

The Total income value in 2022 increased by 13% compared to 2021, and it is 76% higher than the average value for the period 2017-2021. The turnover from sales represented 73% and other income has an important weight (24%).

Table 77. Economic performance of the Portuguese aquaculture sector: 2017-2022.

Variable	2017	2018	2019	2020	2021	2022	Change 2021-22	Develop. 2022/(17-21)
Total income	84.5	102.4	126.3	117.4	195.0	220.1	▲ 13%	▲ 76%
Total operating costs	40.2	48.2	83.7	60.4	66.1	102.0	▲ 54%	▲ 71%
Total wages	10.8	14.7	18.3	17.2	19.2	26.8	▲ 40%	▲ 67%
Gross Value Added	55.2	67.7	59.2	70.4	143.0	138.4	▼ -3%	▲ 75%
Depreciation of capital	5.4	5.8	6.8	4.9	5.9	11.7	▲ 97%	▲ 103%
Earning before interest and taxes	38.9	48.4	35.8	52.1	123.0	106.4	▼ -13%	▲ 78%
Financial costs, net	7.9	0.7	3.5	3.1	3.2	4.0	▲ 26%	▲ 8%
Net profit	31.0	47.6	32.3	49.0	119.8	102.4	▼ -14%	▲ 83%
Total value of assets	108.8	119.5	193.3	185.4	113.0	290.6	▲ 157%	▲ 102%
Capital productivity (%)	50.7	56.7	30.6	38.0	126.6	47.6	▼ -62%	▼ -21%
Return on Investment (%)	35.8	40.4	18.5	28.1	108.8	36.6	▼ -66%	▼ -21%

Source: Own elaboration from EU Member States DCF data submission

The total operating costs of the Portuguese aquaculture sector in 2022 were €102 million and corresponds to 46% of the total income. The total operating costs in 2022 increased by 54% compared to 2021 and 71% to the average of the period 2017-2021. The largest expenditure item in 2022 was raw material: feed costs with €35 million, followed by wages and salaries €25.8 million and raw material costs: livestock costs with €15.2 million. Repair and maintenance were the cost that increased the most in percentage terms compared to the 2017-2021 average (163%). Raw material costs: feed costs and wages and salaries grew by 80% when compared to the 2017-2021 average.

According to capital cost, consumption of fixed capital is the main cost with the amount of €11.7 million. In 2022, the consumption of fixed capital increased by 97% compared to 2021, the financial costs increased by 26%. The increase in 2022 is likely to be related to an accounting operation by a company that is very important in Portuguese aquaculture. Regarding capital value, the total value of assets and debt amounted to €290.6 million and €158.6 million, respectively. The total value of assets in 2022 increased by 102% compared to the average 2017-2021. The debt also increased in 2022, by 66% compared to 2021.

The GVA generated by the Portuguese aquaculture sector was €138.4 million in 2022, corresponding 63% of the total income. The GVA in 2022 increased by 75% compared to the period 2017-2021. EBIT was equal to €106.4 million in 2022 and increased by 78% compared to the average for the 2017-2021 period. The net profit generated by the Portuguese aquaculture sector in 2022 was €102.4 million and increased by 83% compared to the period 2017-2021.

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. Oyster culture also appears in estuaries and coastal lagoons. 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.

As shown in Figure 135, the most produced species in Portuguese aquaculture is grooved carpet shell. It is mainly produced in farms with small areas of land in intertidal zone, usually with less than 1 hectare, mostly (60%) by companies in the clam on-bottom segment. The total sales volume was 4.2 thousand tonnes with a value of €83 million, which represents 52% and 26% of the aquaculture total sales volume and value, respectively.

The second most important species is turbot, produced entirely by the segment Other marine fish Tanks and race-ways. The production volume was 2.9 thousand tonnes with a corresponding value of €35.7 million and represents 19% of total sales volume and 17% of the total sales value. The production techniques used are tanks and recirculation systems (RAS).

The third species in gross sales is gilthead seabream, produced mainly in cages (70% of the volume) but also in ponds. Production techniques are intensive and semi-intensive in open systems. The total sales volume was 3.2 thousand tonnes with a corresponding value of €18 million. Seabream covers 20% in volume and 11% in value of the total Portuguese production.

European seabass is the fourth species in terms of gross sales representing 5% of the total sales and 7% of the total volume sold. More than 80% of the seabass production is semi-intensive in ponds and 19% is in cages (intensive). All the production is in open system. The total sales volume was 3.2 thousand tonnes with a corresponding value of €1.1 million.

The fifth aquaculture species in Portugal is Pacific cupped oyster whose sales amounted to €6.8 million (4% of the total sales), with 1.6 thousand tonnes sold (10% of the total volume sold).

Figure 135. Main species produced in terms of weight and value in Portugal: 2022.

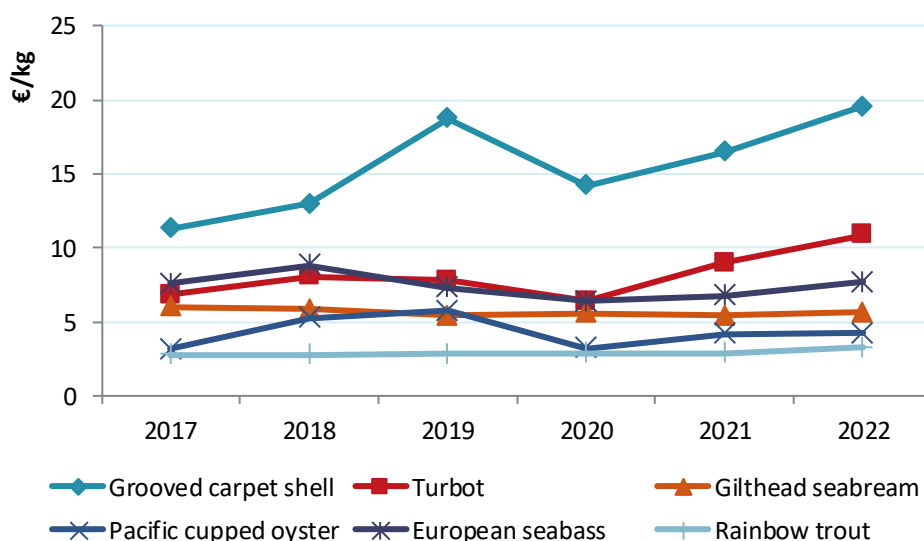


Source: Own elaboration from EU Member States DCF data submission

The average prices for the period 2017-2022 of the most important species for the Portuguese aquaculture sector are presented in Figure 136. The average price of clams fluctuated over the period, but showed an upward trend from 2020 to 2022, when the price reached its highest value: €20 per kg. The average price of turbot has risen by 71% from 2020 to 2022, having reached €11 per kg.

The average price of gilthead seabream was stable oscillating between €5.4 and €6 per kg in the period. In 2022, the price was €6 per kg as it was in 2017. The average price of seabass was €8 per kg, showing a 20% increase from 2020 to 2022. Regarding oysters, there has been considerable fluctuation, with the average price in 2021 and 2022 being €4.2 per kg. Analysis of the figure shows that, excluding seabream, all species saw a drop in price in 2020, which is probably related to COVID-19 pandemic. From 2020 to 2022, there is a progressive increase in average prices, both due to the recovery from the pandemic and the increase in production costs.

Figure 136. Average prices €/kg for the main species produced in Portugal: 2017-2022.



Source: Own elaboration from EU Member States DCF data submission

The economic performance of the main four Portuguese segments is shown in Figure 137 and the cost structure of the three main Portuguese segments are presented in Figure 138.

Table 78. Economic performance of main Portuguese aquaculture segments: 2017-2022.

Variable	2017	2018	2019	2020	2021	2022	Change 2021-22	2017	2018	2019	2020	2021	2022	Change 2021-22
Clam On-bottom								Other marine fish Tanks and race-ways						
Number of enterprises	767	729	556	533	544	543	0%	5	5	5	3	2	3	50%
FTE	696	318	397	232	361	375	4%	23	143	198	168	177	300	69%
Average wage (thousand €)	4.2	11.1	9.6	9.6	4.4	4.8	8%	134.6	19.6	20.8	20.2	20.5	23.0	12%
Labour productivity (thousand €)	52.2	130.4	134.1	148.7	155.7	142.4	-9%	320.0	58.5	30.4	70.9	144.2	34.8	-76%
Sales weight (thousand tonnes)	4.1	3.4	3.0	2.5	3.2	2.9	-10%	2.7	2.8	3.8	3.6	3.4	2.9	-17%
Total income (million €)	41.0	44.0	57.4	36.7	58.0	56.0	-3%	19.6	23.6	31.9	24.6	47.4	33.0	-30%
Total operating costs (million €)	7.6	5.7	7.0	3.3	2.8	4.0	41%	15.4	18.0	30.0	15.9	23.6	28.4	21%
Gross Value Added (million €)	36.3	41.5	53.2	34.5	56.2	53.4	-5%	7.3	8.4	6.0	11.9	25.5	10.4	-59%
Net profit (million €)	32.2	38.5	50.4	33.4	55.3	52.0	-6%	-4.1	3.4	-0.9	6.1	20.8	-1.1	-105%
Total value of assets (million €)	9.2	9.8	19.8	1.1	1.9	1.9	4%	49.0	46.6	66.0	57.0	7.4	134.6	1729%
Net investments (million €)	2.5	1.3	2.1	0.2	0.9	15.0	1638%	4.3	2.8	8.8	10.4	2.5	17.0	574%
Capital productivity (%)	394.3	424.5	269.5	3270.9	3012.2	2743.6		14.8	17.9	9.1	20.9	346.6	7.8	
Return on Investment (%)	357.4	388.0	253.4	3158.0	2947.1	2660.3		5.7	9.6	0.8	13.0	299.4	0.8	
Future Expectation Indicator (%)	21.9	9.7	8.5	16.3	37.8	756.8		5.8	3.6	11.3	16.0	10.1	10.0	
Sea bass & Sea bream Ponds								Sea bass & Sea bream Cages						
Number of enterprises	6	8	38	36	24	36	50%	2	3	5	4	4	6	50%
FTE	26	31	159	159	129	176	36%	4	20	41	126	164	189	15%
Average wage (thousand €)	18.5	21.7	20.7	19.7	18.7	16.3	-13%	2.0	66.9	21.6	17.5	19.3	23.9	24%
Labour productivity (thousand €)	82.0	21.1	-41.0	-13.9	41.3	83.6	102%	-328.8	-96.1	-10.8	16.9	140.4	142.9	2%
Sales weight (thousand tonnes)	0.7	0.5	1.2	1.4	1.9	2.7	44%	0.3	0.6	1.4	1.5	1.9	2.4	31%
Total income (million €)	4.8	3.8	9.5	11.5	17.0	32.9	94%	1.3	3.5	6.9	10.4	31.4	44.6	42%
Total operating costs (million €)	3.2	3.8	19.3	16.8	13.8	20.2	47%	2.6	6.2	7.8	9.1	10.8	21.0	95%
Gross Value Added (million €)	2.1	0.7	-6.5	-2.2	5.3	14.7	176%	-1.3	-1.9	-0.4	2.1	23.0	27.0	17%
Net profit (million €)	1.1	-0.4	-10.8	-6.4	2.1	10.5	399%	-1.4	-3.1	-1.2	0.9	19.5	21.4	10%
Total value of assets (million €)	6.2	8.6	40.8	56.9	29.3	54.1	85%	0.9	4.3	19.6	14.7	18.8	33.9	80%
Net investments (million €)	2.9	2.9	11.4	8.7	6.7	12.2	82%	0.0	2.9	2.8	3.1	0.0	6.1	
Capital productivity (%)	33.5	7.6	-16.0	-3.9	18.2	27.2		-146.0	-45.2	-2.3	14.5	122.3	79.7	
Return on Investment (%)	18.1	-4.5	-26.3	-11.1	8.2	21.3		-155.4	-72.9	-5.3	6.6	105.6	63.9	
Future Expectation Indicator (%)	38.0	29.3	25.8	13.7	20.2	20.3		0.0	59.7	13.9	18.4	0.0	12.3	

Source: Own elaboration from EU Member States DCF data submission

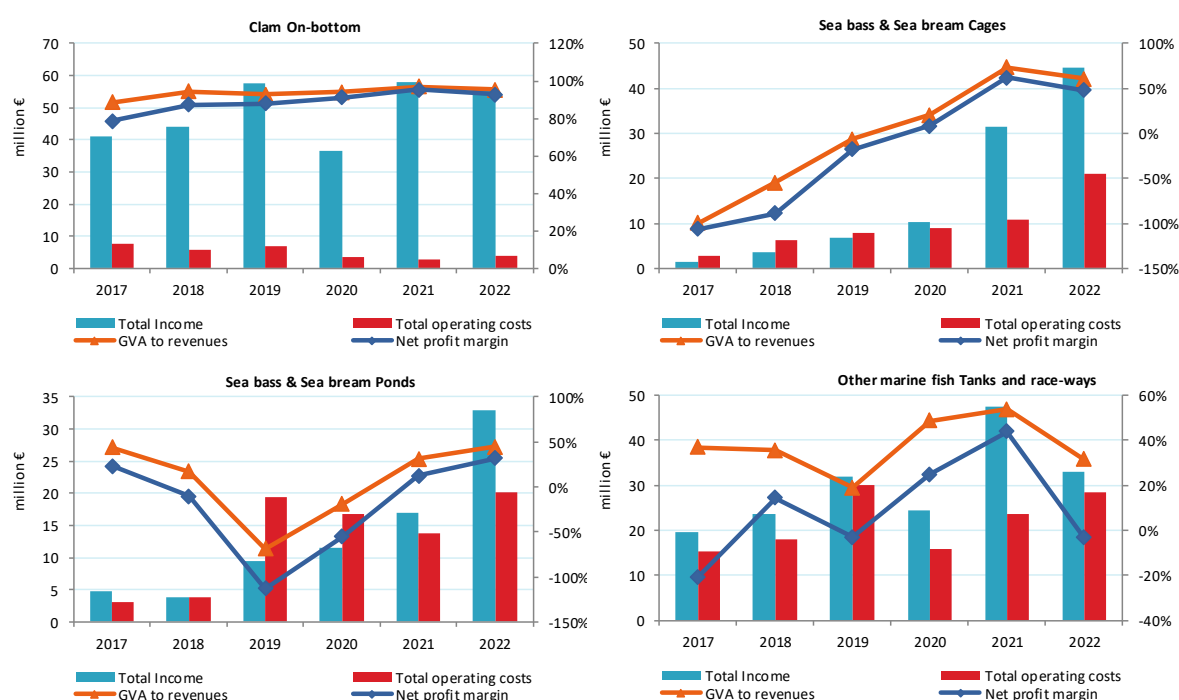
Clam On-bottom

The most important segment regarding the sales volume and value in 2022 was clam on bottom. This segment consisted of 543 active enterprises. The main species produced was grooved carpet shell (97% of the segment gross sales and 88% of the sales volume). The value of total income was €56 million, which is 3% less than in 2021, and 18% more when compared to the average for the period 2017-2021. The amount of total sales volume in 2022 decreased by 10% when compared to 2021 and to the average 2017-2021.

In terms of economic indicators, the amount of GVA generated by the clam on bottom segment in 2022 was €53.4 million, which represents a 5% decrease when compared to 2021 and an increase of 20% over the period 2017-2021. GVA to revenues was 95% and net profit margin was 93%.

The most important cost in this segment is wages and salaries, which represents 28% of the total operating costs. Raw material costs: Livestock costs represented 21% of the total operating costs.

Figure 137. Economic performance in € million, indicators for the main Portuguese segments: 2017-2022.



Source: Own elaboration from EU Member States DCF data submission, 2024

Other marine fish Tanks and race-ways

Other marine fish Tanks and race-ways is the second most important segment regarding the sales volume and value in 2022. This segment consisted of 3 active enterprises. The main species produced was turbot (99% of the segment gross sales and sales volume). The value of total income was €33 million, which is 30% less than in 2021, and 12% more when compared to the average for the period 2017-2021. The amount of total sales volume in 2022 decreased by 17% when compared to 2021 and 13% to the average 2017-2021.

In terms of economic indicators, the amount of GVA generated by the other marine fish Tanks and race-ways segment in 2022 was €10.4 million which represents a 59% decrease when compared to 2021 and 12% over the period 2017-2021. GVA to revenues was 32% and net profit margin was -3%, which means that the turbot sector was not profitable. However, this result is probably due to the fact that the most important company in the sector is investing in its plant by creating a solar energy self-consumption production unit and modernizing the transformation unit.

The most important cost in this segment is raw material costs: Feed costs, which represents 46% of the total operating costs Wages and salaries were the second operating costs (24% of the total operating costs).

The production of sea bass and sea bream is an important sector in the Portuguese aquaculture, being produced with two different fish farming technique: Cages and Ponds. Both the final product and the economic results are different between these two segments. The production in cages is more intensive, with higher production costs and a larger quantity sold. However, the fish produced is smaller and less valued by consumers. The average price of sea bream was €4.89 per kg and sea bass €5.03 per kg. Production in ponds is semi-intensive, with lower production costs and a smaller quantity sold, but it is more highly valued, considering its size and similarity to fish from fisheries. The average price of sea bream was €7.35 per kg and sea bass €8.30 per kg. As a result, the Sea bass & Sea bream Cages segment has a better economic performance in terms of GVA to revenues and Net profit margin.

Sea bass & Sea bream Cages

The production of seabass and seabream in cages is the fifth segment in terms of gross sales (€12 million) and in volume (2.4 thousand tonnes) in 2022. This segment is composed of 6 enterprises, 2 more than in 2020 and 2021. The production of gilthead seabream represents 91% of the value and volume of the segment. The value of total income was €44.6 million, which is 42% more than in 2021 and 317% more when compared to the average for the period 2017-2021. The amount of total sales volume in 2022 increased by 31% when compared to 2021 and 116% to the average 2017-2021.

In terms of economic indicators, the amount of GVA generated by the Sea bass & Sea bream Cages segment in 2022 was €27 million, which is a 17% increase compared to 2021. GVA to revenues was 61% and net profit margin was 48%.

The most important cost in this segment is raw material costs: Feed costs, which represents 45% of the total operating costs Wages and salaries were the second operating costs (22% of the total operating costs).

Sea bass & Sea bream Ponds

The Sea bass & Sea bream Ponds segment is the third in terms of gross sales (€30 million) and in volume (2.7 thousand tonnes) in 2022. This segment is composed of 36 enterprises. These enterprises have a diversified production, with establishments producing other species. For that reason, seabass and seabream production represents 47% of the gross sales of the segment and 69% of the volume. Grooved carpet shell is also an important specie produced in this segment (€15 million for 767 tonnes sold). The value of total income was €32.9 million, which is 94% more than in 2021 and 253% more when compared to the average for the period 2017-2021. The amount of total sales volume in 2022 increased by 44% when compared to 2021 and 137% to the average 2017-2021.

In terms of economic indicators, the amount of GVA generated by the Sea bass & Sea bream Cages segment in 2022 was €14.7 million, which is a 176% increase compared to 2021. It should be noted that the GVA increased from a negative value in 2020 and has been growing ever since. GVA to revenues in 2022 was 45% and net profit margin was 32%.

The most important cost in this segment is raw material costs: Feed costs, which represent 47% of the total operating costs and Raw material costs: Livestock costs represent 16%. Wages and salaries were the third operating costs (14% of the total operating costs).

4.21.5 Outlook

The institutional framework of Portuguese aquaculture is governed by Decree Law No. 40/2017. This decree regulates the creation and operation of farming establishments in marine waters, estuaries and inland waters whether publicly or privately owned. Thus, it is the Portuguese state that grants the application for the attribution of an aquaculture activity and the permit for the use of waters in the public hydraulic domain.

The main axes for the development of Portuguese aquaculture are set out in the Strategic Plan for Portuguese Aquaculture 2021-2030, which is implemented through the Mar2030 program financed by EMFAF for Portugal. In 2022, there were 1 287 aquaculture establishments in Portugal. Aquaculture

located in estuaries areas is the most widespread in Portugal. The use of marine salt industry facilities has given Portuguese aquaculture an option to develop at a low cost, through an easy and cheap transformation of already decommissioned salt facilities. However, the size of the tanks, the characteristics of the bottoms and the water flow rates are not adequate for the semi-intensive aquaculture production being carried out. These systems use a mixed feeding system. On the other hand, in the intertidal zones there are extensive bivalve farms, which account for a large part of the total aquaculture production.

In addition, on the coast, in recent decades, intensive installations have been built to capture seawater for the cultivation of sole and turbot. Another future objective of Portuguese aquaculture is to extend the use of floating farms along the Portuguese coast, especially along the Algarve coast, since it offers more favourable conditions than other locations. Although there is currently already a production of fish (seabream and seabass) and bivalve molluscs (clams and mussels) using this technology offshore, it is expected that, with the approval of Aquaculture Production Areas (APA) for the cultivation of fish, shellfish and seaweed production and its importance in the Portuguese aquaculture context will increase in the near future.

Trends and triggers

The Biomarine Center and bivalve mollusc hatchery in the port of Nazaré has continued its activity. This centre, located in the central region of Portugal, has as its main activity the sustainable production of bivalve mollusc seeds, especially focused on the grooved carpet shell and pullet carpet shell. Portugal exports a large part of its clam seed to Spain, so this project aims to increase the independence and value chain of Portuguese aquaculture.

This project contributes to the achievement of several objectives of the Strategic Plan for Portuguese Aquaculture 2014-2020 and for accomplish the objectives of Strategic Plan for Portuguese Aquaculture 2021-2030. On the one hand, this initiative increases the availability of clam seed, whose scarcity and annual fluctuations were a drawback for the sustained growth of the cultivation of this bivalve. On the other hand, it increases the percentage of skilled labour in a sector whose technological level is low.

The Strategic Plan for Portuguese Aquaculture 2014-2020 is no longer in force, but given that part of the projects approved under MAR2020 have recently started, an increase in production is expected for the coming years. It should be noted that, for this plan, strategic line of action A, which was based on facilitating administrative procedures, and strategic line of action B, focused on facilitating access to coastal space and water, have been almost entirely fulfilled.

In view of the completion of the first plan, the Strategic Plan for Portuguese Aquaculture 2021-2030 was approved in 2021. The general objective of this plan is based on four strategic intervention axes: (1) Strengthening resilience and competitiveness; (2) Participating in the energy transition; (3) Promoting social acceptance and information for consumers; (4) Increasing knowledge and innovation. These strategic intervention axes and the objectives of the plan were identified following the evaluation of the results of the previous 2014-2020 period.

This plan was essential to the approval of European Funds to Aquaculture. In Portugal, the projects are approved under MAR2030.

4.21.6 Data Coverage and Data Quality

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 fulfils the needs of DCF (production and socio-economic data). The same operation responds to internal information needs (administrative data), EUROSTAT and the DCF. Data is collected at farm level in production. While production data is mandatory and collected at farm level, economic data is provided voluntarily and at enterprise level. In cases of non-response, the variables are estimated to cover the entire population, and the quality indicators are 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 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 does not 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.

In particular, in the Tuna segment, until 2021 it was not possible to aggregate this segment with any other, due to its particularities. This is a segment that has been active since 2011 but which began to be reported in 2021, the year in which the companies authorised the release of the data.

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.

4.22 Romania

Overview of Romanian aquaculture

In 2022, the Romanian freshwater aquaculture industry generated €49.9 million value of sales an increase of 6% compared to 2021. Number of enterprises in aquaculture sector decreased by 6%, decline to 463 registered entities (mainly small farms). Compared to 2021, the total number of employees declined by 14%, in its turn FTE increased by 124%.

4.22.1 Total Production and sales

In 2022, the total value of aquaculture production in Romania increased by 6% to €49.9 million, in its turn sales weight of aquaculture production 312% higher, compared to 2021-2022. Aquaculture production consisted only of freshwater species, because marine aquaculture is not reported to be present.

4.22.2 Industry structure and total employment

The total population of aquaculture farms remained stable in 2022, corresponding to 463 aquaculture enterprises, only freshwater aquaculture units, producing rainbow trout carps, and other freshwater species. No marine aquaculture farms were reported for 2022.

The total number of persons employed in 2022 decreased by 14% to 1 956 employees and 1 956 FTE. Employment in aquaculture industry tends to decrease from 2019. For example, in 2022, compare to 2017-2021 multiannual average, number of employees was 12% lower (see Table 79).

Table 79. Production and sales, industry structure and employment for Romania: 2017-2022.

Variable	2017	2018	2019	2020	2021	2022	Change 2021-22	Develop. 2022/(17-21)
Sales weight (thousand tonnes)	13.6	13.6	17.9	11.5	11.7	48.3	▲ 312%	▲ 253%
Sales value (million €)	30.0	51.8	65.1	30.3	47.0	49.9	▲ 6%	▲ 11%
Number of enterprises	440	456	474	470	490	463	▼ -6%	▼ -1%
Employment	2,230	1,965	2,295	2,055	2,274	1,956	▼ -14%	▼ -10%
FTE	2,230	1,965	2,295	2,055	874	1,956	▲ 124%	▲ 4%

Source: Own elaboration from EU Member States DCF data submission

4.22.3 Overall Economic performance

In 2022, total income decreased by 31% to €55.1 million, compared to 2017-2022 multiannual average had a 33% decrease. Around 90% from the total income was generated from gross sales of aquaculture production, while 8% came from other income and rest from the direct subsidies.

