Our Fish

Empowering EU Fisheries Policy to Restore Marine Health, Tackle Climate Change and Create Jobs

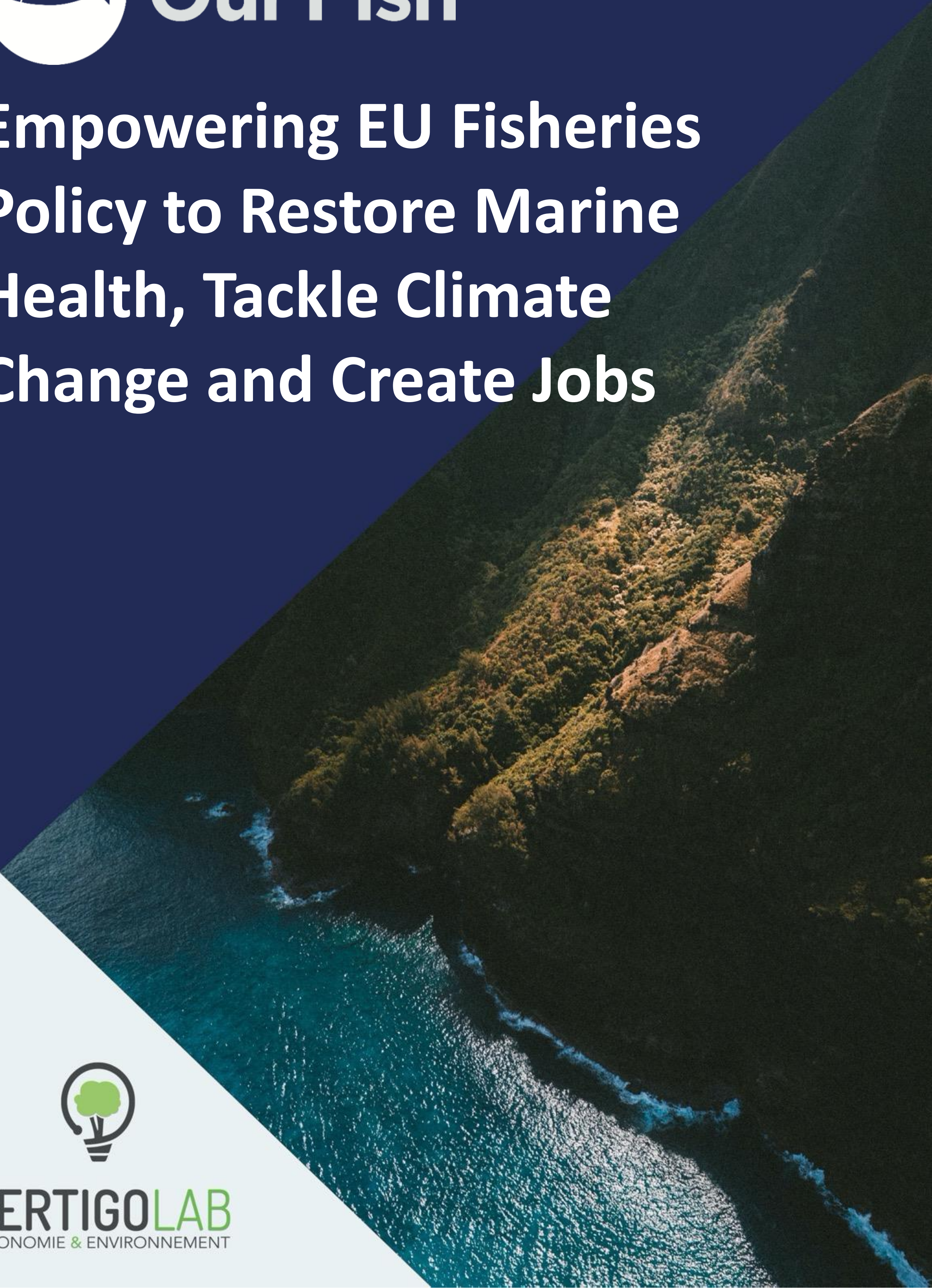

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TABLE OF CONTENTS

FIGURES

TABLES

EXECUTIVE SUMMARY

The European Union's common fisheries policy primarily aims to ensure the sustainability of fisheries and to guarantee stable income and jobs for fishermen. This mission is reflected in the management of the impact of fisheries on fish stocks through the establishment of Total Allowable Catches (TAC) that determine the number of landings that can be made in a year. These TACs are allocated among member countries, then within these countries among fishers.

To reduce the environmental impacts of fisheries, fishing ought to be guided towards low impact fishing practices, whilst securing jobs in the sector. This balancing act requires looking at socioeconomic impacts of incorporating environmental and social criteria in quota allocation.

Through case studies, this analysis investigated the socioeconomic impacts of environmentally driven reallocation scenarios. The focus was on two fisheries, haddock in France and Ireland, and plaice in Poland, Germany, Sweden, and Denmark. The results investigate how favouring artisanal fleets equipped with passive gears would impact the sector's revenues, contribution to GDP through added value, and number of jobs.

Using a peer-reviewed method based on input-output models, Vertigo Lab computed the socioeconomic impacts of specific fishing activities at the European Union level. The indicators of interest were jobs, gross added value which indicated the sector's contribution to the European Gross Domestic Product (GDP), and turnover which is the sum of revenues generated by the sector. The method not only evaluated the direct impacts generated by the sector, but also the indirect impacts and the induced impacts.