The largest expenditure items in 2022 were wages and feed costs accounting for 26% and 25%, respectively, of total operating costs. Operating costs decreased significantly by 64% from 2021 to 2022. Industry generated €26.2 million in GVA, with a net profit of €11.5 million in 2022. Despite the reported net profit in 2022, the profitability of the aquaculture sector has been on a downward trend and has been loss-making from 2018 to 2020. The total value of assets in 2022 decreased by 58% to €118.3 million resulting capital productivity of 22.1%. Capital productivity has a decreasing trend, compared to 2017-2022 (see Table 80).

Table 80. Economic performance of the Romanian aquaculture sector: 2017-2022.

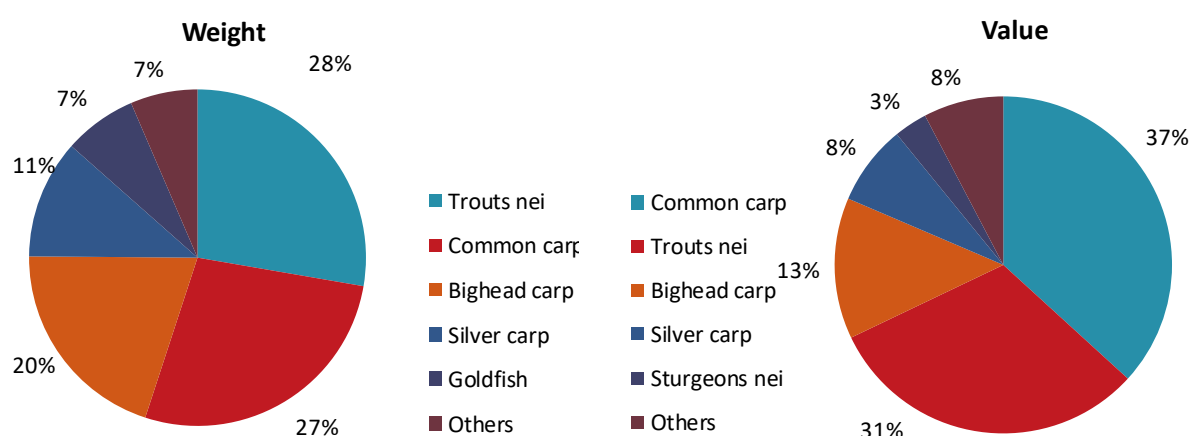
Variable	2017	2018	2019	2020	2021	2022	Change 2021-22	Develop. 2022/(17-21)
Total income	39.2	58.0	71.9	43.7	79.8	55.1	▼ -31%	▼ -6%
Total operating costs	41.0	49.5	47.9	55.4	104.9	37.8	▼ -64%	▼ -37%
Total wages	11.1	11.4	14.8	14.2	17.2	9.7	▼ -44%	▼ -30%
Gross Value Added	9.2	13.8	37.2	1.5	-11.4	26.2	▲ 330%	▲ 160%
Depreciation of capital	8.9	8.0	8.6	10.6	16.3	6.4	▼ -61%	▼ -39%
Earning before interest and taxes	-10.8	0.6	15.4	-22.3	-41.5	11.0	▲ 127%	▲ 194%
Financial costs, net	-51.0	0.8	1.5	0.4	-0.1	-0.5	▼ -275%	▲ 95%
Net profit	40.2	-0.2	13.9	-22.8	-41.3	11.5	▲ 128%	▲ 667%
Total value of assets	122.0	210.6	239.3	89.6	282.1	118.3	▼ -58%	▼ -37%
Capital productivity (%)	7.6	6.5	15.6	1.6	-4.0	22.1	▲ 649%	▲ 305%
Return on Investment (%)	-8.8	0.3	6.4	-24.9	-14.7	9.3	▲ 163%	▲ 211%

Source: Own elaboration from EU Member States DCF data submission

4.22.4 Main species produced and economic performance by segment

Freshwater species covers more than 99% in Romanian aquaculture production, therefore marine aquaculture is skipped from analysis. In 2022, trout production represented 28% of total aquaculture quantities, following by 27% of common carp and 20% of bighead carp. However, value of sales was predominant in common carp aquaculture corresponding to 37% of total aquaculture value (see Figure 138).

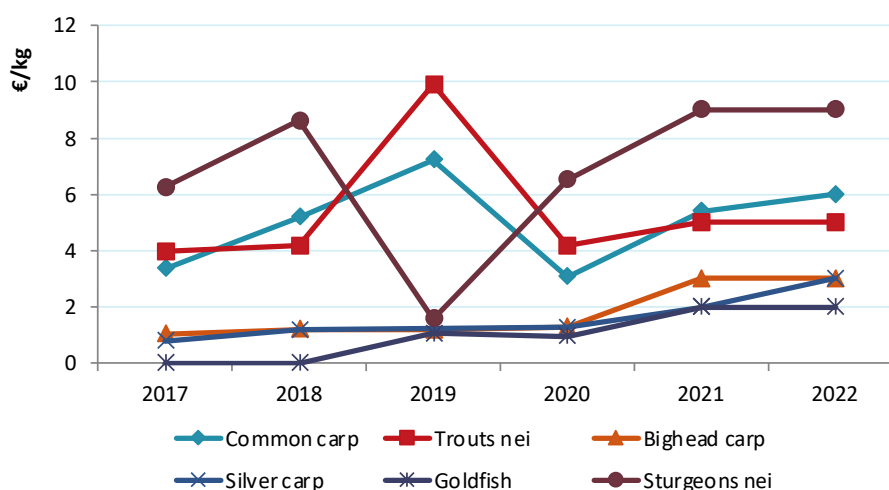
The average price for carp in 2022 increased by 10% to €6.0 per kg and reached the highest level since 2020. In 2022, silver carp was placed on the market with the share of 8% and 33%, respectively, increasing in price to €3.0 per kg. The average price for trout in 2022 remained relatively stable at €5.0 per kg (see Figure 139).

Figure 138. Main species produced in terms of weight and value in Romania: 2022.

Source: Own elaboration from EU Member States DCF data submission

The valuable species, such as sturgeons and *Poloydon spathula*, including pike-perch, catfish species vary year to year. Pike-perch 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.

Figure 139. Average prices €/kg for the main species produced in Romania: 2017-2022.



Source: Own elaboration from EU Member States DCF data submission

The most relevant segments in Romanian aquaculture in 2022, are the following:

- Carp polyculture
- Trout other methods

Segment 1: Carp polyculture

The largest segment in terms of total income is carp polyculture generated of €33.0 million in 2022, with 26% decrease in 2022 compared to 2021. In 2022, the segment generated €19.6 million in GVA and €11.9 million in net profit. In the carp polyculture, technologies used for the production are extensive. It has the low labour productivity in the sector with €13.4 thousand per FTE, decreased by 78%, compared to 2021. Carp polyculture segment provides the lowest remuneration among segments with €4.2 thousand per FTE annually. The number of FTE in the segment increased significantly from 2021 to 2022 by 266%, from 400 to 1465 employees. This could be explained by the lifting of COVID-19 restrictions, when companies returning to normal business hours. The segment is important in the MS aquaculture sector, as it supplies the market with all the freshest fish products. In addition, recreational fishing is allowed in this facility as a very important component of the overall revenue, mainly for carp ponds (see Table 81).

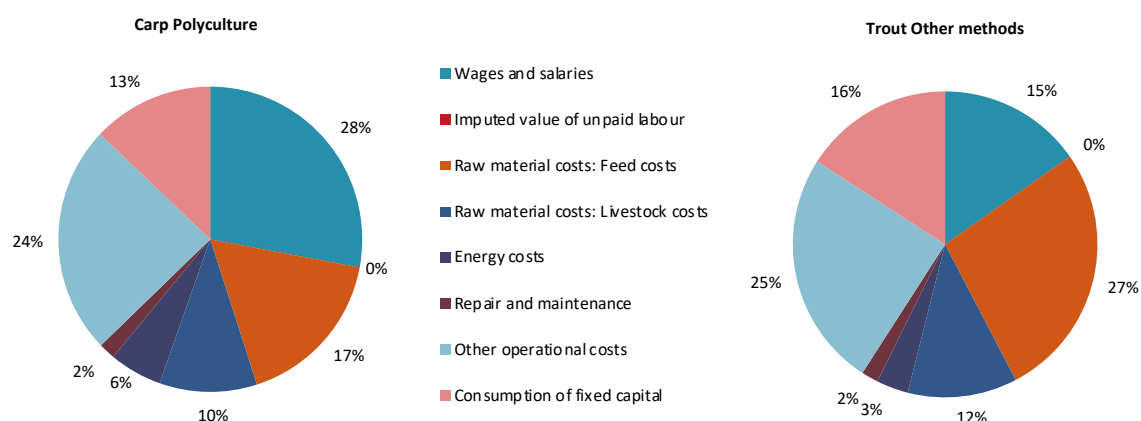
Segment 2: Trout other methods

Trout in ponds is the second largest aquaculture segment in Romania, generated €20.2 million of total income in 2022, with 39% decrease compared to 2021. Segment generated €5.4 million in GVA in 2022, however, the segment was not profitable and reported a negative net profit of €0.9 million. The trout other method segment shows low labour productivity with €13.0 thousand per FTE, declined by 75%, compared to 2021. The average annual wage was paid in this segment accounting for €7.6 thousand per FTE. Average annual wage in 2022 decreased by 52%, compared to 2021, while the total number of employees increased by 5%, to 419 employees.

Table 81. Economic performance of main Romanian aquaculture segments: 2017-2022.

Variable	2019	2020	2021	2022	Change 2021-22	2019	2020	2021	2022	Change 2021-22
	Carp Polyculture					Trout Other methods				
Number of enterprises	323	326	325	319	▼ -2%	137		152	137	▼ -10%
FTE	1990	1629	400	1465	▲ 266%	249		400	419	▲ 5%
Average wage (thousand €)	5.5	6.2	25.9	4.2	▼ -84%	13.7		15.7	7.6	▼ -52%
Labour productivity (thousand €)	10.9	6.7	60.1	13.4	▼ -78%	62.2		50.9	13.0	▼ -75%
Sales weight (thousand tonnes)	12.1	8.7	8.3	44.6	▲ 435%	5.7		2.7	3.1	▲ 13%
Total income (million €)	43.5	29.2	44.7	33.0	▼ -26%	27.1		32.9	20.2	▼ -39%
Total operating costs (million €)	31.1	27.7	30.3	19.2	▼ -37%	15.0		16.1	17.4	▲ 8%
Gross Value Added (million €)	21.6	10.8	24.0	19.6	▼ -18%	15.5		20.4	5.4	▼ -73%
Net profit (million €)	7.9	-5.0	2.9	11.9	▲ 310%	8.8		13.9	-0.9	▼ -106%
Total value of assets (million €)	210.2	19.9	211.0	69.6	▼ -67%	4.9		48.2	46.3	▼ -4%
Net investments (million €)	7.9	9.2	13.1	2.5	▼ -81%	2.7		7.0	3.3	▼ -53%
Capital productivity (%)	10.3	54.4	11.4	28.2		315.3		42.3	11.7	
Return on Investment (%)	4.1	-24.4	0.9	15.8		179.8		29.6	-1.2	
Future Expectation Indicator (%)	2.0	14.5	0.2	-0.4		-10.9		9.2	0.0	

Source: Own elaboration from EU Member States DCF data submission

Figure 140. Cost structure of the main segments in Romania: 2022.

Source: Own elaboration from EU Member States DCF data submission, 2024.

4.22.5 Outlook

Trends and triggers

As mentioned above two main group species are mostly cultured on Romania industry carp and trout, marine aquaculture is still missing, and some other species not for importance in total volume and value production. The sector does not 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.

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 sea 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.

COVID-19 impact

The COVID crisis influenced last year the aquaculture Romanian industry and the main impacts were caused by the lock down, 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.

4.22.6 Data Coverage and Data Quality

Data quality and availability

The values provided for Employment and FTE are equal for the years: 2017, 2018, 2019, 2020 and 2022.

The sales volume and value of aquaculture production in EU-MAP data deviates significantly from FAO.

Time series at segment level was not available for analysis between 2017 and 2022 due to segments provided by MS in the frame of data call do not match. The MS data was provided for two segments 'Carp Polyculture' and 'Trout Other methods' for the period 2019-2022, while for the 2017 and 2018 'Carp ponds', 'Carp cages', 'Trout ponds', 'Trout Tanks and race-ways' were provided. The analysis by segments was performed only for two last year's 2021 to 2022.

4.23 Slovakia

Summary

As a landlocked country, Slovakia concentrates on freshwater aquaculture, specialising in the production of various freshwater fish species. However, the sector remains notable for its diversity of fish species and farming methods. Production is quite stable at a level slightly above 2.5 thousand tonnes.

Total production and sales

The Slovak aquaculture sector produced 2.6 thousand tonnes of fish in 2022. This production was valued at about €7.8 million (FAO, 2024).

The production has been showed increasing trend between 2017-2022, in terms of volume and value. The production weight in 2022 was 6% higher than previous five-year average; growth in value was 24%.

Table 82. Production and sales for Slovak Republic: 2017-2022.

Variable	2017	2018	2019	2020	2021	2022	Change 2021-22	Develop. 2022/(17-21)
Production weight (thousand tonnes)	2.6	2.2	2.7	2.3	2.5	2.6	▲ 4%	▲ 6%
Marine	0	0	0	0	0	0		
Shellfish	0	0	0	0	0	0		
Freshwater	2.6	2.2	2.7	2.3	2.5	2.6	▲ 4%	▲ 6%
Production value (million €)	6.1	5.5	7.2	5.6	7.2	7.8	▲ 9%	▲ 24%
Marine	0	0	0	0	0	0		
Shellfish	0	0	0	0	0	0		
Freshwater	6.1	5.5	7.2	5.6	7.2	7.8	▲ 9%	▲ 24%

Source: Own elaboration from FAO (2024) data

Main species produced and economic performance by segment

According to available FAO statistics, the rainbow trout was the main species produced by the Czech aquaculture sector, representing 40% in terms of volume and 50% in terms of value in 2022. Trout farming is dominated by the production of fish for direct human consumption, for the domestic market. Trout production is carried both in cage farms situated in water reservoirs at higher altitudes and in tanks and raceways.

The second important species is North-African catfish, with 33% share in production volume and 27% share in production value. With a production of 850 tonnes, Slovakia is among the three largest producers of North-African catfish in the EU. The production of this species is carried out in recirculation systems, in heated (26-28°C) water.

23% of production in terms of quantity (18% in terms of value) is accounted for by traditional breeding of common carp in earthen ponds, based on natural food and supplementation with cereals. Carp is bred in polyculture with white amur, bighead carp, pike, pike-perch.

In recent years, new recirculation aquaculture facilities have started farming species such as European eel. The eel is primarily reared for restocking purposes. So far, the production results for eel are not yet reflected in FAO data.

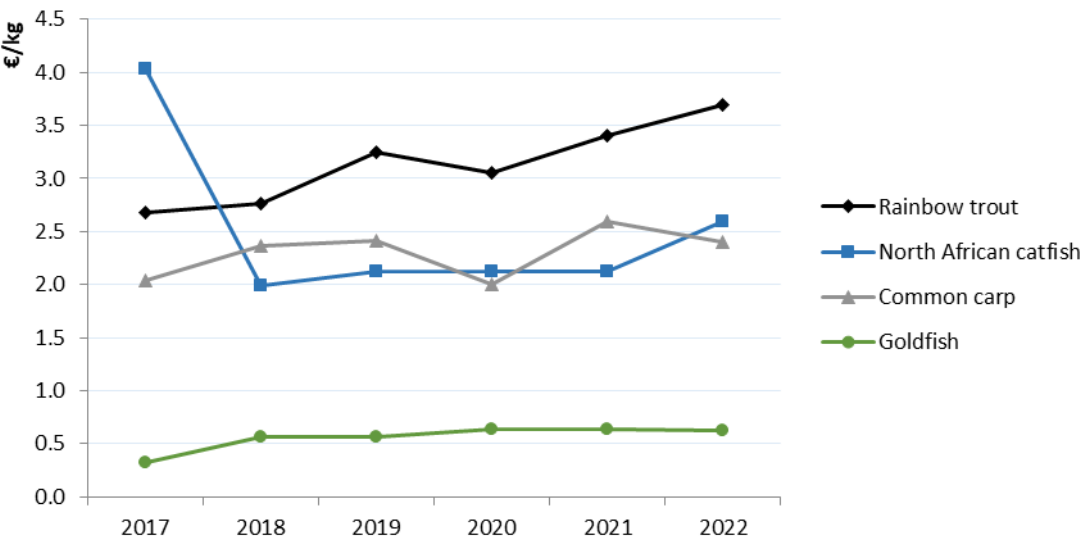
In 2022, the price of carp decreased by 8% to €2.40/kg. At the same time the prices of rainbow trout increased by 9% to €3.70/kg. The prices of North-African catfish increased significantly (by 23%, to €2.60/kg).

Figure 141. Main species in terms of weight and value in Slovak Republic: 2022.



Source: Own elaboration from FAO (2024) data

Figure 142. Average prices for the main species produced in Slovak Republic: 2017-2022.



Source: Own elaboration from FAO (2024) data

Data Coverage and Data Quality

The socio-economic data collection for Slovakia is not mandatory under the DCF, as the share of Slovak aquaculture is under 2.5% of total EU production and value. The analysis of the Slovak aquaculture sector is therefore based on data extracted from FAO and literature.

4.24 Slovenia

Overview of Slovenian aquaculture

Data on the Slovenian aquaculture were collected only for the marine fish species and shellfish, so economic data in the report are presented only for marine aquaculture. The data collection of freshwater aquaculture is not mandatory under the DCF and EU-MAP programmes of the EU data collection, therefore, regarding freshwater aquaculture, the data from FAO were used.

The main segments in the Slovenian marine aquaculture sector are Sea bass & Sea bream cages (seg3.6) and Mussel rafts (seg10.9).

In 2021, the marine aquaculture turnover was €0.8 million, in 2022 the same turnover increased by 83% and amounted €1.5 million. The total sales volume, on the other hand, increase by 7% from 2021 to 2022 and it was 544 tonnes in 2021 and 581 tonnes in 2022.

In 2021, the freshwater aquaculture turnover was €5.3 million, in 2022 the same turnover increased by 6% and amounted €5.6 million (FAO data). The total sales volume, on the other hand, decrease by 13% from 2021 to 2022 and it was 1175 tonnes in 2021 and 1022 tonnes in 2022, according to FAO data.

The amount of GVA, EBIT and Net profit generated by the Slovenian aquaculture sector in 2022 was €-0.1 million, €-1.3 million and €-1.4 million respectively.

4.24.1 Total Production and sales

In 2022, there were five 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.

Table 83. Production and sales, industry structure and employment for Slovenia: 2017-2022.

Variable	2017	2018	2019	2020	2021	2022	Change 2021-22	Develop. 2022/(17-21)
Sales weight (thousand tonnes)	0.7	0.7	0.8	0.6	0.5	0.6	▲ 7%	▼ -13%
Marine	0.1	0.1	0.1	0.1	0.1	0.1	▲ 49%	▲ 24%
Freshwater	1.0	1.3	1.2	1.2	1.2	1.0	▼ -13%	▼ -12%
Shellfish	0.7	0.6	0.7	0.4	0.5	0.5	▲ 1%	▼ -18%
Sales value (million €)	1.3	1.4	1.4	1.2	0.8	1.5	▲ 83%	▲ 27%
Marine	0.3	0.4	0.4	0.5	0.3	0.9	▲ 195%	▲ 146%
Freshwater	3.6	5.2	5.1	4.8	5.3	5.6	▲ 6%	▲ 17%
Shellfish	1.0	1.0	1.0	0.7	0.5	0.6	▲ 15%	▼ -27%
Number of enterprises	7	7	6	6	6	6	▲ 0%	▼ -6%
Marine	1	1	1	1	1	1	▲ 0%	▲ 0%
Shellfish	6	6	5	5	5	5	▲ 0%	▼ -7%
Employment	27	29	29	30	30	30	▲ 0%	▲ 3%
Marine	10	12	12	12	12	13	▲ 8%	▲ 12%
Shellfish	17	17	17	18	18	17	▼ -6%	▼ -2%
FTE	23	26	25	26	27	26	▼ -4%	▲ 2%
Marine	10	12	12	12	11	12	▲ 8%	▲ 8%
Shellfish	13	14	13	14	15	13	▼ -13%	▼ -3%

Source: Own elaboration from 2024 EU Member States DCF data submission and FAO (2024) data

In 2021, the marine aquaculture turnover was €0.8 million, in 2022 the same turnover increased by 83% and amounted €1.5 million. The total sales volume, on the other hand, increase by 7% from 2021 to 2022 and it was 544 tonnes in 2021 and 581 tonnes in 2022.

In 2021, the freshwater aquaculture turnover was €5.3 million, in 2022 the same turnover increased by 6% and amounted €5.6 million (FAO data). The total sales volume, on the other hand, decrease by 13% from 2021 to 2022 and it was 1175 tonnes in 2021 and 1022 tonnes in 2022, according to FAO data.

The economic situation regarding turnover in marine aquaculture in Slovenia has improved mainly due to higher purchase prices, which increased after the COVID-19 period. During the pandemic, sales dropped significantly due to the closure of restaurants and disruptions in supply chains. This recovery in prices has played a key role in stabilizing the sector post-pandemic.

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 2020 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 84% of total mariculture production in 2022.

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 2019, with 690 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, so almost as much as the total sales volume in 2022.

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 2022 sales volume increase to 15 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.

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, while in 2022 sales volume increase to 39 tonnes.

Slovenia is a net importer of fish and fish products. In 2022, 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 2022, Slovenia had four 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 2022 was estimated at 30 jobs, corresponding to 26 FTEs. The level of employment increased between 2017 and 2022, with total employed increasing by 3% while the numbers of FTEs increase by 2% over the period. Average salary per FTE employees in 2017 was €20.3 thousand. In 2022 average salary per FTE employees increase for approximately 30% regarding 2017 and amounted €26.8 thousand.

4.24.3 Overall Economic performance

The total amount of income generated by the Slovenian aquaculture sector in 2022 was €4.1 million. This consisted of €1.5 million in turnover and €2.6 million in other income. The total income of the Slovenian aquaculture sector increased by 6% between 2021 and 2022, while turnover increased by 83% in the same period.

Table 84. Economic performance of the Slovenian aquaculture sector: 2017-2022.

Variable	2017	2018	2019	2020	2021	2022	Change 2021-22	Develop. 2022/(17-21)
Total income	2.4	2.7	4.2	3.9	3.9	4.1	▲ 6%	▲ 20%
Total operating costs	2.7	3.2	3.5	4.3	5.1	4.9	▼ -4%	▲ 31%
Total wages	0.5	0.5	0.5	0.6	0.7	0.7	▼ -1%	▲ 21%
Gross Value Added	0.2	0.1	1.2	0.3	-0.6	-0.1	▼ -84%	▼ -138%
Depreciation of capital	1.0	0.8	0.7	0.5	0.5	0.5	▲ 5%	▼ -28%
Earning before interest and tax	-1.2	-1.3	0.0	-0.9	-1.7	-1.3	▼ -26%	▲ 26%
Financial costs, net	0.0	0.0	0.0	0.0	0.0	0.1	▲ 73%	▲ 99%
Net profit	-1.3	-1.3	0.0	-0.9	-1.8	-1.4	▼ -24%	▲ 28%
Total value of assets	7.3	6.8	6.7	6.6	7.9	8.4	▲ 6%	▲ 19%
Capital productivity (%)	3.2	1.5	17.7	3.9	-7.1	-1.1	▼ -85%	▼ -129%
Return on Investment (%)	-16.9	-19.1	0.1	-13.0	-21.9	-15.3	▼ -30%	▲ 8%

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 2022 was €4.9 million. The largest expenditure items were other operational costs (€3.2 million) and Wages and salaries (€0.7 million). The total operating costs increased for 31% from 2017-2022, 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 2022 was €-0.1 million, €-1.3 million and €-1.4 million respectively. Values of all economic indicators decreased from 2017, namely due increased value of total operating costs in 2022.

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 81% (472 tonnes) of total sales volume in 2022. Turnover from this sector represent 30% of the total turnover in the same year (0.46 millions). In the Mussel rafts sector were 13 FTE employees in 2022, which represent 50% of all FTE employees in Slovenian aquaculture sector in the same year.

The production of European seabass is more important than the production of gilthead seabream. It contributes around 9% (54 tonnes) to total mariculture production in 2022. Turnover from this sector represent 39% of the total turnover in the same year (0.59 millions).

Figure 143. Main species produced in terms of weight and value in Slovenia: 2022.



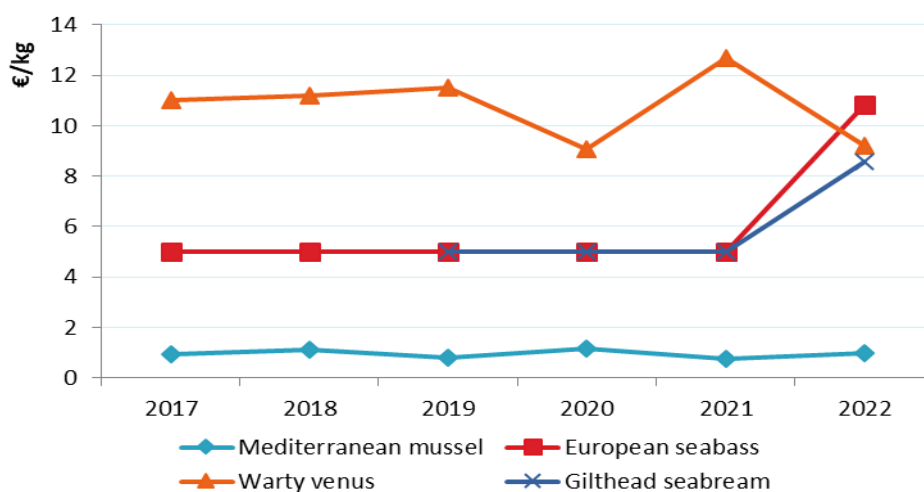
Source: Own elaboration from EU Member States DCF data submission

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 2022 sales volume increase to 15 tonnes. Income of Warty Venus represent, because of very high first sales price of around €9/kg, around 23% of all income from Mussels sector in 2022 (0.6 millions). On the other hand, sales volume of Warty Venus represent 3% of all sales volume from Mussels sector in the same year.

The figure 144 presents the price trends for four marine species—Mediterranean mussel, European seabass, Warty Venus, and Gilthead seabream from 2017 to 2022. Mediterranean mussel prices remained relatively stable, fluctuating around €1 to €2 per kg. European seabass experienced a sharp price increase starting in 2021, peaking in 2022 at around €10/kg, likely due to rising demand or supply issues. Warty Venus showed the greatest volatility, with a significant price spike in 2020, a drop in 2021,

and a partial recovery in 2022. Gilthead seabream followed a stable trend until 2021, but saw a significant price rise in 2022, nearly doubling to around €8/kg.

Figure 144. Average prices €/kg for the main species produced in Slovenia: 2017-2022.



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 Table 85, it can be seen that the gross value added is positive in the period from 2017 to 2022, while net profit is negative in the last few years, with exemption of 2019. 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 85. Economic performance of main Slovenian aquaculture segment: 2017-2022.

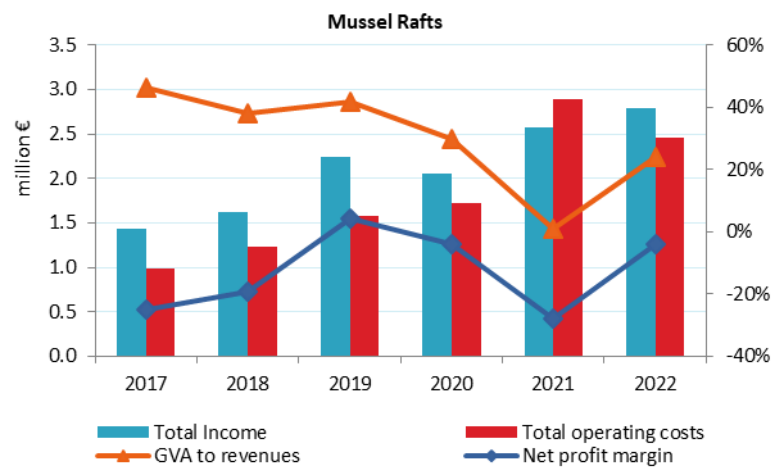
Variable	2017	2018	2019	2020	2021	2022	Change 2021-22
Mussel Rafts							
Number of enterprises	6	6	5	5	5	5	0%
FTE	13	14	13	14	15	13	-13%
Average wage (thousand €)	16.1	16.5	21.1	20.6	22.3	24.8	11%
Labour productivity (thousand €)	51.8	43.4	70.1	45.1	1.4	49.6	3330%
Sales weight (thousand tonnes)	0.7	0.6	0.7	0.4	0.5	0.5	1%
Total income (million €)	1.4	1.6	2.2	2.1	2.6	2.8	8%
Total operating costs (million €)	1.0	1.2	1.6	1.7	2.9	2.5	-15%
Gross Value Added (million €)	0.7	0.6	0.9	0.6	0.0	0.7	2876%
Net profit (million €)	-0.4	-0.3	0.1	-0.1	-0.7	-0.1	-85%
Total value of assets (million €)	4.7	4.4	4.2	4.3	5.6	5.3	-5%
Net investments (million €)	0.0	0.2	0.0	0.0	0.8	0.1	-94%
Capital productivity (%)	14.2	14.0	22.0	14.2	0.4	12.6	
Return on Investment (%)	-7.1	-6.5	2.7	-1.5	-12.4	-1.1	
Future Expectation Indicator (%)	-16.8	-10.2	0.0	0.0	7.8	-6.4	

Source: Own elaboration from EU Member States DCF data submission

In terms of sales volume, sales volume of the Mussel rafts segment represents 81% of the total sales volume of Slovenian aquaculture sector in 2022. Turnover from this sector represent 30% 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 2022 was €0.7 million and €-0.1 million respectively. Despite increased productions of Mediterranean mussel as the most important species in this segment, the values of majority economic indicators in Mussel rafts sector are decreased from 2017. In terms of sales volume and value, Mediterranean mussel represents 97% and 77% of the total sales volume and value of the Mussel rafts segment.

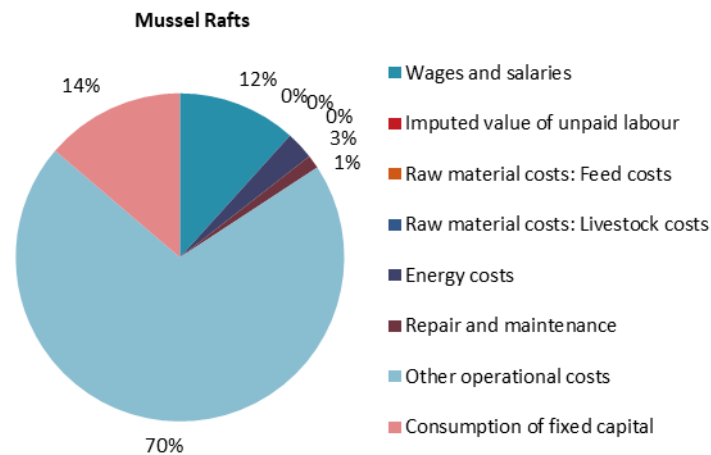
Figure 145. Economic performance in € million, indicators for the main Slovenian segments: 2017-2022.



Source: Own elaboration from EU Member States DCF data submission

The largest cost item of Mussel rafts sector in 2022 were other operation costs, accounted for 70% of the total operational costs. Consumption of fixed capital made up 14% of all operational costs. Depreciation of the capital increases significantly from the beginning of the observed period. 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 146. Cost structure of the main segments in Slovenia: 2022.



Source: Own elaboration from EU Member States DCF data submission

4.24.5 Outlook

The preliminary data for 2021 shows a decrease of 7% and 15% in terms of production volume and value, while, for employment, a stable trend is indicated. The main reason for decrease in production is the COVID–19 situation.

In 2022, because of the extremely high cost of energy, we can also expect a drop in production and significant decreased values of all economic performance indicators. According to current information, production could fall by more than 10% regarding 2020. The drop will be more noticeable in the mussel raft sector, as it is an activity with a lower added value.

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 2022, imports were approximately five times larger than export and amounted to 13 076 tonnes (EUR 91 million) of fish and other fish product (source; <https://pxweb.stat.si/SiStatData/pxweb/si/Data/-/2490101S.px>). Exports amounted to 3 453 tonnes (EUR 23 million) in the same year. The majority of the imported fish and fish products come mainly from the EU. The largest Slovenian seafood import partners are Italy, Spain and Croatia. Concerning exports, the largest partners are Bosnia and Herzegovina, Croatia and Hungary. The most important imports are fresh and frozen fish and fish products for consumption, as well as fish and other marine organisms intended for the fish processing industry. The main Slovenian export fish products are various fish cans, Tuna pate and Dried cod spread.

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 (e.g. 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 Implementation Program of the European Maritime, Fisheries, and Aquaculture Fund for the period 2021-2027 (ESPRA) the emphasis is primarily on promotion of sustainable aquaculture activities and the processing and marketing of fishery and aquaculture products. Challenges are also faced in the aquaculture sector, where mostly small and medium-sized enterprises operate. This diverse and fragmented sector is often insufficiently recognized and frequently equipped with outdated machinery. Therefore, funds will be directed towards the green transition in the aquaculture sector. Investments will support the modernization of fish farms into more environmentally friendly and climate-adapted facilities. ESPRA will enable diversification and investment in aquaculture as a complementary activity on farms.

Funds will also be available for the construction of new, sustainable aquaculture facilities. Technologies for wastewater treatment and biomass production for animal feed, pharmaceuticals, cosmetics, and organic fertilizers will be promoted. Investments will also support digitization and robotization (e.g., for feeding and online monitoring). Opportunities will be provided for aquaponics, combining agriculture and aquaculture in a closed water cycle, and algae cultivation, utilizing renewable energy sources and minimizing environmental impact. Algae cultivation is also an important part of the blue bio economy, contributing to sector decarbonisation and carbon neutrality.

Opportunities for organic farming will be available in the fund for warm-water aquaculture and shellfish farming. Regarding marketing, the fund will contribute to promoting local production and supply.

Preservation and discovery of short supply chains will be encouraged. Smaller family fish farms will have easier access to dedicated funds, and they will also be encouraged to adopt technological solutions for better utilization of natural resources, improving their own products, and selling directly to consumers. Fund resources will enable research on the nutritional values of shellfish, guiding promotional activities and their greater inclusion in a balanced human diet.

Additionally, the fund will provide compensation for operations engaged in extensive and semi-intensive production, which may reduce economic efficiency but simultaneously provide ecosystem services and preserve habitats. Compensation will also be provided for shellfish farmers in the event of bio toxin occurrences or transitioning to organic farming. Various activities will be implemented for the aquaculture sector to contribute to networking and better sector connectivity.

New knowledge is strongly linked to innovation; here, fund resources can be a starting point for innovations related to increased water utilization and the introduction of new species. In the marketing and processing sector, ESPRA funds will primarily be allocated to enable investments in increasing and upgrading production, in terms of new market-recognizable products, improved energy efficiency, circular economy integration, enhanced digitization, and robotization.

Promotional activities and informing the broader public and consumers about the importance of fishery and aquaculture products in the diet, especially locally produced and organic ones, as well as presenting the sector that can provide these products, are crucial for greater sector recognition (OP ESPRA 2021-2027).

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 in Slovenia there are about 60 trout farms, with a total production of only about 600 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.

COVID-19 impact

The COVID-19 pandemic had a notable impact on Slovenian mariculture, primarily due to disruptions in the supply chain and reduced demand. As restaurants and hotels, key markets for seafood, were forced to close or limit operations, sales of mariculture products plummeted. Export markets were also affected due to restrictions and logistical challenges. Moreover, the interruption in normal business operations led to an oversupply of mariculture products, resulting in lower prices initially. However, production costs remained constant, leading to financial strain for many mariculture producers. Labour shortages and health restrictions further complicated operations, creating bottlenecks in production processes.

On the positive side, as the pandemic progressed, some producers were able to shift to direct sales to consumers and explore local markets, helping to mitigate losses. Post-pandemic recovery was supported by rising seafood prices, although challenges such as energy costs and supply chain uncertainties persisted.

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.

High energy prices

High energy prices have a significant impact on the economic state of marine aquaculture in Slovenia. The increase in energy costs raised operational expenses for fish farms, as energy is crucial for powering equipment, maintaining water quality, and processing feed. These rising costs squeezed profit margins, making it harder for aquaculture producers to remain competitive. Despite higher fish prices helping the sector recover from previous challenges, the burden of elevated energy prices added financial strain, limiting growth and profitability in the industry during this period.

Social acceptance

In terms of fish and seafood production, Slovenia's greatest potential undoubtedly lies in aquaculture: sea bass and shellfish are farmed at the coast, while in the hinterland, trout (cold water) and carp (warm water) dominate farmed species. An interesting aspect is the increase of fish consumption among Slovenians (whose fish consumption has previously been low), and the intention to satisfy higher domestic demand with their own production. According to the "EU Consumer Habits Regarding Fishery and Aquaculture Products" survey (<https://europa.eu/eurobarometer/surveys/detail/2271>), most respondents in Slovenia have no preference if the fish is caught or farmed, although there are still many respondents who prefer to consume wild fish. According to the aforementioned survey, the most important factor for Slovenian buyers when purchasing fish is freshness and price, while the origin of the product comes third. However, in order for aquaculture to be well received by the local population and customers, a number of factors must be taken into account. Mariculture areas should be located in areas where the environmental conditions are suitable for the cultivation of individual types of marine organisms and where there are no conflicts with other uses of the sea. Mariculture areas should be outside protected areas, areas of important marine habitats and waterways. They should also be located at a suitable distance from touristic areas, swimming pools and underwater discharges. Last but not least, the determination and operation of areas for mariculture should also take place in cooperation with local authorities.

4.24.6 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 2022, there were five 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 six subjects.

In June 2023 the questionnaires for 2022 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/FAO 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.

4.25 Spain

Overview of Spanish aquaculture

The Spanish aquaculture sector produced 282 251 tonnes in 2022, generating a turnover of €868.7 million. The number of companies remains stable at around 2 800 and employment decreases slightly to 5 878 FTEs. Despite the decline in production since the COVID-19 crisis and the increase in operating costs, the latter rose proportionally less than the value, which had a positive impact on the economic performance indicators. Net profit went from -€2.2 million in 2021 to €12.2 million in 2024.

4.25.1 Total Production and sales

In Spain, the production of aquatic products from aquaculture continued the negative trend started in 2020, during and after the COVID-19 pandemic. As a matter of fact, from 2017 to 2022, the volume of production decreased by 9%. Despite these results suggest the consolidation of the negative trend of the industry, freshwater remains stable and finfish marine has resumed a positive evolution in 2022, while the overall reduction in total production is caused by the drop in mussel production. In terms of value, the evolution over the last two years has been very positive with a rise of more than 20% in 2022, mainly due to the positive evolution of the segment with the highest added value, marine fish.

The production in 2022 corresponds mainly to marine aquaculture (fish and shellfish), which together represent more than 92% of the quantities produced, while only 7% is freshwater aquaculture. There is a fourth incipient category, algae, which in 2021 represented 0.0016% of production, improving to 0.012% in 2022. Besides, marine aquaculture is represented by shellfish and around 22% of the total production is marine fish.

Marine fish production has increased at pre-COVID-19 production levels, although the importance of the species produced in this segment has varied. This fact occurs when two trends coexist in the fish farming sector. On the one hand, the production of seabass and, above all, seabream is decreasing. On the other hand, the production of turbot, meagre and bluefin tuna is increasing. The main species in marine fish production were seabass, bluefin tuna, seabream and turbot, with 24 729 tonnes, 13 145 tonnes, 12 033 tonnes, and 9 087 tonnes, respectively.

In freshwater production, the main species is rainbow trout with 16 680 tonnes produced in 2022, accounting for more than 95% of production in this segment. In the case of freshwater, the stability of the sector was altered as a result of the decline in demand in 2020, mainly due to the stoppage of activity in the Horeca channel. In 2022, trout production showed a year-on-year variation of 4.1%. This increase in production was localized in the most important Spanish regions in trout production (Castilla y León, Galicia, Andalusia, Catalonia, La Rioja and Aragón).

By far the most important activity in Spanish aquaculture in terms of production is the cultivation of mussels (*Mytilus galloprovincialis*). The 192 208 tonnes obtained in 2022 represented 68% of total Spanish aquaculture production. In 2022, mussel production decreased, while its first sale value increased.

The value of the Spanish aquaculture industry has grown steadily since 2012, except for the year 2020 due to the COVID-19 pandemic crisis (€623 million), to reach a turnover of €868 million in 2022, which is 28% higher than the average during the period 2017-2022, reaching the highest value in the dataset since 2012. In recent years, although all groups have increased the value of their productions, freshwater aquaculture production has consolidated its loss of importance in the aquaculture industry in Spain.

In shellfish production, Mediterranean mussel production generated €155.6 million turnover in 2024, 14% higher compared to 2021. Among the shellfish, apart from the commented importance of mussels,

there are other species cultivated as oysters and clams. The main clam species cultivated in 2022 were Japanese carpet shell (€8.2 million), Corrugated venus (€2.6 million), common edible cockle (€1.2 million) and grooved carpet shell (€0.5 million). Regarding oyster production, Pacific cupped oyster (€3.8 million) and European flat oyster (€1.5 million) are the main species cultivated. With the exception of the Mediterranean mussel, the Pacific cupped oyster, and the Common edible cockle, the rest of shellfish species decreased the value of their productions compared to 2017.

Table 86. Production and sales, industry structure and employment for Spain: 2017-2022.

Variable	2017	2018	2019	2020	2021	2022	Change 2021-22	Develop. 2022/(17-21)
Sales weight (thousand tonnes)	331.1	329.7	318.9	284.4	283.9	282.3	-1%	-9%
Marine	65.3	63.2	65.2	56.3	53.1	64.1	21%	6%
Freshwater	19.1	18.0	20.9	19.0	21.0	20.7	-1%	6%
Shellfish	244.4	246.6	230.8	206.9	206.5	194.9	-6%	-14%
Algae	2.3	2.0	2.0	2.2	3.2	2.5	-22%	7%
Others			0.0	0.0	0.0	0.0	147%	367%
Sales value (million €)	635.8	717.3	701.9	623.8	706.2	868.8	23%	28%
Marine	398.6	478.8	470.2	408.1	434.1	588.8	36%	34%
Freshwater	71.2	70.7	75.7	71.1	80.4	82.8	3%	12%
Shellfish	148.9	152.7	137.9	125.0	162.8	173.9	7%	20%
Algae	17.0	15.1	16.1	17.5	27.4	21.3	-22%	14%
Others			2.0	1.9	1.5	2.1	39%	15%
Number of enterprises	2,945.0	2,887.0	3,007.0	2,828.0	2,931.0	2,807.0	-4%	-4%
Marine	56	53	51	49	47	43	-9%	-16%
Freshwater	176	141	138	111	110	108	-2%	-20%
Shellfish	2685	2664	2781	2630	2723	2606	-4%	-3%
Algae	28	29	28	28	34	33	-3%	12%
Others			9	10	17	17	0%	42%
Employment	25,423	28,515	22,418	19,050	17,275	15,783	-9%	-30%
Marine	2,459	2,781	2,727	2,394	1,858	2,025	9%	-17%
Freshwater	1,058	980	1,046	891	917	936	2%	-4%
Shellfish	21,384	24,149	18,014	15,257	14,003	12,420	-11%	-33%
Algae	522	605	585	459	434	341	-21%	-35%
Others			46	49	64	61	-5%	15%
FTE	6,269	6,691	6,715	5,651	5,722	5,878	3%	-5%
Marine	1,921	1,926	1,886	1,791	1,749	1,931	10%	4%
Freshwater	701	679	727	689	703	705	0%	1%
Shellfish	3,420	3,834	3,815	2,918	2,881	2,957	3%	-12%
Algae	226	252	248	222	342	246	-28%	-5%
Others			38	31	47	39	-16%	-99%

Source: Own elaboration from EU Member States DCF data submission

Similarly, the increase in the industry turnover was led by the improvement in marine fish production. 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. Despite this trend, seabream production grew again during 2021 and 2022 from 9 769 tonnes in 2020 to 12 033 tonnes in 2022. Turbot production and value has increased since 2020 to reach its highest figures in history in 2022. In 2022, quantities produced increased by 20.5% over 2021 to 9 087 tonnes, and turnover increased by 42.1% to €80.6 million.

Although Atlantic Bluefin tuna is the fourth species in terms of quantities, due to its greater value, it is ranked as the first most important species in marine fish culture, with a production value €219.7 million in 2022. Following the trend started in 2010, the value of tuna production increased significantly in 2018, by 73% compared to 2016, and in 2022, by 59% compared to 2021. This trend is due to the increase in

aquaculture production in the Murcia region, which doubled its production in 2022. The increase in Atlantic bluefin tuna catches has increased the net profit margin of Atlantic bluefin tuna companies to 24% in 2022. The management of the fishing quota, together with the development of captive tuna farming on an industrial scale, will be the determining factors in the development of this industry.

Despite the decline in its importance in Spanish aquaculture, the production of the main Spanish freshwater species has stable trend from 2017 to 2022, in terms of quantities. In terms of value this has increased by 2.5% year-on-year and by 16.6% in the last six years. Rainbow trout is the main freshwater species in Spanish aquaculture, with a production of 16 680 tonnes in 2022, valued at €76.1 million, which was 8.8% lower but 1.7% higher respectively compared to the previous year. Other species cultivated continentally in Spain are *Acipenser naccarii*, *Acipenser gueldenstaedtii*, *Acipenser baerii*, *Hucho hucho* HUC, and *Tinca tinca*.

4.25.2 Industry structure and total employment

The Spanish aquaculture sector had 2 807 companies in 2022, a decrease of 4% compared to the previous year and 4% compared to the average for the period 2017-2022. There is a general downward trend in all segments. In the case of mussel producing companies, these are small producers and family businesses that represent 92% of aquaculture firms Spain. Despite some volatility in its number along the period, the number remain quite stable. It is in the case of freshwater and finfish marine production where there has been a progressive reduction in the number of companies, mainly related with a business concentration process, especially in the seabream and seabass sector.

The total number of employees in the Spanish aquaculture industry was 15 783 in 2022. The figure shows a decrease of 9% with respect to 2021, but a decrease of 30% if the last 6 years observed are considered. The long-term decline in employment is greater than that of the number of companies. This evolution suggests that the retiring firms are more labour intensive and inefficient than the remaining ones. Moreover, there is a trend towards digitalization and reconversion towards the Industry 4.0 model that decreases the need for labour. The evolution of employment in terms of global FTE shows an increase of 3% compared to 2021, but a decrease of 6% compared to the previous 6-year period. This trend may be encouraged by new Spanish labour regulations promoting full-time employment. Despite this improvement, the ratio of total employment to FTE was 2.6 in 2022. Although it continues to decrease over the years observed, it still suggests high levels of job turnover and occupational instability. The production of marine fish and trout generates more full-time and more stable employment, while the mussel sector is where more discontinuous and part-time employment occurs.

4.25.3 Overall Economic performance

The economic performance of the aquaculture sector in Spain has experienced a notable improvement during 2021 and 2022, following the poor results obtained in 2020 due to the effects of the COVID-19 pandemic. The results during 2021 and, especially, 2022 confirm the positive evolution of production value and total revenues. Total revenues have increased proportionally more than the quantities produced, indicating a higher average value of the products.

Although there has been a strong increase in operating costs during 2021 and 2022, this increase has not been proportionally higher than that of revenues. Gross value added increased by 15% in 2022 compared to 2021, while the increase has been particularly significant for EBIT, rising from €7.2 million to €19.6 million. The economic profitability, that is, the return on investments has gone from -2.57% in 2020 to almost 2% in 2022. In other words, aquaculture activity was once again economically profitable in 2022.

Operational costs show particular structures across species, but at the aggregated level, four factors represent the 84% of the total operational expenditures in 2022; feed cost (28%), other operational cost (21%), livestock cost (20%), and wages and salaries (15%).

The depreciation of capital has increased in 2021 and 2022 in line with the increase in the total value of assets, confirming a positive trend in new investments after the decrease experimented during 2020. Net financial costs decreased significantly in 2022, both compared with 2021 and with the average from previous years (13%). The volume of debt increased in 2021 and 2022, leading to an increase in financial expenditures. The reduction in financial costs net in 2022 is caused by a strong increase in financial incomes that year.

Table 87. Economic performance of the Spanish aquaculture sector: 2017-2022.

Variable	2017	2018	2019	2020	2021	2022	Change 2021-22	Develop. 2022/(17-21)
Total income	659.9	748.4	716.6	646.7	746.6	913.2	▲ 22%	▲ 30%
Total operating costs	602.4	713.1	654.3	639.4	705.3	855.4	▲ 21%	▲ 29%
Total wages	190.4	198.4	160.0	163.7	183.9	203.6	▲ 11%	▲ 14%
Gross Value Added	231.7	224.0	215.3	166.1	216.7	249.3	▲ 15%	▲ 18%
Depreciation of capital	27.0	28.9	31.0	29.6	34.1	38.2	▲ 12%	▲ 27%
Earning before interest and taxes	30.5	6.5	31.2	-22.3	7.2	19.6	▲ 172%	▲ 85%
Financial costs, net	9.2	4.6	10.7	8.4	9.4	7.4	▼ -22%	▼ -13%
Net profit	21.3	1.9	20.5	-30.7	-2.2	12.2	▲ 653%	▲ 471%
Total value of assets	871.4	937.2	920.0	864.8	909.7	1035.1	▲ 14%	▲ 15%
Capital productivity (%)	26.6	23.9	23.4	19.2	23.8	24.1	▲ 1%	▲ 3%
Return on Investment (%)	3.5	0.7	3.4	-2.6	0.8	1.9	▲ 139%	▲ 63%

Source: Own elaboration from EU Member States DCF data submission

The net profit of the industry is the indicator with the best performance, increasing by 653%, from minus €2 million in 2021 to more than €12 million in 2022. When considering a relative measure such as the Return on Investment ratio, an increase in economic performance from 0.8% in 2021 to 1.9% in 2022 is confirmed. If we analyze this variable since 2017 we observe that, except in 2020, the economic return on assets of Spanish companies has been positive in these six years of study. This means that, for every €100 of investment made in companies, €3.5 was obtained in 2017, €0.7 in 2018, €3.4 in 2019, €0.8 in 2021 and €1.9 in 2022. Taking this into account, and regardless of how the activity was financed and what the financial cost was, the activities developed by the Spanish aquaculture industry were profitable.

After a few years of improvement in the economic performance indicators of the Spanish aquaculture sector, and despite the fact that during 2021 and 2022 production remained stable and its value has continued to increase after the COVID-19 crisis, the increase in costs has once again dented economic returns. Even so, the sector as a whole remains profitable and attractive to investors.

4.25.4 Main species produced and economic performance by segment

The five main species in Spanish aquaculture in terms of production (Mediterranean mussel, European seabass, Rainbow trout, Atlantic bluefin tuna, and Gilthead seabream) accounted for 92% and 82% of the overall industry quantities and value in 2022, respectively.

Mediterranean mussels are by far the main farmed species in Spain, with a production in 2022 of 192 208 tonnes, accounting for 60% of the total aquaculture production in Spain. This species is mainly produced in Galicia in mussel rafts, but it is also cultivated in Catalonia, and to a lesser extent in Valencia and the Balearic Islands in rafts, and in Andalusia in longlines. However, the value of mussel production represented 18% of the country's aquaculture industry. The mussel is a species whose production depends on changes in environmental conditions, suffering large fluctuations in different years in the past. Mussel production has continued to decline during 2021 and 2022, just as it did in 2020. However, the increase in prices, from €0.51/kg in 2020, to €0.68/kg in 2021 and €0.81/kg in 2022, has led to a positive evolution in production value, reaching €155 million in 2022, the highest result in the time series analysed.

When talking about marine fish, European seabass is the main harvested species in volume in Spain, with 24 729 tonnes in 2022, with a total value of €203 553 million. Gilthead seabream is the third and fifth marine fish cultivated in Spain, in volume and value, respectively, with 12 033 tonnes in 2022, valued €56 416 million. Since 2012, seabream has progressively decreased its production. Among other reasons, the importation of Greek and Turkish seabream has meant strong competition that has undermined the viability of the crop. In Spain, in 2022, only 14% of the seabream marketed was of domestic origin. Despite these issues, these two species represented the 30% of the total aquaculture production value in 2022. Seabream and 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, in terms of value is turbot. This specie is produced in the North Atlantic coast, with a total production in 2022 of 9 087 tonnes, valued €80.6 million. Since 2020, turbot production has grown by 18.4%. All this process is happening while during the last three decades this sector has been in a trend of takeovers and mergers that have made the Spanish market to be concentrated only in two large companies and one SME company (Fernández-González et al., 2023). The Atlantic Bluefin tuna, with only nearly 13 145 tonnes in 2022 (less than 5% of the total industry production volume), increased production 57% compared to 2021, valued €219.7 million, which was equivalent to 25% of total Spanish 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 (Andalusia, Aragon, Asturias, Cantabria, Castilla y Leon, Castilla la Mancha, Catalonia, Galicia, Rioja, and Navarra). Total production achieved 16 680 tonnes in 2022 with a value of €76 138 thousand.

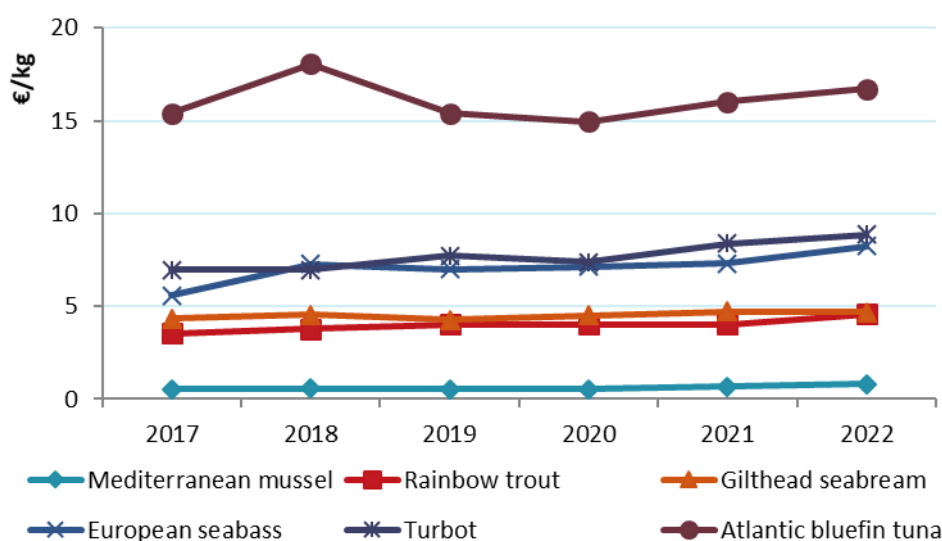
Figure 147. Main species in terms of weight and value in Spain: 2022.



Source: Own elaboration from EU Member States DCF data submission

The analysis of the evolution of the average prices of the main Spanish aquaculture species indicates that since 2017 they have had a positive evolution. Seabream changed the negative trend started in 2016 with a rise in the average price to 4.7 €/kg in 2022. In the case of seabass, average prices in 2022 consolidated the upward price trend to €8.2 €/kg, the historical maximum of the last 15 years. Trout prices have followed an increasing trend since 2013 to reach 4.6 €/kg. The average price in 2022 was 13% higher than in 2021, which is the historical maximum of the last 10 years. In the case of mussels, prices have increased in 2022 to €0.8/kg, the highest price observed since 2008. The most significant aspect in the evolution of prices is the increase experienced by the price of Atlantic bluefin tuna. Between 2017 and 2022 its average price grew by 20.1% registering an average price of 16.7 €/kg in 2022.

Figure 148. Average prices €/kg for the main species produced in Spain: 2017-2022.



Source: Own elaboration from EU Member States DCF data submission

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

Segment 1: Seabass and Seabream cages

Seabass (*Dicentrarchus labrax*) and seabream (*Sparus aurata*) species are important in fish aquaculture in Spain in terms of production volume and together they are the most important species in the whole industry in terms of value (€259.9 million). Seabass production has followed a positive trend in recent years, both in terms of quantities and value. In 2022, seabass production reached 24 729 tonnes with a value of €203 million. Traditionally, seabream used to be the more important of the two species, but the positive evolution of seabass has ranked this species as the most valuable species in the Spanish aquaculture industry. Meanwhile, seabream production in 2022 was 12 033 tonnes valued at €56 million.

With the exception of a part of the production developed in brackish waters in southern Spain, most of the national production of seabass and seabream is farmed in cages. These species are farmed in warm waters, in the Mediterranean Sea, but also on the Spanish Atlantic coast and in the Canary Islands. Therefore, there are productions in Andalusia (21.1%), Canary Islands (17.4%), Valencian Community (33.3%), Murcia (26.6%), and Catalonia (1.7%). Although the hatcheries located in Spain produce enough juveniles for national production, part of these are imported from other countries such as France or Greece. This fact is due, on the one hand, to the need of small producers, who do not have their own hatcheries, to satisfy their demand and, on the other hand, because the breeding centres that are part of large groups of companies with operations in Spain are located outside the national territory.

Seabass and seabream production in cages increased during 2021 and 2022. The value of production increased proportionally more (23%) than the quantities produces (8%), so that points out to a more value-added production. However, at the same time, operating cost increased 27% just in one year, from 2021 to 2022, which has caused an even more negative evolution of economic indicators. While GVA is still positive in 2022, ROI and Net profit not only remain negative, but have also worsened in the last year considered. In general, profitability in this segment worsens.

In the structure of operating expenses, feed maintains the highest percentage (42%). The feed price fluctuated between 2017 and 2021, and increased again in 2022. The feed cost in the seabass and seabream cage segment in Spain decreased from 43% of the total operating cost in 2017 to 40% of the total in 2021, and increased again to 42% in 2022. Other operational cost together with feed costs represented in 2022 almost 68% of the total operating cost. The relevance of other operating costs is more significant in the cage segment, as larger companies usually develop more activities related to external services, consulting, marketing, etc. Of particular relevance is the 68% increase in energy costs between 2017 and 2022. In fact, energy costs in the seabass and seabream cage segment in Spain decreased from €1.7 million in 2017 to €1.2 million of total costs in 2020, and increased again to €2.9 million in 2022.

Table 88. Economic performance of main Spanish aquaculture segments: 2017-2022.

Variable	2017	2018	2019	2020	2021	2022	Change 2021-22	2017	2018	2019	2020	2021	2022	Change 2021-22
	Sea bass & Sea bream Cages							Mussel Rafts						
Number of enterprises	25	24	23	21	19	20	▲ 5%	1950	1959	1968	1930	1920	1926	▲ 0%
FTE	845	633	638	573	563	647	▲ 15%	2641	3099	3401	2449	2423	2531	▲ 4%
Average wage (thousand €)	31.8	31.1	37.7	35.0	34.2	33.3	▼ -3%	32.4	27.9	15.2	26.9	24.3	34.9	▲ 44%
Labour productivity (thousand €)	51.6	47.7	23.9	1.7	19.6	3.0	▼ -85%	38.0	33.7	27.2	32.0	44.7	42.1	▼ -6%
Sales weight (thousand tonnes)	32.4	30.5	32.8	22.6	26.0	28.0	▲ 8%	240.7	242.4	227.7	202.2	201.5	190.8	▼ -5%
Total income (million €)	198.0	187.3	196.7	142.5	173.6	212.8	▲ 23%	132.7	137.2	120.5	105.5	138.6	157.4	▲ 14%
Total operating costs (million €)	173.1	174.3	200.0	158.1	176.2	224.4	▲ 27%	115.4	116.9	79.7	92.7	88.6	138.5	▲ 56%
Gross Value Added (million €)	43.6	30.2	15.2	1.0	11.0	1.9	▼ -82%	100.4	104.4	92.4	78.4	108.3	106.6	▼ -2%
Net profit (million €)	14.0	6.3	-17.4	-27.4	-13.6	-24.5	▲ 80%	14.4	15.8	36.7	10.4	45.5	13.6	▼ -70%
Total value of assets (million €)	229.9	242.8	263.9	256.0	234.2	359.2	▲ 53%	50.7	46.8	38.8	58.9	46.6	30.0	▼ -36%
Net investments (million €)	6.5	10.0	9.9	5.0	5.0	31.7	▲ 532%	6.1	6.2	3.2	18.0	0.2	0.8	▲ 230%
Capital productivity (%)	19.0	12.4	5.8	0.4	4.7	0.5		197.8	222.8	237.8	133.1	232.3	355.5	
Return on Investment (%)	7.7	2.9	-4.3	-8.7	-4.0	-5.3		29.2	34.7	94.4	17.7	98.2	45.7	
Future Expectation Indicator (%)	-0.2	1.7	0.7	-0.7	-0.8	6.7		7.3	4.5	-2.5	26.4	-8.5	-14.9	
	Tuna Cages							Trout Tanks and race-ways						
Number of enterprises	4	4	3	4	3	3	▲ 0%	83	79	76	71	75	67	▼ -11%
FTE	184	307	267	298	308	314	▲ 2%	565	563	606	575	588	568	▼ -3%
Average wage (thousand €)	46.3	38.5	39.1	45.3	33.0	37.8	▲ 14%	23.9	25.8	25.2	21.8	25.2	26.5	▲ 5%
Labour productivity (thousand €)	109.0	35.0	122.6	55.1	79.3	210.8	▲ 166%	32.6	39.5	40.9	40.1	38.5	38.3	▲ 0%
Sales weight (thousand tonnes)	5.1	8.0	8.0	10.7	8.8	13.1	▲ 50%	18.3	17.4	20.2	18.3	20.4	19.2	▼ -6%
Total income (million €)	81.5	145.4	124.7	147.8	142.7	226.6	▲ 59%	66.0	67.0	71.3	68.2	76.0	78.7	▲ 4%
Total operating costs (million €)	69.9	145.9	102.4	144.8	128.4	172.0	▲ 34%	60.8	58.9	61.7	57.7	67.8	71.2	▲ 5%
Gross Value Added (million €)	20.1	10.7	32.7	16.4	24.5	66.2	▲ 171%	18.4	22.2	24.8	23.1	22.6	21.8	▼ -4%
Net profit (million €)	9.6	-3.6	18.5	-0.5	11.1	53.7	▲ 385%	2.7	5.5	6.4	7.8	4.8	4.3	▼ -10%
Total value of assets (million €)	49.5	122.0	45.4	77.6	68.6	73.0	▲ 6%	90.2	81.8	100.8	66.7	71.2	63.9	▼ -10%
Net investments (million €)	2.0	2.3	-4.5	3.5	0.3	1.0	▲ 217%	2.1	3.8	6.5	7.3	5.0	3.5	▼ -31%
Capital productivity (%)	40.5	8.8	72.2	21.2	35.6	90.7		20.4	27.2	24.6	34.6	31.8	34.1	
Return on Investment (%)	19.3	-3.1	44.2	0.1	17.3	71.7		3.5	7.0	6.4	12.1	7.3	7.2	
Future Expectation Indicator (%)	0.0	-0.8	-14.8	0.7	-3.1	-1.6		0.1	1.7	3.3	7.1	2.7	0.9	

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). Since 2017, ICCAT has progressively increased catch quotas for the species after

detecting a recovery of the species. In 2022, the TAC was reduced (6 093.28 tonnes) compared to the figure allocated for 2020 and 2021 (6 107.60). However, production in 2022 had an inter-annual increase of 50%.

The progressive increase in catches has caused a shift in the supply of juvenile fish, increasing production volumes and keeping the average price per kg of tuna high (16.7 €/kg). The data in Table 88 show an increase in sales (50%) and income (59%) in 2022 compared to 2021. Operating costs have also increased (34%) as a result of the growth in activity over the last year. These trends can be clearly seen in Figure 149. Despite the growth of certain types of costs, revenues increased by a higher percentage than operating costs, causing the GVA to revenues and the net profit margin to grow with an even steeper slope. In fact, the behaviour of bluefin tuna prices was a key factor in this scenario. While in 2019 and 2020 the average price did not exceed an average price of 15.5€/kg, in 2022 it almost reached 17€/kg.

The increase in demand for bluefin tuna together with the limitation of bluefin tuna quotas have made the purchase of juveniles more expensive. For this reason, Livestock costs are the main cost representing 47% and almost doubling its figure between 2021 and 2022. In addition, tunas are fed mainly on fresh small pelagic fish, as fishmeal-based feed is not viable for fattening. For this reason, feed is the second most important cost in the tuna farming cost structure, accounting for 22% of the total cost. Other operational costs, which represent 19% of total costs, represent an important consumption of technology and farming equipment. Labour costs are the fourth largest cost, but represent only 7% of total costs (Figure 150). The evolution of raw material costs is shown in Figure 151. Livestock costs increased sharply in 2018, 2020 and 2022 with the increase in activity due to sharp rises in their main costs: Livestock costs and feed cost.

Figure 149. Economic performance in € million, indicators for the main Spanish segments: 2017-2022.



Source: Own elaboration from EU Member States DCF data submission

Segment 3: Mussel rafts

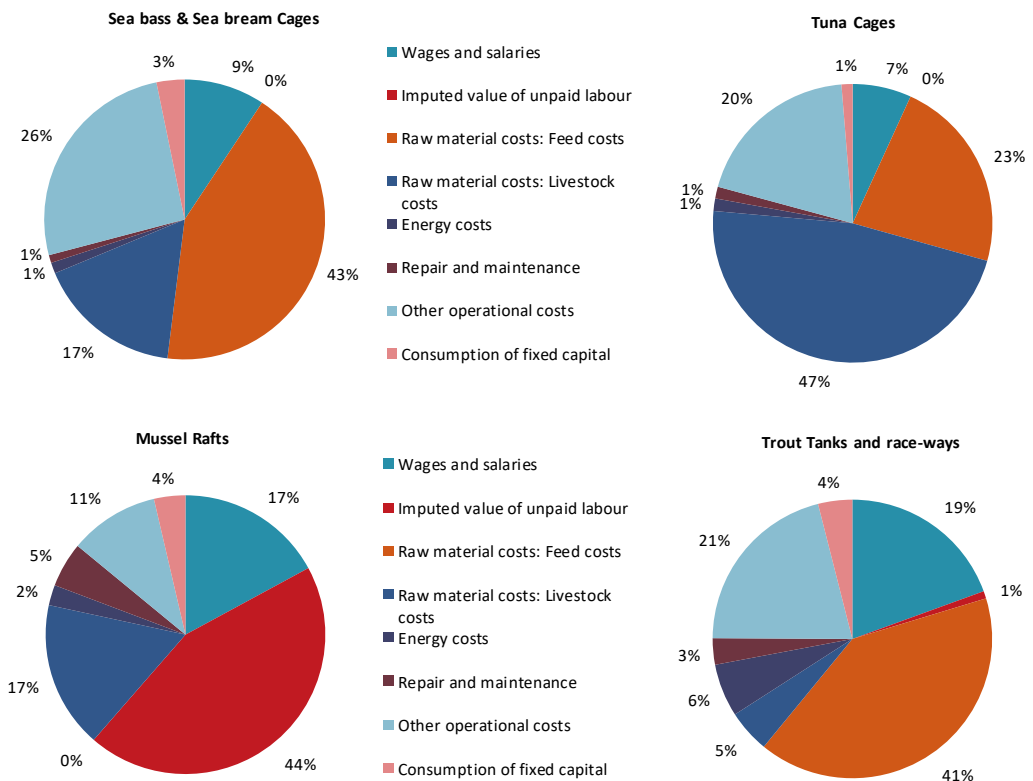
The mussel industry in Spain, mostly concentrated in Galicia, represented 68.1% of the total Spanish aquaculture production in terms of quantities and 17.9% of the value in 2022, considering that the average price of this product is significantly lower than that of the main farmed fish in Spain. Being a

species, which is strongly dependent on natural conditions, such as red tides, its annual production may reflect high fluctuations over time. In 2018 it experienced a 13% increase over 2016 to 244 thousand tonnes. However, after this production peak the trend in the sector is towards a decrease in production. The lack of mussel seed, the change in winds and the increase in water temperature have significantly affected the sector. The production value of this segment was €155 million in 2022, the highest production value during the entire 10-year period analysed. This increase is mainly explained by price growth in 2022 (0.8 €/kg), the highest price observed since 2008.

This is the segment with the highest number of employees, with 2531 FTE in 2022, 4% more than in 2021; and also the one with the highest number of employed people in the segment during the period. It is traditionally a sector in which there are many people working part of the year, most of them self-employed, so small family units are the basis of this segment. In this context, in 2022, the mussel industry saw the biggest drop in profitability of the three segments analysed during 2022. Despite this, economic indicators continue to show positive results.

The GVA and net profit of the mussel industry have been positive since 2017. Although all economic indicators have a positive value it is necessary to highlight the break in the positive evolution of the indicators between 2019 and 2020, again the improvement experienced in 2021 after the impact of COVID-19 in 2020, and once a worsening during 2022. The main economic indicators of this segment show a decrease in the value of production from 2019 to 2022 compared to 2018, despite the increase in prices (from €0.6 per kg in 2018 compared to €0.8 per kg in 2022) (Xunta de Galicia, 2019).

Figure 150. Cost structure of the main segments in Spain: 2022.

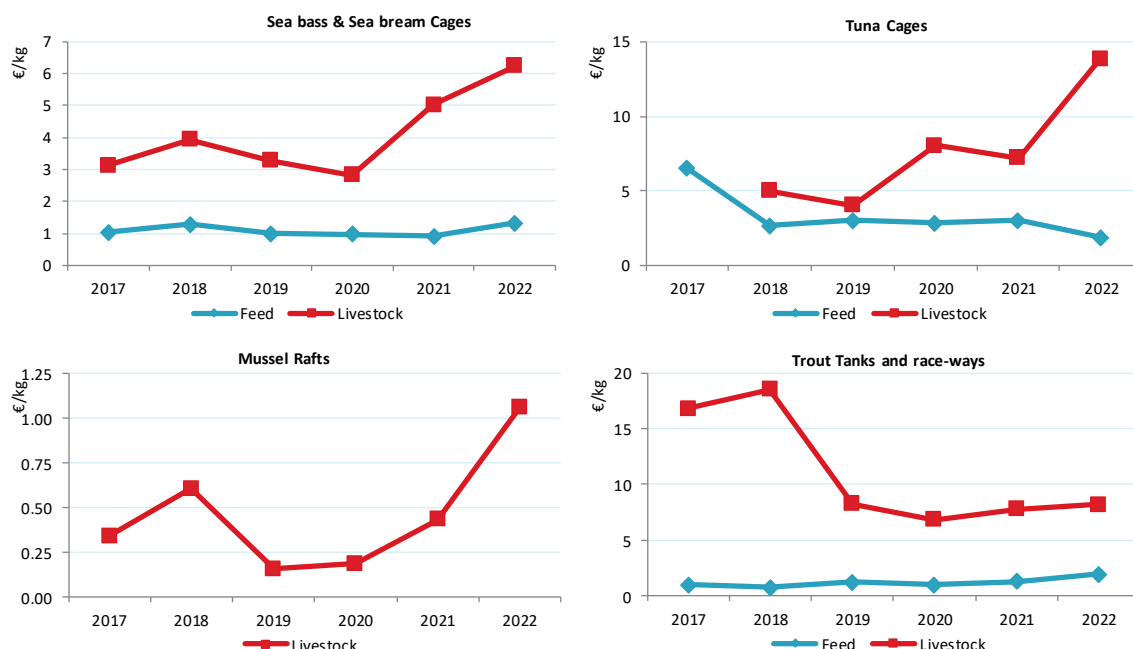


Source: Own elaboration from EU Member States DCF data submission

The operational cost structure of this extensive aquaculture activity differs greatly from that observed in the other segments analysed. Unlike fish farming, where livestock cost or feed costs are the main costs and labour cost is less than 27% of the total cost, in the case of the mussel industry there is no feed cost, but being a low investment capital activity, labour cost is the most relevant operational cost. The

relevance of labour cost is confirmed in Figure 150, where it can be observed that wages and salaries represented 17% of the operational cost, but what is more relevant, the imputed value of unpaid labour was 44% of the total operational cost.

Figure 151. Feed and livestock average prices €/kg for the main Spanish segments: 2017-2022.



Source: Own elaboration from EU Member States DCF data submission

Segment 4: Trout tanks and race-ways

The main producing regions are Castilla y León, Galicia, Andalucía, Cataluña, La Rioja, Castilla la Mancha, Asturias and Aragón. Rainbow trout usually take 10 months from hatching to reach serving size (250-300 g), although commercial sizes reach several kilograms in weight. In Spain, trout farming is generally carried out in an installation whose operation is based on a circuit that derives the flow of the river that feeds it, through which the captured water is passed. The water flows through a system of channels and ponds where the fish are confined, and is finally returned to the river at a discharge point.

The trout segment appears to be consolidating the recovery trend in production and sales of previous years, after a downward trend until 2016. While the number of companies decreased, employment remained stable. Total sales increased compared to 2018, as well as net profits, benefiting from better prices and a lower increase in operating costs (by 15% between 2017 and 2020) (Table 88). Rainbow trout production is changing in recent years shifting to farming larger trout with a higher average price. This is due to the stagnation of the price of ration trout and the new opportunities offered by the HORECA market for fish weighing more than 1 kg.

The evolution of revenues over the last six years (Figure 149) shows an increase in the last two years. However, the increase in operating costs, mainly due to the increase in feed prices as a result of the crisis in Ukraine, has reduced the net profit margin. Feed costs are the main item within raw materials, accounting for 40% of the total cost structure. Other operational costs is the second largest item. Finally, wages and salaries, with 19% of the total, are the third most important type of costs (Figure 150).

4.25.5 Outlook

Nowcasts for 2023-24

Aquaculture production in Spain in 2023 declined by 11% from 282 251 tonnes to 250 693 tonnes, with a value of €756.4 million. Freshwater production, led by rainbow trout, increased by 1.8% to 13 792 tonnes with a value of €49.6 million. Marine production decreased by 12.8% and 10.2% in quantity and value respectively to 250 000 tonnes with a value of around €703 million. Finfish marine production shows an increase of 9.9% to 64 994 tonnes, but decreased in value by 5.7% to €555 million due to the context of lower prices. Meanwhile, the production of molluscs, mainly mussels, fell by 19% to 185 000 tonnes.

Seabream and seabass productions remained stable in volume in 2023. Seabass consolidated its position as the main species in marine fish aquaculture in Spain, both in quantity (24 thousand tonnes) and value (€202 million). Seabream keeps during 2023 the positive trend recorded in 2022, and is once again increasing its production in both volume and value. In 2023, the growth of bluefin tuna production seems to have stopped, but it remained as the second most important species in value, reaching €136 million in 2022.

Another trend observed for the 2023 data is the growth of seaweed production in Spain, which increases by 23% and 17.2% in quantity and value respectively to 28.1 tonnes with a value close to €2.5 million.

Trends and triggers

One of the challenges most discussed by aquaculture business associations are the institutional obstacles faced by the sector. On the one hand, fish farmers continue to demand the long-standing demand to simplify the administrative procedures to start and maintain an aquaculture initiative in Spain. These procedures depend on the national government but also on the regional administration, since they have received competences in aquaculture matters. On the other hand, the aquaculture sector claims the concession and renewal of rights of occupation of the public maritime-terrestrial domain. Representatives of the aquaculture sector denounce that part of the stagnation of Spanish aquaculture production is due to the slowing down and even paralysation of the processes to obtain permits to occupy spaces in the public domain.

Part of the aquaculture sector does not agree with the possible incorporation of the Bolkestein Directive of the European Union (Directive 2006/123/EC) and the consideration of aquaculture as a service activity, and not as a primary productive activity, within the context of this regulation. As a consequence of this decision, the renewal or granting of a new license would have to be put out to public tender, making it possible for other investors to obtain it.

Particularly relevant is the institutional confrontation between the regional government of Galicia, one of the most important aquaculture regions, and the Spanish government. In view of the possible problems of coastal management described above, the Government of Galicia passed Law 4/2023, of July 6, 23, on integrated coastal planning and management in Galicia (LOLGA), approved by the regional Parliament. Initially, this regional law was suspended by the Constitutional Court, which subsequently upheld it. At present, the Government of Galicia is in negotiations with the national administration to approve the future law. Governments of other regions, such as the Canary Islands, Balearic Islands and Valencia, have expressed their desire to create a coastal law similar to the Galician one.

Another of the most important problems in coastal management in Spain related to aquaculture is the conflict between the mussel and goose barnacle sector in Galicia. The conflict arose due to the harvesting of mussel seed on the same rocks where barnacles inhabit. In 2019, the regional government of Galicia published a decree establishing exclusion zones to protect the barnacle, which generated tensions between those dedicated to barnacle harvesting and those dedicated to mussel farming. The former claimed environmental damage and lack of alternatives, while the latter blamed poor management and poaching for the shortage of barnacles. To mitigate the conflict, measures such as the extension of mussel farming and the delimitation of exclusive barnacle zones were implemented.

Despite these measures, tensions continued, leading to protests and confrontations. In 2021, the High Court of Justice of Galicia dismissed an appeal against the decree, and in 2022, tensions escalated with demonstrations and blockades. In 2023, the exclusion zone was reduced, leading to further conflict.

Another species showing a downward trend, in addition to mussel, is gilthead seabream. Although in 2023 production has grown to 13 108 tonnes, producers face a strong competition from fresh or chilled seabream from Turkey or Greece. Therefore, seabass and seabream producers, faced with strong competition and some other disadvantages such as morphological anomalies of seabream fry and their lower price compared to seabass, have decided to increase seabass farming to the detriment of seabream.

As for continental aquaculture, the association of producers in this sector demands special treatment by the administrations to guarantee the supply of fresh water. Drought episodes are important, especially in the central and southern part of the country, so that trout, salmon, sturgeon and tench farming can be seriously affected. For all these reasons, the sector requests (i) a reduction in the current rates of freshwater abstraction, (ii) the approval of public aid for the decrease in production due to drought, (iii) the creation of new regulations so that the ecological flows can be temporarily reduced, and (iv) the approval of a definitive framework which contemplates the possibility for aquaculture companies to have sufficient time to adapt to the reduction in authorized flows.

In addition, it is important to highlight that in 2023, the Spanish Aquaculture Business Association (Apromar), together with animal welfare NGOs, scientific groups, and the Ministry of Agriculture, Fisheries and Food (MAPA), created the first Guide on Fish Welfare in Spanish Aquaculture. This guide is composed of several volumes and recommends animal care standards in general and specifically for seabream and seabass.

4.25.6 Data Coverage and Data Quality

Minor data mistakes were found and amended.

4.26 Sweden

Overview of Swedish aquaculture

In 2022, the Swedish aquaculture sector produced 12.7 thousand tonnes of aquaculture products valued at €70.1 million. The majority of production is carried out in freshwater and the main specie produced is rainbow trout. The industry consists of 91 enterprises employing 461 people. The sales value of production is growing slowly and saw an increase of €5.9 million for 2022 compared to the previous year.

4.26.1 Total Production and sales

Over the years 2017 to 2022 production levels have decreased from 15.8 thousand tonnes in 2017 to 12.7 thousand tonnes in 2022. However, the value of total production has increased from €63.1 million in 2017 to €70.1 million in 2022. The change in production levels between 2021 and 2022 is a decrease of 21%, but the sales value as a whole increased by 9% (Table 89). The decrease in production volume from 2021 to 2022 is mostly a post-COVID-19 effect in 2021. Farms were authorised to stock more fish during COVID-19 pandemic due to a decreased market in 2020 hence the higher production volume in 2021.

4.26.2 Industry structure and total employment

In 2022, the total number of aquaculture sites were 140, distributed on 91 enterprises. The Swedish aquaculture sector is dominated by small enterprises, and in 2022, 79% of the Swedish enterprises had less than 6 employees.

Table 89. Production and sales, industry structure and employment for Sweden: 2021-2022.

Variable	2017	2018	2019	2020	2021	2022	Change 2021-22	Develop. 2022/(17-21)
Sales weight (thousand tonnes)	15.8	13.8	12.1	12.8	16.2	12.6	▼ -22%	▼ -11%
Freshwater	13.8	11.8	10.2	10.5	12.7	10.3	▼ -19%	▼ -13%
Shellfish	2.0	2.0	2.0	2.3	3.5	2.3	▼ -32%	▼ 0%
Sales value (million €)	63.1	63.5	45.2	48.6	62.2	68.8	▲ 11%	▲ 22%
Freshwater	61.8	62.9	43.5	46.7	58.6	65.9	▲ 12%	▲ 20%
Shellfish	1.3	0.6	1.7	1.9	3.5	2.9	▼ -18%	▲ 61%
Number of enterprises	105	93	85	98	105	91	▼ -13%	▼ -6%
Freshwater	87	79	71	79	86	78	▼ -9%	▼ -3%
Shellfish	18	14	14	19	19	13	▼ -32%	▼ -23%
Employment	559	478	444	639	531	433	▼ -18%	▼ -18%
Freshwater	487	441	379	561	438	364	▼ -17%	▼ -21%
Shellfish	72	37	65	78	93	69	▼ -26%	▼ 0%
FTE	335	284	325	348	237	269	▲ 13%	▼ -12%
Freshwater	310	263	268	295	166	226	▲ 37%	▼ -13%
Shellfish	26	21	57	53	71	43	▼ -40%	▼ -7%

Source: Own elaboration from EU Member States DCF data submission

4.26.3 Overall Economic performance

The Swedish aquaculture sector has fairly stable performance during the 2017-2022 period. Total income has been rising along with operating costs during the period but net profit has increased by 82%. (Table 90).

Table 90. Economic performance of the aquaculture sector: 2017-2022.

Variable	2017	2018	2019	2020	2021	2022	Change 2021-22	Develop. 2022/(17-21)
Total income	64.3	58.9	50.5	53.6	67.3	78.0	▲ 16%	▲ 32%
Total operating costs	55.5	33.8	42.3	48.6	45.2	58.1	▲ 29%	▲ 29%
Total wages	10.0	9.6	9.6	8.8	10.4	13.1	▲ 26%	▲ 35%
Gross Value Added	18.8	34.7	17.8	13.9	32.5	32.9	▲ 1%	▲ 40%
Depreciation of capital	3.6	3.5	3.5	3.4	3.2	3.2	▲ 1%	▼ -7%
Earning before interest and taxes	5.1	21.5	4.7	1.6	19.0	16.6	▼ -12%	▲ 60%
Financial costs, net	0.9	0.4	0.3	-1.5	0.2	-2.0	▼ -1434%	▼ -4287%
Net profit	4.3	21.1	4.4	3.1	18.8	18.6	▲ -1%	▲ 80%
Total value of assets	76.3	74.6	76.2	87.1	94.8	137.9	▲ 46%	▲ 69%
Capital productivity (%)	24.6	46.4	23.4	15.9	34.3	23.9	▼ -30%	▼ -17%
Return on Investment (%)	6.7	28.8	6.2	1.9	20.0	12.0	▼ -40%	▼ -5%

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 EU-MAP:

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 due to confidentiality issues only *national totals* and segments *Other freshwater fish – Cages* and *Mussel – Other* can be reported with trustworthy numbers on economic performance.

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. Blue mussels aggregated with oysters is the second most important production in terms of volume but other freshwater fish are the second most important group with respect to value (Figure 152).

In 2022, Swedish aquaculture yielded 12.7 thousand tonnes, out of which 10.4 thousand tonnes were fish. The amount of fish that was produced for human consumption was 9.5 thousand tonnes. The dominating species was Rainbow trout, with 67% of the total production and 77% of the value.

Rainbow trout is the most important specie both in terms of weight and total production value while it only carries the second highest value per kilo. However, due to confidentiality, values for eel and arctic char are not presented for 2022, for years prior to 2022, they both exceeded the price for rainbow trout. (Figure 153).

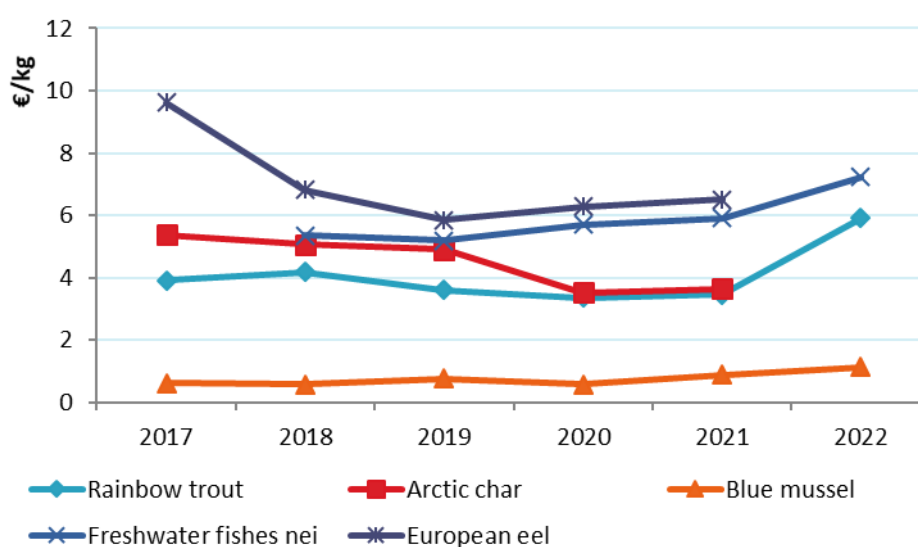
The prices of the main species produced by Swedish aquaculture have been fairly stable for most species until 2022 after which there has been an increase in price. The increase in prices in 2022 is likely an effect of increased inflation (Figure 153).

Figure 152. Main species in terms of weight and value in Sweden: 2022.



Source: Own elaboration from EU Member States DCF data submission

Figure 153. Average prices €/kg for the main species produced in Sweden: 2017-2022.



Source: Own elaboration from EU Member States DCF data submission

Table 91. Economic performance of main aquaculture segments: 2017-2022.

Variable	2017	2018	2019	2020	2021	2022	Change 2021-22	2017	2018	2019	2020	2021	2022	Change 2021-22
Other freshwater fish Cages								Mussel Other						
Number of enterprises	37	36	37	37	40	35	-13%	9	7	7	10	12	10	-17%
FTE	192	178	188	181	166	176	6%	24	20	55	53	71	43	-40%
Average wage (thousand €)	38.6	44.3	32.2	32.4	38.7	46.0	19%	23.0	17.7	136.0	84.5	39.4	65.9	67%
Labour productivity (thousand €)	82.7	195.6	58.2	47.7	174.8	173.9	0%	45.9	39.9	49.3	107.6	55.8	92.6	66%
Total sales volume (thousand tonnes)	13.0	11.1	10.1	10.1	12.1	9.7	-20%	2.0	2.0	0.0	2.3	3.5	2.3	-32%
Total income (million €)	55.8	55.5	41.2	42.1	55.6	67.0	20%	1.2	0.8	3.2	5.8	4.2	3.9	-6%
Total operating costs (million €)	47.3	28.5	36.3	39.3	33.1	44.5	34%	0.6	0.4	7.9	4.6	3.0	2.8	-7%
Gross Value Added (million €)	15.9	34.9	11.0	8.7	28.9	30.7	6%	1.1	0.8	2.7	5.7	4.0	3.9	-1%
Net profit (million €)	5.3	24.0	2.6	2.4	20.6	22.6	10%	-0.6	-0.2	-8.5	-0.9	0.8	0.5	-33%
Total value of assets (million €)	62.5	65.6	55.5	57.3	61.4	99.9	63%	4.7	3.8	41.1	46.4	28.2	14.5	-49%
Net investments (million €)	0.9	2.2	1.5	0.0	0.4	1.8	400%	2.1	3.3	0.3	0.2	0.7	1.6	112%
Capital productivity (%)	25.4	53.2	19.8	15.1	47.1	30.7		22.9	21.0	6.6	12.3	14.1	27.2	
Return on Investment (%)	9.9	37.2	4.8	1.5	33.8	20.5		-10.8	-4.7	-17.1	-1.7	1.7	4.3	
Future Expectation Indicator (%)	-2.2	-0.6	-1.3	-3.3	-2.3	-0.2		22.9	70.2	-4.8	-4.0	0.2	7.4	

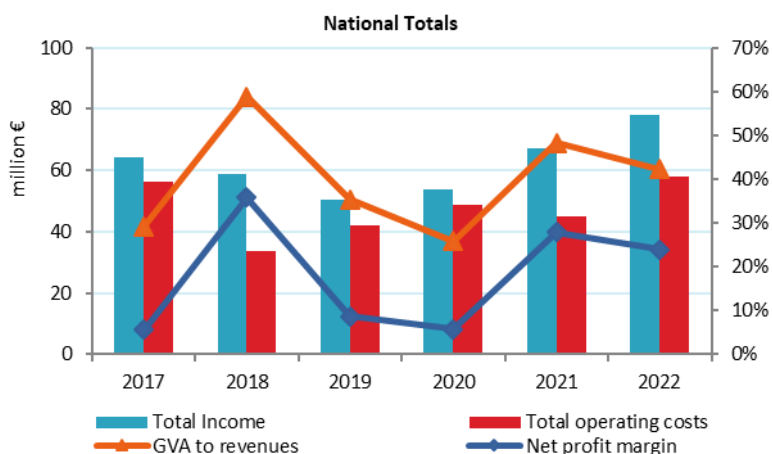
Source: Own elaboration from EU Member States DCF data submission

National totals

The total number of enterprises decreased between 2021 and 2022. This is likely in part an effect of larger companies buying smaller ones. There was also a decrease in FTE and sales volume. However, the economic indicators are positive.

GVA to revenue have increased over the last two years. The net profit follows the same trend as GVA to revenues. Operating costs decreased in 2021 but increased in 2022 mostly due to increased feed costs (Figure 154).

Figure 154. Economic performance in € million, indicators for the total Swedish production: 2017-2022.

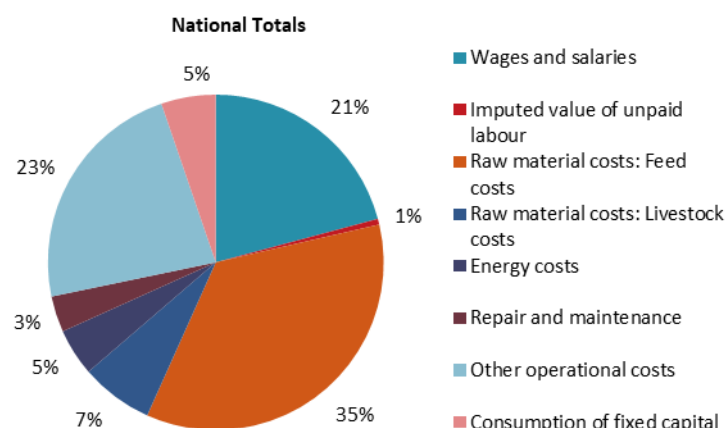


Source: Own elaboration from EU Member States DCF data submission

The operational cost structures for the national total of the Swedish aquaculture sector is presented in Figure 155, using the EU-MAP segmentation. Due to low number of enterprises and response rate only national totals are presented.

In 2022, the feed costs were the main cost component with 35% of total operating costs for Swedish aquaculture. Other operational costs amounted for 23% of the total costs in 2022 and wages and salaries amounted 21%. The energy costs are of minor importance, 5% of total operational costs are due to energy costs.

Figure 155. Cost structure of the total production in Sweden: 2022.



Source: Own elaboration from EU Member States DCF data submission

Other freshwater fish cages

The number of enterprise as well as the sales volume follows the same trend as for national totals.

The volume of production of freshwater fish in cages has decreased between 2017 and 2022 however, the figures indicated that there is a positive trend for the economic indicators. The segment produced 76% of aquaculture production in 2022 and the total income accounted for 86% (€67 million) of total income. Gross value added increased significantly from €15.9 to €30.7 million (54%).

Mussel other

The segment *Mussel other* consists of enterprises producing mussels and oysters. This segment represents 18% (2.3 thousand tonnes) of Sweden's total aquaculture production in terms of weight but only 5% (€3.9 million) of the total income.

4.26.5 Outlook

Nowcasts for 2022-23

In 2022 and 2023, the Swedish aquaculture sector is predicted to keep developing at a rate somewhat similar to previous years. The sector is undergoing a structural shift towards fewer but larger enterprises due to large companies buying smaller actors. This development may impact data collection by causing data to become confidential. 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. While the sector appears to mostly have recovered from the COVID-19 pandemic the war in Ukraine with higher energy and feed costs as a result has a potential to continue to affect the growth of the Swedish aquaculture sector in a negative way.

Trends and triggers

Market structure, current production trends and main drivers

The Swedish aquaculture sector has experienced a decrease in volume of production. Over the last five years production levels have decreased from 15.8 thousand tonnes (2017) to 12.7 thousand tonnes (2022). One explanation for the observed decrease in production is likely related to permits not being renewed for existing. Data since 2017 show that the number of enterprises has decreased, at the same time as production volumes have decreased.

Between 2017 and 2022, the increase in production stalled and a decrease was seen these years. However, in 2021 the production saw a sharp increase compared to the previously reported years. This was most likely due to COVID-19 in 2020 causing farmers to keep their production in the systems into 2021 as the market became unfavourable. The downturn in 2018 and 2019 is most likely the result of permits expiring for a few enterprises coupled with disease outbreaks that had a negative impact on production. The continued decline in 2020 may have similar causes as 2017 and 2018 coupled with the effects of the COVID-19 pandemic. 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

The national strategy document (Strategi för svenskt fiske och vattenbruk) with the objective to identify how the Swedish aquaculture and fishery sectors can grow in the direction of economic and environmental sustainability to 2026 was implemented 2021. The strategy is a common strategy for the fishery and aquaculture sectors. As part of the strategy, the action plan for Swedish aquaculture was evaluated and updated to better suit the future needs of the sector. The new national strategy for Swedish fisheries and aquaculture constitutes the main foundation for constructing a national action plan for sustainable development of Swedish aquaculture.

In 2021 the European Maritime Fisheries and Aquaculture Fund (EMFAF) entered into force with the purpose of supporting the EU Common Fisheries Policy (CFP), the EU maritime policy and the EU agenda for international ocean governance. The Swedish government decided to provide additional co-funding to the national programme that was adopted in 2022 with the aim of supporting the development of sustainable aquaculture in Sweden.

Outlook for 2023 and 2024

Sweden's net imports of fish, crustaceans and molluscs were considerably higher than the production in 2022. 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 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. In 2022 the state's public inquiry was given the task of reviewing legislation connected to Swedish fisheries and aquaculture with the aim of presenting areas of improvement, the results were presented to the Swedish government in 2023.

The sector also faced setbacks to its development in 2020 and beyond due to the COVID-19 pandemic and the war between Russia and Ukraine in February 2022.

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.

4.26.6 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 a questionnaire and a tax declaration survey for each year. Data was collected from both income tax declarations, administrative records and the questionnaire sent to all aquaculture enterprises. 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 is sent out to all aquaculture enterprises. For each enterprise, the value of sales from the questionnaire 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) are considered to have their primary activity in aquaculture. The questionnaire 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 EU-MAP.

Data quality and availability

Some of the data for the aquaculture sector is published in August every year with a one year delay. The total data collected is available at the end of April two years after production.

Confidentiality

To avoid problems with confidentiality, segments should in general include more than 10 enterprises. Due to the Swedish aquaculture sector moving towards fewer but larger enterprises confidentiality problems have arisen. In order to avoid future problems the Swedish board of agriculture will reorganize its work with data collection so that the work will be conducted by the statistics unit which has the ability to view confidential data that currently cannot be accessed which hopefully will reduce confidentiality problems.

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 THE ECONOMIC SUSTAINABILITY OF THE EU AQUACULTURE

Economic sustainability refers to the ability of an economy to support a defined level of economic production in the long term. Economic sustainability requires efficient use of inputs, such as capital and natural resources, to create profit and promote long term resilience for the aquaculture industry. Furthermore, long term resilience requires that industries are able to continuously invest in new technology to stay competitive, and at the same time pay for negative externalities (side effects) imposed on society or from use of natural resources. It is a critical component of a broader sustainable development framework as it is intrinsically linked to the other two pillars of sustainability, social and environmental. These relationships highlight the need for an integrated approach that considers the impact of economic growth on communities and ecosystems.

As the global demand for seafood continues to rise, aquaculture presents an opportunity for sustainable food production as capture fisheries production is stagnant and future expectation for growth is limited (Elleby et al., 2024). Globally, aquaculture grows year-to-year in production volumes and since 2022 the food supply by aquaculture is surpassed that by fisheries (FAO, 2024). Aquaculture has proven to be an efficient technology to produce animal protein and important fatty acids as well as the performance in regard to its impact on climate and the environment is for most aspects good compared to other terrestrial animal food productions (Gephart et al., 2021; Bianchi et al., 2022). Despite good performances regarding climate and environmental effects by aquaculture compared to other terrestrial animal protein production systems, there are still challenges to overcome. Nevertheless, new insights on global aquaculture production using the aquaculture performance index show that on average aquaculture production is able to support all three pillars of sustainability simultaneously if managed properly (Garlock et al., 2024). To this end, the European aquaculture sector (including UK and Norway) is performing better in all dimensions compared to global averages (Nielsen et al., 2025).

Aquaculture has become increasingly vital for food security, economic growth, and social development in the European Union (EU) despite the limited growth in the sector (Guillen et al., 2024). This is because capture fisheries in the EU have been stagnant or even declining, while demand for aquatic foods has increased. EU's dependency on import of aquatic food is around 60% of the total consumption. Thus, next to fisheries the European aquaculture sector plays a crucial role in the EU economy for providing safe and environmentally sustainable sea food. The EU has set ambitious targets for increasing aquaculture production to ensure food security and reduce reliance on imports. According to the EU's "Farm to Fork" strategy, the goal is to promote sustainable food systems that balance economic viability, environmental health, and social equity.

Several challenges hinder the economic sustainability of aquaculture in the EU, including environmental pressures, regulatory compliance, competition, and diseases. Environmental concerns have garnered increasing attention. In response, the EU has implemented stricter regulations concerning aquaculture practices to minimise ecological impacts while encouraging sustainable production methods. Additionally, competition from international seafood markets can affect the economic positions of EU aquaculture producers. For example, if production costs (wages and salaries, regulations for improving sustainability, required ecolabelling, etc.) are higher within Europe compared to global competitors, which will deteriorate the competitive strength of the European aquaculture. This dynamic raises concerns about the competitiveness of EU aquaculture and its economic sustainability.

Sustainability Indicators and Assessments

Before going into more detail with the individual indicators it should be stressed that this report is built on data collected from private enterprises and that the indicators therefore express the private economic situation. For the indicators to provide the situation for society at large, information on each production system's negative or positive impact on the environment and society should be taken into account, which is beyond the scope of this report. Furthermore, this report provides indicators at the overall sector level

and for the main species produced and technologies used in the EU aquaculture sector. However, it is beyond the scope of this report to develop a tool for individual enterprises or farms in which they can compare their own performance to the sector. Nevertheless, enterprises and farms can compare themselves against the averages provided in the report. The development of a tool should also include societal values in order to give an accurate evaluation of the economic performance in different segments taking positive and negative externalities (side effects) into account. This would require substantially more work and increase data needs, which goes far beyond the data collection program and the scope of this report.

Estimating the economic sustainability in an industry involves a multifaceted approach utilizing various indicators. Profitability metrics, cost efficiency, market share, investments in sustainable practices, employment metrics, financial stability ratios, resource efficiency, consumer satisfaction, and supply chain sustainability all provide valuable insights into an industry's overall performance and commitment to sustainability.

The reports on the performance of aquaculture in the European Union, prepared under the framework of the activities of the Scientific, Technical and Economic Committee for Fisheries (STECF), provide valuable insights into the private economic sustainability of the sector. These reports use several key indicators to assess profitability, resource use, and efficiency, including Gross Value Added (GVA), Earnings Before Interest and Taxes (EBIT), Return on Investment (ROI), Future Expectations of the Industry (FEI) and productivity measures such as labour and capital productivity. These indicators are essential for understanding the economic health of the EU's aquaculture industry and its sustainability over the long term.

In the following each indicator is described in more detail and how it is calculated within this report. Furthermore, how it can be used to interpret the situation in the aquaculture sector.

Gross Value Added (GVA)

Gross Value Added (GVA) = Turnover + Other Income – Energy costs – Livestock costs – Feed costs - Repair and maintenance - Other Operational costs.

GVA is the surplus/deficit obtained when taking the income generated from the production in the sector and subtracting the cost of the input used in the production. Thus, GVA measures what is left for the remuneration of labour and capital. GVA is an important indicator of sustainability because it demonstrates the economic value generated by the sector and its capacity to create wealth. A higher GVA indicates that aquaculture is not only producing more but is also doing so efficiently, by adding significant value to the inputs it uses.

Earnings Before Interest and Taxes (EBIT)

Earnings Before Interest and Taxes (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

EBIT is the surplus/deficit obtained when subtracting total cost used in production including the cost of labour and capital from the total income. In the context of economic sustainability, EBIT is crucial because it highlights how well the aquaculture sector manages its resources to generate profits. High EBIT values show that the sector can cover its operating costs including remuneration of labour and capital, while generating sufficient surplus, and a positive EBIT is an essential condition for long-term sustainability. If EBIT is low or negative, it may signal inefficiencies, overexploitation of resources, or unsustainable practices that could undermine the sector's future. EBIT is a measure of a firm's profitability that excludes interest and income tax expenses.

Return on Investment (ROI)

Return on Investment (ROI) = (EBIT/Total value of assets) *100

ROI is calculated by dividing EBIT with the Total value of assets multiplied with 100 to get a percentage. EBIT is used instead of Net Profit because EBIT is more comparable between Member States having different tax systems, which on the other hand will affect the calculation of Net Profit.

ROI is a key indicator used to evaluate the efficiency of an investment. ROI measures how efficiently capital is used to generate profits. To evaluate if an industry is sustainable ROI is usually compared to a low-risk long term investment rate such as governmental bonds. If the calculated ROI over a longer period exceeds the rate the investment in governmental bonds is seen as sustainable in the long term. However, depending on the global economic situation the rate fluctuates, and it is therefore difficult to set a threshold for future investments. However, the industry's sustainability can be evaluated historically using the known rates.

Future Expectations of the Industry (FEI)

Future Expectations of the Industry (FEI) = ((Net investment - Consumption of fixed capital)/ (Total value of assets)) *100%

The FEI indicator is calculated as Net investment subtracted the Consumption of fixed capital (depreciations). This number is divided by the Total value of assets multiplied with a 100 to get a percentage measure.

The indicator FEI can be interpreted as a proxy for the enterprise/industry's intent to remain in the market in the medium/long term. If investment minus depreciation is positive, it means 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 the sector only is interested in keeping the status quo and they are not planning to expand. If the sector invests less than the cost of depreciation, it can be interpreted as an intention to reduce presence in the market in the future. Thus, as the indicator approximates the industry's investing behavior it gives important information on the future intentions of the industry and thereby if the industry itself considers the sector to be long term sustainable.

In order to estimate how well the industry utilises important input factors such as labour and capital, productivity indicators are essential. In this report the following indicators are used.

Labour productivity

Labour productivity = Gross Value Added (GVA)/Full Time Equivalents (FTE).

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 per FTE. A high labour productivity indicates that the sector is utilising its workforce effectively, which is important for maintaining competitiveness and ensuring job security.

Capital productivity

Capital productivity = ((Gross Value Added (GVA))/ (Total value of Assets)) *100

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 shows how well the sector is using its equipment, infrastructure, and financial resources to generate value.

Using a single-point indicator for assessing the economic sustainability threshold in aquaculture is unreliable due to the variability and complexity of sustainability metrics in this field. Aquaculture, as a business, faces fluctuating economic indicators largely influenced by inherent and external factors. One primary issue is the misalignment between economic and production cycles, which means that profit and cost metrics do not always coincide with the biological cycles of fish or other farmed species. Aquaculture operations often require significant capital expenditures on equipment, infrastructure, and breeding stock. Since returns on these investments are not immediate, a point-in-time measure might

overlook periods of financial strain before profitability is achieved, thus providing a distorted view of the business's economic sustainability. External factors also play a considerable role in the economic viability of aquaculture. Adverse climatic conditions, such as temperature shifts and extreme weather events, can impact production by affecting water quality, fish health, and survival rates, thus influencing costs and revenue unpredictably.

A dynamic approach to assessing economic sustainability in aquaculture is superior because it captures the complex and changing nature of the industry. Unlike a static indicator, a dynamic model can account for the misalignment between economic and production cycles, which is critical in aquaculture due to its reliance on biological growth periods that do not align neatly with standard financial reporting. This approach helps managers and investors gain a clearer view of financial health over time, as it reflects profitability and costs at different stages of the production cycle, from investment to harvest and sales.

Despite the above challenges, certain economic indicators can provide valuable insights when attempting to define such thresholds. Among these, Net Profit, Return on Investment (ROI), and the Future Expectations of the Industry (FEI) are critical metrics that can serve as proxies for long-term sustainability.

One of the most fundamental indicators of economic sustainability is Net Profit. A company or sector that continuously operates at a loss is unlikely to survive in the long run. Negative net profit limits the capacity for reinvestment, making it difficult for businesses to maintain operations, adopt innovations, or respond effectively to challenges such as rising feed costs or market fluctuations. Over time, persistent sustain growth.

In order to grow and remain competitive, the aquaculture industries must attract investment. A healthy ROI assures investors that their capital is being used effectively and generating adequate returns. Low or negative ROI discourages further investment. Sustainable aquaculture operations must demonstrate consistent and attractive ROI to maintain the flow of capital necessary for long-term viability.

The Future Expectations of the Industry (FEI) represents the level of confidence stakeholders have in the industry's medium- and long-term prospects. A positive FEI reflects optimism about future growth, stability, and adaptability to external challenges, such as environmental shifts or regulatory changes. Without a positive FEI, it is difficult to envision sustained investment or expansion, as stakeholders may lose confidence in the industry's ability to adapt and thrive.

Evaluating the economic sustainability of the EU aquaculture sector

Date included in this section only include EU-MAP data from 2017 to 2022. If countries have not provided data for all years for the calculation of the economic indicators, they are excluded from the dataset, in order to get the most coherent comparison of the indicators over time.

Between 2017 and 2022, the EU aquaculture industry shows a generally positive trend in Gross Value Added (GVA) and Earnings Before Interest and Taxes (EBIT), with GVA increasing by 10%, however EBIT declined by 3%. The GVA and EBIT are especially making a strong recovery in 2021 and 2022, suggest resilience and growth potential within the industry, contributing positively to its economic sustainability.

The decline in Return on Investment (ROI), falling by from 10% in 2017 to 8% in 2022, could raise concerns about the profitability. However, ROI is quite stable over the years signalling a robust industry where the revenue and earnings are growing, and the return relative to invested capital are stable. Additionally, the Future Expectation Index (FEI) has decreased by 4%, nevertheless it is almost at the same level from 2017 to 2022. The negative sign on most of the indicators could reflect a cautious outlook among industry players, potentially influenced by market uncertainties or increased operational costs.

Productivity indicators also present challenges. Labour productivity decreased by 8%, and capital productivity declined by 12%, indicating a reduced efficiency in generating output from both labour and capital. This reduction in productivity could affect long-term sustainability if not addressed, as it implies a need for either increased investments in technology and workforce skills or more efficient capital allocation.

While the EU aquaculture industry shows growth in GVA, declines in EBIT, ROI, FEI, and productivity metrics suggest that improvements in efficiency and investment strategy may be necessary to ensure sustainable economic performance in the long run. Addressing these challenges could strengthen the industry's long-term stability and profitability (Table 92).

Table 92. Sustainable economic indicators of EU total aquaculture: 2017-2022.

Total aquaculture	2017	2018	2019	2020	2021	2022	2017-22
GVA (€ million)	1487	1431	1411	1414	1589	1633	10%
EBIT (€ million)	538	423	364	428	556	522	-3%
ROI (%)	10%	7%	6%	7%	8%	8%	-22%
FEI (%)	3%	4%	2%	2%	3%	3%	-4%
Labour productivity (thousand €)	52	51	47	50	51	48	-8%
Capital productivity (%)	27%	25%	22%	22%	23%	24%	-12%

*Excluded due to partly missing data: Poland, Hungary, and Czechia.

Source: Own elaboration from EU Member States DCF data submission

Marine aquaculture

Between 2017 and 2022, the marine aquaculture sector in the EU has shown resilience in terms of Gross Value Added (GVA), which saw a recovery after significant declines in 2018 and 2019, ending at nearly the same level in 2022 as in 2017, indicating the sector's ability to bounce back despite fluctuations.

However, Earnings Before Interest and Taxes (EBIT) presents a more concerning trend, with a 38% decrease from 2017 to 2022. EBIT faced a sharp downturn in 2019, dipping into negative territory before partially recovering, which raises questions about profitability and financial sustainability.

Return on Investment (ROI) also dropped significantly by 56%, from 11% in 2017 to 5% in 2022. This decline in ROI suggests reduced returns relative to capital investments, despite slight improvements in recent years.

On the positive side, the Future Expectation Index (FEI) saw a noticeable increase of 98%, rising from 2% in 2017 to 4% in 2022, indicating a growing optimism about the sector's future, particularly from 2020 onward. This optimism may support economic sustainability if it translates into strategic growth initiatives.

Productivity indicators showed that labour productivity is decreased by 23%, while capital productivity declined by 29%. These reductions in productivity highlight potential inefficiencies in labour and capital use, which could affect long-term sustainability if not addressed.

The marine aquaculture sector in the EU demonstrates ability to bounce back in terms of GVA and the future expectations indicator improved, however, challenges in EBIT, ROI, and productivity underscore areas that need attention. Enhancing efficiency and profitability could be key to ensuring sustained economic performance in this sector (Table 93).

Table 93. Sustainable economic indicators of EU marine aquaculture: 2017-2022.

MARINE	2017	2018	2019	2020	2021	2022	2017-22
GVA (€ million)	504.7	327.8	236.4	395.2	475.4	507.0	0%
EBIT (€ million)	277.7	84.7	-40.5	132.1	177.1	171.4	-38%
ROI (%)	11%	3%	-1%	4%	5%	5%	-56%
FEI (%)	2%	2%	2%	1%	5%	4%	98%
Labour productivity (thousand €)	84.7	49.4	33.4	56.9	64.7	65.1	-23%
Capital productivity (%)	19%	12%	8%	12%	14%	14%	-29%

Source: Own elaboration from EU Member States DCF data submission

Within marine aquaculture, the seabass and seabream industry in the EU experienced significant economic challenges, as indicated by key sustainability indicators between 2017 and 2020 (Table 94). GVA decreased by 33%, from €422 million in 2017 to €284 million in 2022, reflecting a reduction in the industry's value generation despite a brief recovery in 2020 and 2021. EBIT showed a sharp 68% decline, dropping from €281 million in 2017 to €89 million in 2022. The industry struggled with profitability, especially in 2019 with significant losses. ROI dropped 78%, from 16% in 2017 to 3% in 2022, indicating a poor return on investments over the years. Future Expectations Index increased by 116%, from 2% in 2017 to 3% in 2022, showing growing optimism for the future despite the financial difficulties. The fluctuations suggest that the industry remains hopeful about market recovery or improvements in technology.

Labour Productivity fell by 44%, from €99 thousand per worker in 2017 to €55 thousand in 2022, pointing to declining efficiency in labour utilization. Capital Productivity decreased by 54%, from 24% in 2017 to 11% in 2022, showing a reduced ability to generate returns from invested capital. Overall, while the industry saw a decline in profitability and productivity, the rise in future expectations suggests optimism about recovery. However, the industry's financial performance remains weak, highlighting the need for improved efficiency and innovation to align future expectations with actual results.

Table 94. Sustainable economic indicators of EU seabass and seabream aquaculture: 2017-2022.

Seabass & seabream	2017	2018	2019	2020	2021	2022	2017-22
GVA (€ million)	422	240	193	277	295	284	-33%
EBIT (€ million)	281	101	22	123	108	89	-68%
ROI (%)	16%	6%	1%	6%	5%	3%	-78%
FEI (%)	2%	2%	2%	1%	6%	3%	116%
Labour productivity (thousand €)	99	54	39	58	59	55	-44%
Capital productivity (%)	24%	13%	10%	14%	13%	11%	-54%

Source: Own elaboration from EU Member States DCF data submission

Shellfish aquaculture

The shellfish aquaculture industry has shown growth in key economic indicators, including GVA, EBIT, and ROI, over the past years. However, the FEI indicates a more cautious outlook, reflecting concerns over environmental challenges. Despite these concerns, the sector improved its capital productivity, suggesting successful adaptation to the environmental challenges faced by the industry (Table 95). However, the labour productivity decreased.

The Gross Value Added (GVA) of shellfish aquaculture saw a 16% increase, growing from €747 million in 2017 to €864 million in 2022. This growth suggests that the industry managed to maintain and slightly improve its economic output despite facing environmental challenges. EBIT rose by 35%, from €254 million in 2017 to €339 million in 2022. This positive trend in profitability indicates that the sector improved its operational efficiency and cost management over the period. The Return on Investment (ROI) increased by 21%, from 16% in 2017 to 19% in 2022. This shows that investments in shellfish aquaculture became more profitable, pointing to improved financial performance. The FEI index dropped significantly by 79%, from 3% in 2017 to 1% in 2022. This indicates that expectations for the future of the industry have become more cautious, likely due to increasing environmental risks and uncertainties.

Labour productivity decreased by 8%, from €58 thousand in 2017 to €54 thousand in 2022. This drop may suggest that the sector has not been able to adopt more efficient practices or technologies to enhance the output per worker. On the other hand, capital productivity increased 5% from 47% in 2017 to 49% in 2022.

Table 95. Sustainable economic indicators of EU shellfish aquaculture: 2017-2022.

SHELLFISH	2017	2018	2019	2020	2021	2022	2017-22
GVA (€ million)	747	780	880	796	883	864	16%
EBIT (€ million)	254	254	357	315	414	339	33%
ROI (%)	16%	16%	18%	17%	25%	19%	21%
FEI (%)	3%	2%	0%	-1%	-1%	1%	-79%
Labour productivity (thousand €)	58	63	67	65	58	54	-7%
Capital productivity (%)	47%	48%	45%	43%	52%	49%	5%

Source: Own elaboration from EU Member States DCF data submission

Mussels, is the most important shellfish segment by volume. The industry has faced steady but modest growth in GVA despite the environmental challenges. However, there have been declines in profitability and productivity, especially in EBIT, ROI, labour productivity, and capital productivity, suggesting that the recurring environmental threats, such as red tides and seed shortages, are affecting the sector's performance. The sharp drop in FEI further highlights the increasing uncertainty about the future prospects of mussel aquaculture (Table 96).

GVA for mussels showed a modest 2% increase, from €266 million in 2017 to €271 million in 2022. Despite the environmental challenges, the economic value remained relatively stable, reflecting the importance of mussels in the shellfish sector. EBIT decreased slightly by -2%, from €74 million in 2017 to €73 million in 2022. Although profitability remained positive, it experienced fluctuations, likely influenced by environmental factors such as red tides and seed shortages. ROI decreased by 13%, from 12% in 2017 to 11% in 2022, indicating a slight decline in profitability relative to investments, which may be attributed to the ongoing environmental pressures and the challenges associated with seed availability. The Future Expectations Index dropped significantly by 84%, from 3% in 2017 to 0% in 2022, reflecting a decline in optimism for the sector's future.

Labour productivity saw a -11% decline, from €52 thousand in 2017 to €46 thousand in 2022, reflecting a reduction in output per worker. Capital productivity also declined by -9%, from 44% in 2017 to 40% in 2022, indicating that the sector became less efficient at generating returns on capital over the period, likely due to the combined environmental and operational challenges it faces.

Table 96. Sustainable economic indicators of EU mussel aquaculture: 2017-2022.

Mussels	2017	2018	2019	2020	2021	2022	2017-22
GVA (€ million)	266	290	275	270	327	271	2%
EBIT (€ million)	74	94	114	94	162	73	-2%
ROI (%)	12%	16%	17%	13%	23%	11%	-13%
FEI (%)	3%	3%	1%	1%	-1%	0%	-84%
Labour productivity (thousand €)	52	54	44	52	58	46	-11%
Capital productivity (%)	44%	50%	41%	38%	46%	40%	-9%

Source: Own elaboration from EU Member States DCF data submission

Freshwater aquaculture

Freshwater aquaculture experienced growth in GVA and EBIT, which indicates a positive economic performance over the period. ROI fluctuated over the period ending up at 1% in 2022, slightly higher than 2017. However, the decline in FEI points to some challenges, potentially from increased costs or uncertainties about the sector's future. On the other hand, there have been moderate improvement in both labour and capital productivity suggesting some minor increases in operational efficiencies, but the overall outlook remains cautious (Table 97).

Table 97. Sustainable economic indicators of EU freshwater aquaculture: 2017-2022.

New FRESHWATER	2017	2018	2019	2020	2021	2022	2017-22
GVA (€ million)	234	321	295	223	227	259	11%
EBIT (€ million)	7	86	53	-14	-37	14	89%
ROI (%)	1%	7%	4%	-1%	-2%	1%	75%
FEI (%)	5%	9%	5%	6%	4%	4%	-12%
Labour productivity (thousand €)	25	36	31	25	26	26	7%
Capital productivity (%)	19%	25%	20%	18%	13%	20%	2%

*Excluded due to partly missing data: Poland, Portugal, Hungary, and Czechia.

Source: Own elaboration from EU Member States DCF data submission

GVA experienced 11% increase, growing from €234 million in 2017 to €259 million in 2022. This limited growth suggests that the sector did not manage to expand, however, an improved economic performance can be seen in the EBIT increasing by 89%, from €7 million in 2017 to €14 million in 2022, showing a positive trend in profitability after some years with deficits in 2020 and 2021. ROI fluctuated over the period ending up at the same level in 2022 as in 2017. FEI dropped by 12%, from 5% in 2017

to 4% in 2022, reflecting a more cautious outlook for the future of the freshwater aquaculture industry. This decline might be attributed to various challenges, including environmental factors, regulatory issues or market uncertainties.

Labour productivity grew by 7%, from €25 thousand in 2017 to €26 thousand in 2022. The increase, while moderate, suggests a slight improvement in efficiency and output per worker over the period. Capital productivity increased by 2%, from 19% in 2017 to 20% in 2022, showing a slight improvement in the sector's ability to generate returns on capital.

Trout is the most important segment in the EU freshwater aquaculture. The trout aquaculture industry faced notable challenges between 2017 and 2022, marked by a decline in all indicators. These negative trends suggest that the industry has struggled with profitability and efficiency, likely due to factors such as strong competition from imports. The decreasing FEI points to a less optimistic outlook for the future, which may reflect concerns about the industry's ability to remain competitive in the face of external market pressures (Table 98).

GVA showed a slight decrease of -1%, dropping from €210 million in 2017 to €208 million in 2022. This modest decline indicates that the sector has faced stagnation over the period, which could be related to increased competition, particularly from imports. EBIT saw a significant decline of -76%, from €59 million in 2017 to €14 million in 2022. This sharp drop suggests that the industry faced significant challenges. ROI fell by -79%, from 8% in 2017 to 2% in 2022. This severe drop in ROI indicates that the sector's investments became much less productive over time, likely due to external pressures such as market oversupply or price competition from imported trout. The Future Expectations Index decreased by -51%, from 6% in 2017 to 3% in 2022. This reduction reflects growing concerns about the future prospects of the trout aquaculture industry, likely driven by market competition, economic challenges, and potentially environmental or regulatory factors.

Labour productivity decreased by -23%, from €50 thousand in 2017 to €38 thousand in 2022. The decline suggests that despite efforts to improve efficiency, the sector faced challenges in increasing output per worker, potentially due to reduced profitability and increased competition. Capital productivity also declined by -14%, from 30% in 2017 to 26% in 2022. This reduction indicates that the sector's ability to generate returns on capital investments weakened, possibly due to lower profit margins and again intense market competition but also limited ability to take advantage of economies of scale.

Table 98. Sustainable economic indicators of EU trout aquaculture: 2017-2022.

New Trout	2017	2018	2019	2020	2021	2022	Variation
GVA (€ million)	209.7	221.3	222.0	186.9	206.1	207.6	-1%
EBIT (€ million)	58.6	65.9	59.2	27.3	15.9	14.0	-76%
ROI (%)	8%	10%	8%	4%	1%	2%	-79%
FEI (%)	6%	13%	8%	7%	3%	3%	-51%
Labour productivity (thousand €)	49.7	52.5	53.6	46.5	38.7	38.1	-23%
Capital productivity (%)	30%	33%	32%	27%	19%	26%	-14%

Source: Own elaboration from EU Member States DCF data submission

Summary and conclusions

The economic sustainability of EU aquaculture between 2017 and 2022 presents a varied landscape, with some sectors showing growth and others experiencing significant challenges. The analysis of Gross Value Added (GVA), Earnings Before Interest and Taxes (EBIT), Return on Investment (ROI), Future

Expectations Index (FEI), labour productivity, and capital productivity across different aquaculture segments provides insights into the performance of the industry.

Overall, total aquaculture showed overall positive trend in growth, with GVA increasing by 10%, from €1 487 million in 2017 to €1 633 million in 2022. This growth in economic output was accompanied by a slight decline of 3% in EBIT. Thus, the profitability has not kept pace with the rise in GVA, as indicated by a decline in ROI from 10% to 8%. Additionally, the FEI dropped slightly, signaling a less optimistic future outlook. Labour productivity fell by 8%, while capital productivity decreased by 12%, reflecting challenges in operational efficiency across the sector. Despite the growth in economic output, the sector still faces significant challenges in terms of profitability and productivity.

In Marine Aquaculture, GVA was the same in 2017 as in 2022, however, with a significant dip in between with the lowest point being 2019, staying at around €507 million by 2022. However, EBIT saw a sharp decline of 38%, reflecting a reduction in profitability. ROI also experienced a significant drop from 11% to 5%, while FEI improved from 2% to 4%, indicating an optimistic outlook for the sector despite the present struggles. Labour productivity dropped by 23%, and capital productivity declined by 29%, suggesting inefficiencies in the sector despite the positive future expectations. This mixed performance highlights the need for greater focus on cost control and efficiency improvement in marine aquaculture.

The Seabass & Seabream sector experienced a significant downturn over the period, with GVA declining by 33%. EBIT also decreased by 68%, from €281 million to €89 million, reflecting a sharp drop in profitability. ROI saw a staggering 78% decline, from 16% to just 3%, indicating poor returns on investment. Although the FEI slightly improved from 2% to 3%, the outlook for this segment remains uncertain. Productivity indicators also showed considerable declines, with labour productivity falling by 44% and capital productivity decreasing by 54%. These trends suggest that the sector has faced significant operational challenges, including market volatility and competitive factors.

Shellfish Aquaculture, despite facing environmental challenges such as red tides and seed shortages, showed significant growth in terms of economic output. GVA increased by 16%, reflecting a positive performance. EBIT grew by 33%, from €254 million to €339 million, showing strong profitability. ROI also increased by 21%, from 16% to 19%, signalling a positive return on investment. However, the FEI decreased by 79%, from 3% to 1%, reflecting a less favourable outlook for the future. Labour productivity decreased by 7%, from €58 thousand in 2017 to €54 thousand in 2022, however capital productivity increased by 5%, indicating improved efficiency in the sector. Despite the environmental challenges, shellfish aquaculture has demonstrated resilience and growth, particularly in profitability and productivity.

The Mussels segment, which is the largest in terms of volume within shellfish aquaculture, experienced a modest growth in GVA of 2%. However, profitability indicators were less positive, with EBIT declining by 2% and ROI falling by 13%. The FEI showed a drastic decrease of 84%, indicating a significant decline in future expectations. Labour productivity decreased by 11%, and capital productivity declined by 9%, signalling challenges in efficiency. These results suggest that mussel farming has been impacted by recurring environmental events, including red tides, and other operational difficulties.

In Freshwater Aquaculture, the sector showed impressive growth in GVA, which increased by 11%. EBIT rose by 89%, from €7 million to €14 million, indicating a slight improvement in profitability. ROI increase slightly, whereas the FEI dropped from 5% to 4%, suggesting a more cautious outlook for the sector. Labour productivity increased by 7%, and capital productivity increased by 2%, indicating slight progress in efficiency and returns on capital. The sector has not managed to expand and it faces challenges in optimizing productivity and sustaining its profitability.

Finally, the Trout sector, facing a keen competitive scenario from the beginning of the century, showed a slight decline of 1% in GVA. EBIT dropped sharply by 76%, and ROI decreased by 79%. FEI fell by 51%, and labour productivity dropped by 23%. Capital productivity also decreased by 14%, indicating challenges in both profitability and operational efficiency. The decline in performance can be attributed to the strong competition from imports and other market pressures, which have significantly affected the economic sustainability of trout farming.

Overall, the EU aquaculture sector displays a mix of growth, stability, and decline across different segments. While some subsectors like Shellfish have shown positive performance, others such as Seabass & Seabream and Trout are facing significant challenges in terms of profitability and competitiveness. Environmental factors, market pressures, regulatory factors, limited availability of licenses, lack of economies of scale and efficiency issues are key drivers behind the observed trends, shaping the future of EU aquaculture.

6 NOWCAST ESTIMATION OF A SELECTION OF INDICATORS TO 2023 AND 2024

6.1 Background

For the third time in the report on the economics of aquaculture in Europe, a nowcast exercise is 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.

The availability of EU-MAP data for the year 2021 has made it possible to analyse the quality of the second nowcast exercise developed during the previous report. The comparison of the estimated values for 2021 and the actual values for 2021 shows a negative deviations of only 2% in total sales volume, a positive deviation of 5% in gross sales, and positive deviations of 29% and 14% in total employment and FTE, respectively. The higher deviation in total employment is caused by the inclusion in the EWG 24_14 of unpaid labour in the measurement of total employment. If we consider only persons employed the deviation is just 4% negative.

On this occasion, the results of the estimates for 2023, despite their limitations, will be especially useful, to analyse the consequences of COVID-19 pandemic and the high energy prices due to Russian invasion of Ukraine.

6.2 Scope

The scope of the nowcast is limited to estimate the production in volume (Total weight of sales), the production in value (Gross sales), and the employment (both total employees and 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 updating the nowcasting methodology to analyse the economic activity of aquaculture in the EU started with the search for possible variables for the estimation in 2023 in 2024.

- First of all, it has been confirmed that the explanatory variables used in the imputation methodology only have information available until 2022.
- 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.

This first stage has highlighted the challenge posed by nowcasting in aquaculture. Just like the previous report, no production data was available for the nowcasted year (2023 and 2024) in Eurostat or FAO. The most recent data available in Eurostat and FAO at the time of preparing this report corresponded to the year 2022. This time the nowcast depends again entirely on the availability of data from national sources and the contributions of experts. 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 2023. 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 2023 and 2024 are based on the evolution of EU-MAP and national public bodies' data and estimates. 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 2024, for which there is still very little final or estimated official information available, and to understand what is the evolution of the situation.

The methodology developed for the nowcast is described in Annex III.

6.4 Nowcast output and coverage

The information obtained during the EWG has allowed a quantitative nowcast at national level in 2023, based on data from EU-MAP and final and estimated data from national public bodies provided by the experts. Then, nowcasted national totals for 2023 have been distributed by environments (finfish marine, finfish freshwater and shellfish) considering countries distribution by environments in 2022. In the case of the weight of sales we have been able to estimate all the countries with the exception of Austria, Belgium, Czech Republic, Estonia, Hungary, Latvia, Portugal, Romania and Slovakia. In the case of gross value there are no nowcast for the following countries; Austria, Belgium, Czech Republic, Estonia, Germany, Hungary, Latvia, Portugal, Romania and Slovakia. This means that the nowcasting coverage for 2023 is equivalent to 90.2% of the production volume and value in 2022. In the case of employment, the availability of data has been lower and the nowcast coverage decreases to 64% and 55% in the case of FTE and employees, respectively.

In the case of 2024, 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 2021. In this case, the qualitative information provided by the experts is essential for the nowcast.

6.5 Nowcast results

The results of the nowcast for national totals in 2023 are included and analysed in the EU overview chapter.

Below are the quantitative results of the estimates made for 2023, as well as the sources of information used to determine the imputation factors. The first two tables represent total sales in volume results (tonnes) and the sources of information to estimators' calculations.

Country	2022	2023	2024
AUT	4,719	Nonowcast	Nonowcast
BEL	243	Nonowcast	Nonowcast
BGR	9,440	10,669	Nonowcast
HRV	27,322	27,131	Nonowcast
CYP	7,594	7,471	Nonowcast
CZE	24,077	Nonowcast	Nonowcast
DNK	56,259	49,136	49,136
EST	506	Nonowcast	Nonowcast
FIN	13,929	13,000	Nonowcast
FRA	217,687	202,013	Nonowcast
DEU	27,381	36,356	Nonowcast
GRC	137,082	153,850	140,000
HUN	18,948	Nonowcast	Nonowcast
IRL	44,040	34,903	40,052
ITA	123,446	125,400	Nonowcast
LVA	925	Nonowcast	Nonowcast
LTU	4,859	4,258	4,051
MLT	16,632	19,447	20,547
NLD	39,330	44,148	Nonowcast
POL	46,856	44,869	47,113
PRT	16,063	Nonowcast	Nonowcast
ROU	48,316	Nonowcast	Nonowcast
SVK	2,614	Nonowcast	Nonowcast
SVN	1,603	875	Nonowcast
ESP	279,696	248,423	Nonowcast
SWE	12,607	12,473	Nonowcast

Country	2022	2023	2024
AUT		Nonowcast	Nonowcast
BEL		Nonowcast	Nonowcast
BGR	EU-MAP	National Sources	Nonowcast
HRV	EU-MAP	EU-MAP	Nonowcast
CYP	EU-MAP	National Sources	Nonowcast
CZE		Nonowcast	Nonowcast
DNK	EU-MAP	National Sources	Experts
EST		Nonowcast	Nonowcast
FIN	EU-MAP	National Sources	Nonowcast
FRA	EU-MAP	Experts	Nonowcast
DEU	EUROSTAT	National Sources	Nonowcast
GRC	EU-MAP	National Sources	National Sources
HUN		Nonowcast	Nonowcast
IRL	EU-MAP	National Sources	National Sources
ITA	EU-MAP	National Sources	Nonowcast
LVA		Nonowcast	Nonowcast
LTU	National Sources	National Sources	Experts
MLT	EU-MAP	National Sources	National Sources
NLD	EU-MAP	National Sources	Nonowcast
POL	National Sources	National Sources	Experts
PRT		Nonowcast	Nonowcast
ROU		Nonowcast	Nonowcast
SVK		Nonowcast	Nonowcast
SVN	EU-MAP	National Sources	Nonowcast
ESP	EU-MAP	National Sources	Nonowcast
SWE	EU-MAP	EU-MAP	Nonowcast

The following tables below present the results of the nowcasting for the gross sales in 2023 and 2024 and the information sources used to calculate the estimation factors in 2023 and 2024.

Country	2022	2023	2024
AUT	32,769,392	Nonowcast	Nonowcast
BEL	1,739,962	Nonowcast	Nonowcast
BGR	32,577,663	44,756,397	Nonowcast
HRV	178,230,697	204,973,170	Nonowcast
CYP	47,726,610	40,857,639	Nonowcast
CZE	66,328,932	Nonowcast	Nonowcast
DNK	213,021,229	199,000,138	199,000,138
EST	3,400,788	Nonowcast	Nonowcast
FIN	94,176,682	86,000,000	Nonowcast
FRA	910,619,128	855,981,981	Nonowcast
DEU	93,724,866	Nonowcast	Nonowcast
GRC	769,822,250	774,780,000	745,620,261
HUN	55,380,693	Nonowcast	Nonowcast
IRL	183,373,402	168,023,336	177,616,201
ITA	404,106,096	557,000,000	Nonowcast
LVA	6,233,244	Nonowcast	Nonowcast
LTU	19,708,433	18,255,648	16,269,769
MLT	286,098,677	182,728,467	210,026,963
NLD	107,674,881	111,235,242	Nonowcast
POL	191,935,131	188,112,570	197,518,199
PRT	158,177,087	Nonowcast	Nonowcast
ROU	49,936,087	Nonowcast	Nonowcast
SVK	7,839,886	Nonowcast	Nonowcast
SVN	7,142,095	8,060,551	Nonowcast
ESP	845,443,013	736,164,838	Nonowcast
SWE	68,815,664	56,414,379	Nonowcast

Country	2022	2023	2024
AUT		Nonowcast	Nonowcast
BEL		Nonowcast	Nonowcast
BGR	EU-MAP	National Sources	Nonowcast
HRV	EU-MAP	EU-MAP	Nonowcast
CYP	EU-MAP	National Sources	Nonowcast
CZE		Nonowcast	Nonowcast
DNK	EU-MAP	National Sources	Experts
EST		Nonowcast	Nonowcast
FIN	EU-MAP	National Sources	Nonowcast
FRA	EU-MAP	Experts	Nonowcast
DEU	EUROSTAT	Nonowcast	Nonowcast
GRC	EU-MAP	National Sources	National Sources
HUN		Nonowcast	Nonowcast
IRL	EU-MAP	National Sources	National Sources
ITA	EU-MAP	National Sources	Nonowcast
LVA		Nonowcast	Nonowcast
LTU	National Sources	National Sources	Experts
MLT	EU-MAP	National Sources	National Sources
NLD	EU-MAP/National	National Sources	Nonowcast
POL	National Sources	Experts	Experts
PRT		Nonowcast	Nonowcast
ROU		Nonowcast	Nonowcast
SVK		Nonowcast	Nonowcast
SVN	EU-MAP	National Sources	Nonowcast
ESP	EU-MAP	National Sources	Nonowcast
SWE	EU-MAP	EU-MAP	Nonowcast

The following tables below present the results of the nowcasting for the total employees in 2023 and 2024 and the information sources used to calculate the estimation factors in 2023 and 2024.

Country	2022	2023	2024	Country	2022	2023	2024
AUT	725	Nonowcast	Nonowcast	AUT		Nonowcast	Nonowcast
BEL	120	Nonowcast	Nonowcast	BEL		Nonowcast	Nonowcast
BGR	1,518	1,491	Nonowcast	BGR	EU-MAP	National Sources	Nonowcast
HRV	1,599	1,689	Nonowcast	HRV	EU-MAP	EU-MAP	Nonowcast
CYP	211	Nonowcast	Nonowcast	CYP		Nonowcast	Nonowcast
CZE	2,463	Nonowcast	Nonowcast	CZE		Nonowcast	Nonowcast
DNK	602	630	630	DNK	EU-MAP	National Sources	Experts
EST	75	Nonowcast	Nonowcast	EST		Nonowcast	Nonowcast
FIN	583	544	Nonowcast	FIN	EU-MAP	National Sources	Nonowcast
FRA	16,890	16,721	Nonowcast	FRA	EU-MAP	Experts	Nonowcast
DEU	4,980	4,890	Nonowcast	DEU	National Sources	National Sources	Nonowcast
GRC	5,007	4,500	Nonowcast	GRC	EU-MAP	National Sources	Nonowcast
HUN	1,216	Nonowcast	Nonowcast	HUN		Nonowcast	Nonowcast
IRL	2,045	2,000	2,047	IRL	EU-MAP	National Sources	Experts
ITA	7,283	Nonowcast	Nonowcast	ITA		Nonowcast	Nonowcast
LVA	310	Nonowcast	Nonowcast	LVA		Nonowcast	Nonowcast
LTU	423	411	393	LTU	National Sources	National Sources	Experts
MLT	370	379	375	MLT	EU-MAP	National Sources	National Sources
NLD	311	320	Nonowcast	NLD	EU-MAP	National Sources	Nonowcast
POL	5,206	4,816	5,056	POL	National Sources	National Sources	Experts
PRT	1,981	Nonowcast	Nonowcast	PRT		Nonowcast	Nonowcast
ROU	1,956	Nonowcast	Nonowcast	ROU		Nonowcast	Nonowcast
SVK	934	Nonowcast	Nonowcast	SVK		Nonowcast	Nonowcast
SVN	177	165	Nonowcast	SVN	EU-MAP	Other	Nonowcast
ESP	15,381	Nonowcast	Nonowcast	ESP		Nonowcast	Nonowcast
SWE	433	544	Nonowcast	SWE	EU-MAP	EU-MAP	Nonowcast

The following tables below present the results of the nowcasting for FTE in 2023 and 2024 and the information sources used to calculate the estimation factors in 2023 and 2024.

Country	2022	2023	2024	Country	2022	2023	2024
AUT	435	Nonowcast	Nonowcast	AUT		Nonowcast	Nonowcast
BEL	81	Nonowcast	Nonowcast	BEL		Nonowcast	Nonowcast
BGR	1,236	1,229	Nonowcast	BGR	EU-MAP	National Sources	Nonowcast
HRV	1,267	1,322	Nonowcast	HRV	EU-MAP	EU-MAP	Nonowcast
CYP	127	117	Nonowcast	CYP	EU-MAP	National Sources	Nonowcast
CZE	1,478	Nonowcast	Nonowcast	CZE		Nonowcast	Nonowcast
DNK	459	474	474	DNK	EU-MAP	National Sources	Experts
EST	45	Nonowcast	Nonowcast	EST		Nonowcast	Nonowcast
FIN	385	355	Nonowcast	FIN	EU-MAP	National Sources	Nonowcast
FRA	9,518	9,327	Nonowcast	FRA	EU-MAP	Experts	Nonowcast
DEU	2,932	2,809	Nonowcast	DEU	Experts	Experts	Nonowcast
GRC	3,958	3,850	Nonowcast	GRC	EU-MAP	Experts	Nonowcast
HUN	730	Nonowcast	Nonowcast	HUN		Nonowcast	Nonowcast
IRL	1,153	1,108	1,132	IRL	EU-MAP	National Sources	Experts
ITA	2,017	Nonowcast	Nonowcast	ITA		Nonowcast	Nonowcast
LVA	202	Nonowcast	Nonowcast	LVA		Nonowcast	Nonowcast
LTU	254	240	232	LTU	National Sources	National Sources	Experts
MLT	315	327	367	MLT	EU-MAP	National Sources	National Sources
NLD	276	284	Nonowcast	NLD	EU-MAP	National Sources	Nonowcast
POL	3,888	3,596	3,776	POL	Experts	Experts	Experts
PRT	1,482	Nonowcast	Nonowcast	PRT		Nonowcast	Nonowcast
ROU	1,956	Nonowcast	Nonowcast	ROU		Nonowcast	Nonowcast
SVK	560	Nonowcast	Nonowcast	SVK		Nonowcast	Nonowcast
SVN	114	Nonowcast	Nonowcast	SVN		Nonowcast	Nonowcast
ESP	5,593	Nonowcast	Nonowcast	ESP		Nonowcast	Nonowcast
SWE	269	381	Nonowcast	SWE	EU-MAP	EU-MAP	Nonowcast

6.6 Nowcast methodology development for Aquaculture economic indicators

In the case of aquaculture, the results of the first nowcast showed 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 for the third 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 information collection to support the nowcast analysis.

In future EWGs, the results of the nowcast would improve if the nowcast had a preparatory work. This preparatory work would allow to obtain from experts final and estimated quantitative and qualitative data for $t+1$ and $t+2$.

7 ABBREVIATIONS

€ - Euro currency.

AJPES - The Agency of the Republic of Slovenia for Public Legal Records and Related Services.

AMA – Italian Association of Mussel Farmers.

AOAD - Areas of Organized Aquaculture Development.

API - *Associazione Piscicoltori Italiani*. Italian Association of Aquaculture Farmers.

APROMAR - the Spanish Aquaculture Business Association

BEL – Belgium.

BGR – Bulgaria.

CFP - Common Fisheries Policy.

COVID-19: COronaVirus Disease 19.

CSB - Central Statistical Bureau of Latvia.

CYP – Cyprus.

CZE - Czech Republic.

DCF - Data Collection Framework.

Destatis - *Statistisches Bundesamt*, Federal Statistical Office of Germany.

DEU – Germany.

DGRM - *Direcção Geral de Recursos Naturais, Segurança e Serviços Marítimos*. The Portuguese Directorate-General for Natural Resources, Safety and Maritime Services.

DNK – Denmark.

e.g. – for example.

EBIT - Earnings Before Interest and Tax.

EMFAF - European Maritime Fisheries and Aquaculture Fund.

EMFF - European Maritime Fisheries Fund.

ESA - European System of Accounts.

ESP – Spain.

ESPR - Slovenian Implementation Program of the European Maritime, Fisheries, and Aquaculture Fund for the period 2021-2027.

Et al. - *et alii*, *et aliae*, and *et alia* (Latin), meaning “and others”.

et seq. – *et sequens* (Latin), meaning “and what follows”.

EU - European Union.

EU-MAP - EU Multi-Annual Management Plans.

EUMOFA - European Market Observatory.

EUROSTAT - Statistical office of the European Union.

EWG - STECF's Expert Working Group.

FAO - Food and Agriculture Organization

FEI - Future Expectations of the Industry.

FIN – Finland.

FRA – France.

FTE - Full Time Equivalents.

G – Grams.

GRC – Greece.

GVA - Gross Value Added.

HoReCa - Hotel, Restaurant, and Café/Catering.

HRV – Croatia.

HUN – Hungary.

i.e. - in other words.

ICCAT - International Commission for the Conservation of Atlantic Tunas.

IHN - Infectious Hematopoietic Necrosis.

IMTA - Integrated Multi-Trophic Aquaculture.

INE - Portuguese National Statistics Institute.

IRL – Ireland.

ISSG - Intersessional Subgroup.

ITA – Italy.

Kg - Kilogram.

LAFPMIS - Lithuanian Agricultural and Food Product Market Information System.

LOLGA - Government of Galicia passed Law 4/2023, of July 6, 23, on integrated coastal planning and management in Galicia.

Ltd. - Limited company.

LUKE - Finnish's Natural Resource Institute.

LVA – Latvia.

MAFF - The Ministry of Agriculture, Forestry and Food of the Republic of Slovenia.

MAPA - the Spanish Ministry of Agriculture, Fisheries and Food.

MLT – Malta.

MNSPA - Malta's Multiannual National Strategic Plan for Aquaculture.

MS - Member State

NACE - *Nomenclature statistique des activités économiques dans la Communauté Européenne* (French). Statistical Classification of Economic Activities in the European Community.

NEVEVI - Dutch aquaculture association.

NGO - Non-governmental organization.

NLD – Netherlands.

NSO - Malta's National Statistics Office.

NSPA – Italian National Strategic Plan for Aquaculture.

OP - Producer Organisation.

PLEN - STECF's Plenary.

POAY - Areas of Organized Aquaculture Development (AOAD) in Greek.

POL – Poland.

PRT – Portugal.

PVC - Polyvinyl chloride, a plastic.

RAS - Recirculating aquaculture systems.

RCG ECON - Regional Coordination Group on Economics Issues.

ROI - Return on Investment.

ROU – Romania.

S.A. – “*Société Anonyme*”, a type of limited company in certain countries.

SB&SB - Sea bream and sea bass.

SBS - Structural Business Statistics.

seg. - Segment.

SF - Statistic Finland.

SGECA - STECF's SubGroup on Economic Affairs.

SMEs - small and medium-sized enterprises.

SOFIA – FAO's State of World Fisheries and Aquaculture.

spp. - species.

STECF - Scientific, Technical and Economic Committee for Fisheries.

SVN – Slovenia.

SWE – Sweden.

TAC - Total Allowable Catch, from wild-capture fisheries.

ToRs - Terms of Reference.

TSG - Traditional Specificity Guaranteed.

UK - The United Kingdom.

USBI - *Unione Spirulina Biologica Italiana* (in Italian). Italian Biologic Spirulina Union.

USD - US dollars currency.

VAPs - Value-Added Products.

VARS - Veterinary Administration of the Republic of Slovenia.

VAT - Value added tax.

ZMR-2 - Slovenia's Marine Fisheries Act.

ZON - Slovenia's Nature Conservation Act.

ZV - Slovenia's Water Act.

Zvet - Slovenia's Veterinary Service Act.

ZVO - Slovenia's Environment Protection Act.

ZŽiv - Slovenia's Livestock-breeding Act.

8 GLOSSARY

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).

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.

$$\text{Mean wage} = (\text{Wages and salaries} + \text{Imputed value of unpaid labour}) / \text{FTE}$$

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:

$$\text{GVA} = \text{Turnover} + \text{Other Income} - \text{Energy costs} - \text{Livestock costs} - \text{Feed costs} - \text{Repair and maintenance} - \text{Other Operational costs}.$$

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.

$$\text{GVA to Revenue} = \frac{\text{GVA}}{\text{Turnover} + \text{Other Income}} 100\%$$

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.

$$\text{Net profit} = \text{EBIT} - \text{Financial\_costs\_net}$$

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.

$$\text{Net profit margin} = \frac{\text{Net profit}}{\text{Total Income}} 100\%$$

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.

$$\text{ROI} = \frac{\text{EBIT}}{\text{Total\_Value\_of\_Assets}} * 100\%$$

Running Cost to Turnover Ratio (in %):

This indicator shows how much of the turnover (income) is consumed by production costs.

$$\text{Running cost to turnover ratio} = (\text{Energy costs} + \text{Wages and salaries} + \text{Livestock costs} + \text{Feed costs} + \text{Repair and maintenance} + \text{Other Operational costs}) \times 100 / \text{Turnover}$$

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.

$$\text{EBIT to Revenue} = \frac{\text{EBIT}}{\text{Turnover} + \text{Other Income}} * 100\%$$

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 2022-21:

The indicator of the relative change in corresponding indicators compared to the previous year. Expressed in percentage, calculated as following:

$$Change\ 2022 - 21 = \frac{(X_{2022} - X_{2021})}{X_{2021}} * 100\%$$

Parameters requested under the EU-MAP

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).

Indicators calculated under the EU-MAP

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 EU-MAP, the indicator is calculated as follows:

Mean wage = (Wages and salaries + Imputed value of unpaid labour) / (Persons employed FTE + Unpaid labour FTE)

$$\text{Mean wage} = \frac{\text{Wages and salaries} + \text{Imputed value of unpaid labour}}{\text{Persons employed FTE} + \text{Unpaid labour FTE}}$$

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 (SBS).

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 EU-MAP, the indicator is calculated as follows:

$$\text{GVA} = \text{Gross sales (total)} + \text{Other Income} - \text{Energy costs} - \text{Livestock costs} - \text{Feed costs} - \text{Repair and maintenance} - \text{Other Operational costs}.$$

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 EU-MAP, Gross Value Added is calculated as under the DCF:

$$\text{GVA to Revenue} = \frac{\text{GVA}}{\text{Turnover} + \text{Other Income}} 100\%$$

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 EU-MAP, the indicator is calculated as follows:

$$\text{EBIT} = \text{Turnover} + \text{Other Income} + \text{Operating Subsidies} + \text{Subsidies on Investments} - \text{Energy costs} - \text{Wages and salaries} - \text{Imputed value of unpaid labour} - \text{Livestock costs} - \text{Feed costs} - \text{Repair and maintenance} - \text{Other Operational costs} - \text{Consumption of fixed capital}.$$

Net profit:

"Net profit" is a measure of a firm's profitability that includes the results of financial activity of the enterprise. Under the EU-MAP, the indicator is calculated as follows:

$$\text{Net profit} = \text{EBIT} - (\text{Financial Expenditure} - \text{Financial Income})$$

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 EU-MAP, the indicator is calculated as follows:

$$\text{Net profit margin} = \frac{\text{Net profit}}{\text{Turnover} + \text{Other Income} + \text{Operating Subsidies} + \text{Subsidies on Investments}} 100\%$$

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 EU-MAP, 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 EU-MAP, 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 EU-MAP, 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 EU-MAP, 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 EU-MAP, 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 EU-MAP, the indicator is calculated as follows:

$$FEI = \frac{(Net\_investment - Consumption\ of\ fixed\ capital)}{Total\_value\_of\_assets} * 100\%$$

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12 LIST OF BACKGROUND DOCUMENTS

Background documents are published on the EWG-24-14 meeting's web site on:

<https://stecf.jrc.ec.europa.eu/ewg2414>

EWG-24-14 – Declarations of invited and JRC experts (see also Annex 6 of this report – List of participants)

Member States Annual Report on the National Data Collection Programmes

<http://datacollection.jrc.ec.europa.eu/ars>

Data-handling procedure for STECF Expert Working Groups

<http://datacollection.jrc.ec.europa.eu>

List of Electronic Annexes

Electronic annexes are published on the meeting's web site on:

https://stecf.ec.europa.eu/reports/economic-and-social-analyses_en

List of electronic annexes documents:

EWG-24-14 – Annex 1 - STECF 24-14 - EU Aquaculture economics report.

13 ANNEX

Annex I Terms of Reference for STECF EWG-24-14

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 25 experts, 5 observers from 20 countries and 3 JRC experts.

Following the latest call for economic data on the EU aquaculture, EWG 24-14 is requested to analyse and comment on the economic performance of the EU and national aquaculture sectors between 2017 and 2022.

In 2024, the special chapters contain:

- An overview of economic indicators provided in the reports and their interpretation related to the economic sustainability of the EU aquaculture sector.
- A third attempt to provide a nowcast using publicly available data and knowledge provided by the expert group

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 2024 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 2021 and 2022 (2023 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 **the scientists' expert analysis and assessment of** the drivers of the economic performance and other aspects of policy relevance. The main objective of the report is **to present high-quality interpretation of all data outputs** to ensure the usefulness for DG MARE's policy development, Member States and the industry. Among other, 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 and Aquaculture Fund support, contribution to the local communities and the Blue Economy, strengths, weaknesses, opportunities and threats.

The main socio-economic **indicators should**, to the extent possible, **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 obtain 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 winter 2024.

Structure and content

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

- An **overview of the economic performance of the EU aquaculture sector**. This should include the drivers and main trends based on expert knowledge, taking into account the exceptional economic shocks in the period 2020-2022. 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 subsectors (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 subsector (marine finfish, marine shellfish, freshwater) and species.
 - Highlights of the economic sustainability chapter.
 - 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 experts should use their expert knowledge to provide an indication about the main consequences of the COVID-19 pandemic, high energy prices due to Russian invasion of Ukraine and the recovery path in the EU aquaculture sector.

- **Special topic on nowcast:**

Following up on the previous Economic report, a nowcasting exercise will be included a special topic. This should bring the report more up to date, since data series will be only available up to 2022 or, in a few cases, up to 2023.

- **Special topic on economic sustainability:**

The EWG is requested to develop a short new section of the report that focuses on the economic sustainability of the EU aquaculture sector. This should include the use of economic sustainability indicators. The experts should use their knowledge to provide an analysis of the period 2017-2022 showing how these economic sustainability indicators evolved, analysing the sector's economic sustainability and consider nowcast, if possible (2023).

- **Annexes**

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

Streamlining of the report and data issues

After seven reports that expanded over time, the structure and content of the report should be streamlined. 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 six years should appear in the time series tables (both for the EU overview and the national chapters, 2017-2022). **The workbook(s)** accompanying the report **should still include the whole database** with all years in the time-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. **Experts should provide a forward looking spin to the report** about their knowledge about the developments in the sectors throughout 2022, 2023 and 2024.

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 water aquaculture was 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 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.

Background

The EWG 18-19 report (STECF, 2018) was the first time that an exercise of imputation was undertaken 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 stated 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 that 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. The EWG 22 17 and EWG 24 14 TORs highlighted again that *“imputation of missing values may be required to obtained coherent time series and indicators that reflect a robust estimate of EU aggregates.”*

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 24 14, that is based on the methodologies applied for the construction of the overall EU trends in the previous EU Aquaculture Sector reports (STECF, 2018, 2020, 2022), 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 previous Economic Aquaculture EWGs 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 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.

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 EU-MAP. Where there are data gaps, the most recent reporting year was adjusted based on the percentage change in FAO production data.

$$(1) \quad TSV_{est}^n = TSV_{EUMAP}^{n-1} \cdot \left(\frac{Production_{FAO}^n}{Production_{FAO}^{n-1}} \right)$$

Where:

TSV = Total sales volume

Production = Total production in quantities

n = year n

n-1 = year n-1

est = estimated value

EU-MAP = data from 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.

$$(2) \quad TSV_{est}^n = Production_{FAO}^n$$

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 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.

$$(3) \quad Turnover_{est}^n = Turnover_{EU-MAP}^{n-1} \cdot \left(\frac{Value_{FAO}^n}{Value_{FAO}^{n-1}} \right)$$

Where:

Turnover = Turnover

Value = Value of production

n = year n

n-1 = year n-1

est = estimated value

EU-MAP = data from 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.

$$(4) \quad Turnover_{est}^n = Value_{FAO}^n$$

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 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.

$$(5) \quad Enterprise_{est}^n = Enterprise_{EU-MAP}^{n-1}$$

Where:

Enterprise = Number of enterprises

n = year *n*

n-1 = year *n-1*

est = estimated value

EU-MAP = data from 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 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 2018 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').

$$(6) \quad Employment_{est}^n = Employment_{EU-MAP}^{n-1} * \left(1 + \frac{\left(\frac{Turnover_{EU-MAP}^n}{Turnover_{EU-MAP}^{n-1}} - 1\right)}{2}\right)$$

Where:

Employment = Total number of employees

Turnover = Turnover

n = year *n*

n-1 = year *n-1*

est = estimated

EU-MAP = data from EU-MAP

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 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.

$$(7) \quad FTE_{est}^n = Employment_{est}^n \cdot \left(\frac{FTE_{MS}^n}{Employment_{MS}^n} \right)$$

Where:

Employment = Total number of employees,

FTE = FTE,

n = year *n*,

est = estimated value,

MS = total MS data from EU-MAP

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 the nowcast exercise for EU Aquaculture Sector report are “Total weight of sales”, “Gross sales”, and employment measured both through the “Total employees” and “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 2022 and 2023.

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, $t = 2022$, $t+1 = 2023$ and $t+2 = 2024$.

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). 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:

$$A_{est}^{t+1} = A_{EU-MAP}^t * \left(1 + \left(\frac{B^{t+1} - B^t}{B^t} \right) \right)$$
$$A_{est}^{t+2} = A_{est}^{t+1} * \left(1 + \left(\frac{B^{t+2} - B^{t+1}}{B^{t+1}} \right) \right)$$

Where:

A = explained variable

B = explanatory variable

t = year t

$t+1$ = year $t+1$

$t+2$ = year $t+2$

est = estimated value

EU-MAP = data from EU-MAP

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).

Total weight of sales

The total weight of sales (TWS) in 2023 is estimated by adjusting the 2022 EU-MAP data with the grow rate experimented by sales (volume) between 2022 and 2023 according to the variable B. Total sales in 2024 is estimated by adjusting the TWS estimated in 2023 with the increase/decrease experimented by sales (volume) between 2023 and 2024 according to indicator B. If any country has provided their data for 2023 in the EU-MAP, 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
 EU-MAP = data from EU-MAP
 B= proxy variable selected

Gross sales

Gross sales in 2023 is estimated by adjusting the 2022 EU-MAP data with the grow rate experimented by variable B between 2022 and 2023. The value of the production in 2024 is estimated by adjusting the gross sales estimated in 2023 with the increase/decrease experimented by variable B between 2023 and 2024. If any country has provided their data for 2023 in the EU-MAP, this data is used instead of the estimate described below.

$$GS_{est}^{t+1} = GS_{EUMAP}^t * \left(1 + \left(\frac{B^{t+1} - B^t}{B^t} \right) \right)$$

$$GS_{est}^{t+2} = GS_{est}^{t+1} * \left(1 + \left(\frac{B^{t+2} - B^{t+1}}{B^{t+1}} \right) \right)$$

Where:

GS = Gross sales
 est = estimated value
 EU-MAP = data from EU MAP
 B= proxy variable selected

Employment

Employment in 2023 is estimated by adjusting the 2022 EU-MAP data with the grow rate experimented by Persons employed between 2022 and 2023 according to the explanatory variable B. Employment in 2024 is estimated by adjusting the employment estimated in 2023 with the increase/decrease experimented by B between 2023 and 2024. If any country has provided their employment data for 2023 in the EU-MAP, this data is used instead of the estimate described below.

$$PE_{est}^{t+1} = PE_{EUMAP}^t * \left(1 + \left(\frac{B^{t+1} - B^t}{B^t} \right) \right)$$

$$PE_{est}^{t+2} = PE_{est}^{t+1} * \left(1 + \left(\frac{B^{t+2} - B^{t+1}}{B^{t+1}} \right) \right)$$

$$FTE_{est}^{t+1} = FTE_{EUMAP}^t * \left(1 + \left(\frac{B^{t+1} - B^t}{B^t} \right) \right)$$

$$FTE_{est}^{t+2} = FTE_{est}^{t+1} * \left(1 + \left(\frac{B^{t+2} - B^{t+1}}{B^{t+1}} \right) \right)$$

Where:

PE = Persons employed

FTE = Persons employed FTE

est = estimated value

EU-MAP = data from EU-MAP

B= proxy variable selected

Annex IV Social variables

The social variables that should be collected for the aquaculture enterprises are gender, age, education, nationality and employment status. In Table 1, the countries reporting the variables for the period 2020 to 2022 is listed.

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 the year 2017 until further experience has been gained from both end users and experts. Thus, in 2020 and again in 2023 all Member States must collect and report data.

During the EWG 24-14 meeting, the available social data, including the data from the 2024 aquaculture data call were reviewed. It was concluded that, based on the national work plans of the Member States, the majority were not obligated to report social data during this data call. Consequently, the EWG recognized that data availability was limited. However, the group proceeded to assess the accessible social data and identified potential issues. These findings have been documented to inform MS on respective areas for improvement, to be addressed ahead of the next data call. This overview can serve as a tool for improvement helping all MS to enhance data quality and comprehensiveness.

List of potential issues:

- Total values are not matching for all variables; ESP (2021), PRT (2020), LVA employment status (2023), ROU (2020, 2021, 2022), SVN gender (2020), SWE (2020, 2021, 2022).
- Several countries continue to report employment with decimal numbers. Unlike the full-time equivalent, this is not considered normal for the total employees; ESP, NDL, PRT.
- Big discrepancies between the data from different years; BEL, NDL.
- ROU included in the AGE column not only age classes, but also other characters and values.
- Values are matching, but they are very high (probably duplicated); GRC (2020).

Table 99. Overview of social data available for 2020 to 2022 by Member State.

Country	Year	Gender	Age	Education	Nationality	Employment Status
BEL	2020	38	-	38	-	-
BEL	2021	101	-	101	-	-
BEL	2022	120	-	120	-	-
BGR	2020	1072	1072	1072	1072	1072
BGR	2021	1503	1503	1503	1503	1503
BGR	2022	1518	1518	1518	1518	1518
CZE	2020	2188	2188	2188	2188	2168
DEU	2020	1750	1752	1754	1749	1760
DNK	2020	585	585	585	585	585
ESP	2020	12477.8	12477.8	12477.8	12477.8	12477.8
ESP	2021	11363.7	11363.7	11744	11363.8	11396.7

ESP	2022	10253.6	10253.6	10253.6	10253.6	10253.6
FIN	2020	485	483	485	485	485
FIN	2021	533	533	532	533	533
FIN	2022	536	535	535	536	536
FRA	2020	20424	-	-	-	-
FRA	2021	17539	-	-	-	-
FRA	2022	19607	-	-	-	-
GRC	2020	15772	15772	15772	15772	15772
GRC	2022	4503	4503	4503	4503	4503
HRV	2020	1283	1283	1283	1283	1283
HRV	2022	1662	1662	1662	1662	1662
HUN	2020	442	442	442	442	442
HUN	2021	498	498	498	498	498
IRL	2020	1848	1846	1847	1846	1849
IRL	2022	1998	2003	1998	1998	1998
ITA	2020	4351	4351	4351	4351	4351
LVA	2020	330	330	330	330	347
LVA	2023	310	310	310	310	641
MLT	2020	410	410	410	410	410
MLT	2021	370	370	370	370	368
MLT	2022	370	395	395	395	371
NDL	2020	170.38	170.38	170.38	170.38	170.38
NDL	2021	40.14	40.14	40.14	40.14	40.14
NDL	2022	9.44	9.44	9.44	9.44	9.44
POL	2021	3567	3567	3566	3566	3566
POL	2022	3649	3649	3648	3649	3649
PRT	2020	1816.19	1610.77	1615.02	1627.77	1926.75
ROU	2020	2054	2054	121	4	2049
ROU	2021	2274	2274	621	69	2274
ROU	2022	1956	1956	538	44	1956
SVN	2020	55.6	30	30	30	30
SWE	2020	499	492	512	426	499
SWE	2021	531	461	475	368	497
SWE	2022	383	367	377	338	416

Annex V Data coverage and quality

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 2021 and 2022; while previous years (2008-2020) 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 2018-2020, in accordance within their National Data Collection programs, had to be provided under the provisions of Regulation 2017/1004 (i.e., EU-MAP).

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 10 of the Commission Delegated Decision (EU) 2021/1167 under EU-MAP) for 2021 and 2022. In particular, we ask for the following variables: Income (gross total sales, operating subsidies, Subsidies on investments and other income), Operating costs (Wages and salaries of staff and value of unpaid labour, Energy costs, livestock costs, feed costs, Repair and maintenance costs, Other operating costs), Capital costs (consumption of fixed capital), Investments in tangible assets (net purchase of assets), Financial position (Capital value and Gross debt), Financial results (Financial income and Financial expenses), Raw material weight (livestock and feed used), Weight of sales, Employment (Paid labour, unpaid labour, Total FTE, Number of hours worked by employees and unpaid labour) and Number of enterprises pertaining to the EU aquaculture sector. Turnover and volume of sales need to be detailed by species.

Furthermore, Member States were requested to report social variables as specified under their national Work Plans. The tables in the annex provide an overview of the requested variables and units.

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 ninth call for data on aquaculture. Although there is a continuous improvement in the overall data quality compared to the previous calls, there are still some issues that prevent to have full coverage by Member States. The main reason for this lack of full coverage is the existence of thresholds to submit the aquaculture data on the Commission implementing decision (EU) 2016/1251, which lead to reduced coverage in some Member States compared to previous data calls under the DCF.

Under the DCF and EU-MAP, previous to the Commission Delegated Decision (EU) 2021/1167, the submission of marine aquaculture data was compulsory, while the submission of inland freshwater aquaculture data was voluntary. With the Commission Delegated Decision (EU) 2021/1167, it is compulsory the reporting of all aquaculture activities not falling below the threshold.

The production in Belgium, Estonia, Hungary, Lithuania, and Slovakia is very low and below the threshold set in the regulation, so they did not submit data or data was partial.

France and Italy submitted data for 2021 and 2022 on most of their aquaculture production, but not for all of their production. For France, 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).

The data coverage by country and variable is presented in the Table 100. The table is showing partially missing data by country and on the National total level.

Table 100. Coverage of the data provided during the data calls at National total level 2017-2022 (Y = submitted).

	2017	2018	2019	2020	2021	2022
Austria						
Belgium			Y	Y	Y	Y
Bulgaria	Y	Y	Y	Y	Y	Y
Croatia	Y	Y	Y	Y		
Cyprus					Y	Y
Czechia	Y	Y	Y	Y	Y	Y
Denmark	Y	Y	Y	Y	Y	Y
Estonia	Data not reported because of thresholds					
Finland	Y	Y	Y	Y	Y	Y
France	Y	Y	Y	Y	Y	Y
Germany	Y	Y	Y	Y	Y	Y
Greece	Y	Y	Y	Y	Y	Y
Hungary	Y	Y			Y	
Ireland	Y	Y	Y	Y	Y	Y
Italy	Y	Y	Y	Y	Y	Y
Latvia	Y	Y	Y	Y	Y	Y
Lithuania						
Luxembourg						
Malta					Y	Y
Poland	Data not reported because of thresholds for marine production					
Portugal	Y	Y	Y	Y	Y	Y
Romania	Y	Y	Y	Y	Y	Y
Slovakia	Y	Y	Y			
Slovenia	Y	Y	Y	Y	Y	Y
Spain	Y	Y			Y	Y
Sweden	Y	Y	Y	Y	Y	Y

Source: Own elaboration based on MS submitted data

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:

- Some Romanian data were considered improbable by the EWG, and so not considered in the EU overview sections.
- Italy FTE data were also considered improbable by the EWG, and so not considered in the EU overview sections.
- Slovenia and the Netherlands only reported marine aquaculture production, not freshwater aquaculture.
- Some countries report inconsistent feed and livestock volumes and costs. So it was not possible to estimate the evolution of feed and livestock prices for all segments in all countries.
- These and other data issues are further detailed under the data issues in each national chapter.

EWG 24-14 noticed the following issues related to the social data:

- Total values are not matching for all variables; ESP (2021), PRT (2020), LVA employment status (2023), ROU (2020, 2021, 2022), SVN gender (2020), SWE (2020, 2021, 2022).
- Several countries continue to report employment with decimal numbers. Unlike the full-time equivalent, this is not considered normal for the total employees; ESP, NDL, PRT.
- Big discrepancies between the data from different years; BEL, NDL.
- ROU included in the AGE column not only age classes, but also other characters and values.
- Values are matching, but they are very high (probably duplicated); GRC (2020).

Annex VI Contact Details of EWG 24-14 Participants

The 2024 aquaculture economic report has been produced by a working group of economic experts convened under the Scientific, Technical and Economic Committee for Fisheries (STECF), which took place virtually from the 21 to the 25 of October (EWG 24-14). The group consisted of independent experts from within the EU and experts from the European Commission's Research Centre (JRC).

¹ - Information on EWG participant's affiliations is displayed for information only. In any case, Members of the STECF, invited experts, and JRC experts shall act independently. In the context of the STECF work, the committee members and other experts do not represent the institutions/bodies they are affiliated to in their daily jobs. STECF members and experts also declare at each meeting of the STECF and of its Expert Working Groups any specific interest which might be considered prejudicial to their independence in relation to specific items on the agenda. These declarations are displayed on the public meeting's website if experts explicitly authorized the JRC to do so in accordance with EU legislation on the protection of personnel data. For more information: <http://stecf.jrc.ec.europa.eu/adm-declarations>

STECF Members		
Name	Affiliation ¹	Email
NIELSEN, Rasmus	University of Copenhagen. Denmark.	rn@ifro.ku.dk

Invited experts		
Name	Affiliation ¹	Email
AVDIC MRAVLJE, Edvard	Fisheries research institute of Slovenia. Slovenia	edoavdic@gmail.com
BARRELET, Johna	Johann Heinrich von Thünen-Institut für Seefischerei. Germany.	johna.barrelet@thuenen.de
CARPENTER, Griffin	Griffin Carpenter. Belgium.	griffincarpenter@gmail.com
COZZOLINO, Maria	Nisea. Italy.	cozzolino@nisea.eu
DANATSKOS, Christos	ELGO Demeter- Fisheries Research Institute. Greece.	cdanatskos@elgo.gr
DAVIDJUKA, Irina	Independent expert. Latvia.	irina.davidiuk@inbox.lv
DENNIS, John	BIM. Ireland.	john.dennis@bim.ie
FERNANDEZ POLANCO, Jose Manuel	Universidad De Cantabria. Spain.	polancoj@unican.es
FERNÁNDEZ-GONZÁLEZ, Raquel	University of Vigo. Spain.	raquelf@uvigo.es

HANNON, Colin	Atlantic Technological University. Ireland.	hannon.colin@gmail.com
HOEKSTRA, Geert	Wageningen Economic Research. Netherlands.	geert.hoekstra@wur.nl
IOANNOU, Myrto	Department of Fisheries and Marine Research. Cyprus.	mioannou@dfmr.moa.gov.cy
KAZLAUSKAS, Edvardas	Agriculture Data Center. Lithuania.	edvardas.kazlauskas@gmail.com
KIELISZEWSKA, Małgorzata	Ministry of Agriculture and Rural Development. Poland.	malgorzata.kieliszewska@minrol.gov.pl
KREISS, Cornelia	Thünen Institute of Fisheries Ecology. Germany.	cornelia.kreiss@thuenen.de
LLORENTE GARCIA, Ignacio (chair)	Universidad de Cantabria. Spain.	ignacio.llorente@unican.es
MORINEAU, Baptiste	University of Nantes. France.	baptiste.morineau@univ-nantes.fr
MYTLEWSKI, Adam	National Marine Fisheries Research Institute. Poland.	amytlewski@mir.gdynia.pl
NICHEVA, Simona	Executive agency for fisheries and aquaculture. Bulgaria.	simona.nicheva@iara.government.bg
PENNER, Johan	Swedish Board of Agriculture. Sweden.	johan.penner@jordbruksverket.se
SCHKEEPR, Caroline	University of Nantes. France.	caroline.schkeeeper@univ-nantes.fr
SCIBERRAS, Andrew	Independent expert. Malta.	andrew.sciberras95@gmail.com
VALVE, Joonas	Natural Resources Institute Finland . Finland.	joonas.valve@luke.fi
VIŠNIĆ NOVAKOVIĆ, Svjetlana	Ministry of Agriculture. Croatia.	svjetlana.visnic@gmail.com

JRC experts		
Name	Affiliation ¹	Email
CONTINI, Franca	Joint Research Centre (JRC). European Commission. Italy.	franca.contini@ext.ec.europa.eu
GUILLEN, Jordi	Joint Research Centre (JRC). European Commission. Italy.	jordi.guillen@ec.europa.eu

VIRTANEN, Jarno	Joint Research Centre (JRC). European Commission. Italy.	jarno.virtanen@ec.europa.eu

European Commission		
Name	Affiliation ¹	Email
PETRUCO, Giacomo (DG MARE focal point)	DG MARE (Maritime Affairs and Fisheries). Brussels, Belgium.	Giacomo.Petrucchi1@ec.europa.eu

Observers		
Name	Affiliation ¹	Email
CANO, Suzana	Direção Geral de Recursos Naturais, Segurança e Serviços Marítimos. Portugal.	sfcano@dgrm.mm.gov.pt
FERREIRA, Ines	DGRM . Portugal.	ifferreira@dgrm.mm.gov.pt
REIS SANTOS, Pedro	Market Advisory Council. Belgium.	secretary@marketac.eu

Annex VII Contact details of STECF members

¹ - Information on STECF members' affiliations is displayed for information only. In any case, Members of the STECF shall act independently. In the context of the STECF work, the committee members do not represent the institutions/bodies they are affiliated to in their daily jobs. STECF members also declare at each meeting of the STECF and of its Expert Working Groups any specific interest which might be considered prejudicial to their independence in relation to specific items on the agenda. These declarations are displayed on the public meeting's website if experts explicitly authorized the JRC to do so in accordance with EU legislation on the protection of personnel data. For more information: <http://stecf.jrc.ec.europa.eu/adm-declarations>

Name	Affiliation ¹	Email
Francois BASTARDIE	Technical University of Denmark, National Institute of Aquatic Resources (DTU-AQUA), Kemitorvet, 2800 Kgs. Lyngby, Denmark	fba@aqua.dtu.dk
Lisa BORGES	FishFix, Lisbon, Portugal	info@fishfix.eu
John CASEY	Independent consultant	blindlemoncasey@gmail.com
Georgi DASKALOV	Labouratory of Marine Ecology, Institute of Biodiversity and Ecosystem Research, Bulgarian Academy of Sciences	Georgi.m.daskalov@gmail.com
Ralf DÖRING	Thünen Institute [TI-SF] Federal Research Institute for Rural Areas, Forestry and Fisheries, Institute of Sea Fisheries, Economic analyses Herwigstrasse 31, D-27572 Bremerhaven, Germany	ralf.doering@thuenen.de
Hilaire DROUINEAU	Inrae, France	hilaire.drouineau@inrae.fr
Leyre GOTI ARALUCEA	Thünen Institute of Sea Fisheries - Research Unit Fisheries Economics, Herwigstrasse 31, D-27572 Bremerhaven, Germany	leyre.goti@thuenen.de
Fabio GRATI	National Research Council (CNR) – Institute for Biological Resources and Marine Biotechnologies (IRBIM), L.go Fiera della Pesca, 2, 60125, Ancona, Italy	fabio.grati@cnr.it
Katell HAMON	Wageningen Economic Research, The Netherlands	katell.hamon@wur.nl
Leire IBAIBARRIAGA	AZTI. Marine Research Unit. Txatxarramendi Ugarteia z/g. E-48395 Sukarrieta, Bizkaia. Spain.	libaibarriaga@azti.es
Ernesto JARDIM	Independent expert	ernesto.jardim@gmail.com

Name	Affiliation ¹	Email
Armelle JUNG	DRDH, Techonopôle Brest-Iroise, BLP 15 rue Dumont d'Urville, Plouzane, France	<a href="mailto:armelle.jung@desrequinsetde
shommes.org">armelle.jung@desrequinsetde shommes.org
Alessandro LIGAS	CIBM Consorzio per il Centro Interuniversitario di Biologia Marina ed Ecologia Applicata "G. Bacci", Viale N. Sauro 4, 57128 Livorno, Italy	ligas@cibm.it ; ale.ligas76@gmail.com
Alessandro MANNINI	CNR IRBIM Ancona, Largo Fiera della Pesca, 260125 Ancona ITALY	<a href="mailto:alessandro.mannini@irbim.cn
r.it">alessandro.mannini@irbim.cn r.it
Paloma MARTIN	CSIC Instituto de Ciencias del Mar, Passeig Marítim, 37-49, 08003 Barcelona, Spain	paloma@icm.csic.es
Arina MOTOVA -SURMAVA	Sea Fish Industry Authority, 18 Logie Mill, Logie Green Road, Edinburgh EH7 4HS, U.K	arina.motova@seafish.co.uk
Claire MOORE	Marine Institute, Ireland	claire.moore@marine.ie
Rasmus NIELSEN	University of Copenhagen, Section for Environment and Natural Resources, Rolighedsvej 23, 1958 Frederiksberg C, Denmark	rn@ifro.ku.dk
Sofie NIMMEGEERS	Flanders research institute for agriculture, fisheries and food, Belgium	<a href="mailto:Sofie.Nimmegeers@ilvo.vlaan
deren.be">Sofie.Nimmegeers@ilvo.vlaan deren.be
Jenny NORD (chair)	Independent consultant	nordjenny@hotmail.com
Cecilia PINTO (vice-chair)	Università di Genova, DISTAV - Dipartimento di Scienze della Terra, dell'Ambiente e della Vita, Corso Europa 26, 16132 Genova, Italy	cecilia.pinto@edu.unige.it
Raúl PRELLEZO (vice-chair)	AZTI -Unidad de Investigación Marina, Txatxarramendi Ugarte a z/g 48395 Sukarrieta (Bizkaia), Spain	rprellezo@azti.es
Tiit RAID	Estonian Marine Institute, University of Tartu, Mäealuse 14, Tallin, EE-126, Estonia	Tiit.raid@gmail.com
Evelina Carmen SABATELLA	National Research Council (CNR) – Institute for Research on Population and Social Policies (IRPPS), Corso S. Vincenzo Ferreri, 12, 84084 Fisciano, Salerno, Italy	evelina.sabatella@cnr.it
Paz SAMPEDRO	Spanish Institute of Oceanography, Center of A Coruña, Paseo Alcalde Francisco Vázquez, 10, 15001 A Coruña, Spain	paz.sampedro@ieo.csic.es

Name	Affiliation ¹	Email
Stylianos SOMARAKIS	Institute of Marine Biological Resources and Inland Waters (IMBRIW), Hellenic Centre of Marine Research (HCMR), Thalassocosmos Gournes, P.O. Box 2214, Heraklion 71003, Crete, Greece	somarak@hcmr.gr
Christoph STRANSKY	Thünen Institute [TI-SF] Federal Research Institute for Rural Areas, Forestry and Fisheries, Institute of Sea Fisheries, Herwigstrasse 31, D-27572 Bremerhaven, Germany	christoph.stransky@thuenen.de
Clara ULRICH	IFREMER, France	Clara.Ulrich@ifremer.fr
Andres URIARTE	Independent expert	auriartes@hotmail.com
Daniel VALENTINSSON	Swedish University of Agricultural Sciences (SLU), Department of Aquatic Resources, Turistgatan 5, SE-45330, Lysekil, Sweden	daniel.valentinsson@slu.se
Luc VAN HOOFF	Wageningen Marine Research Haringkade 1, IJmuiden, The Netherlands	Luc.vanhoof@wur.nl
Francisco VELASCO GUEVARA	Spanish Institute of Oceanography - National Research Council, Spain	francisco.velasco@ieo.csic.es
Nedo VRGOC	Institute of Oceanography and Fisheries, Split, Setaliste Ivana Mestrovica 63, 21000 Split, Croatia	vrgoc@izor.hr

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