Two scenarios are analysed. The first scenario assesses the transfer of 50% of the quota from vessels equipped with active gears to vessels equipped with passive gears of the same size. The second scenario looks at the impacts of transferring 50% of the quota from vessels equipped with active gears to smaller vessels equipped with passive gears. In the second case, there is the double impact of favouring more artisanal fisheries *and* passive gears.

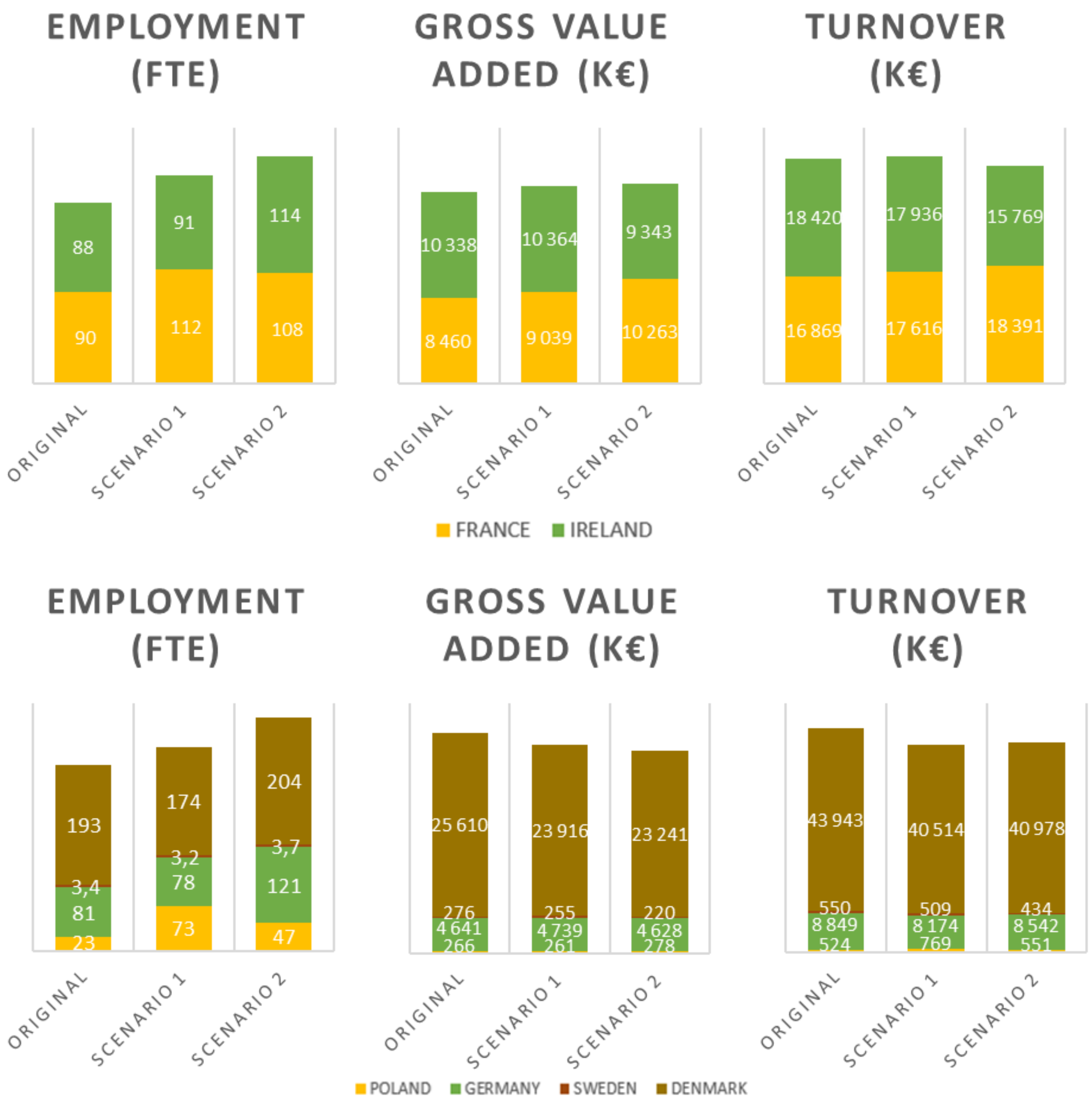
Results, as addressed by Figure 1, demonstrate that **quota reallocations to semi-industrial and artisanal fleets lead to job creation** across all fisheries, which is consistent as both scenarios favour job intensive fishing techniques. In haddock fishing, scenario 1 generates a 14% increase in number of jobs, whilst the increase is 25% for scenario 2. Similarly, for plaice fishing, scenario 1 generates a 9% increase and scenario 2 a 25% increase in the sector's number of jobs.

The value added generated by haddock fishing increases by 3% with scenario 1 and by 4% with scenario 2. For plaice fishing, the respective decrease is by 5% and 8%, mainly located in Denmark. Scenarios are positive for GDP contribution in the haddock fishing sector, whilst negative for plaice fishing although the impacts are mainly located in Denmark. Furthermore, haddock fishing, quota reallocation **leads to fewer wealth leakages and therefore more wealth retention within the European Union.** For plaice fishing, wealth leakages remain stable.

The revenue generated by haddock fishing increases by 1% with scenario 1 and decreases by 3% with scenario 2. The latter decrease is observed in Ireland. For plaice fishing, the respective decreases are 7% and 6%, mainly located in Denmark. The lower revenue stream is generated by lower prices of haddock and plaice fished by fleets equipped with passive gears. **The turnover downturn could be solved by reevaluating positively the prices of fish sold by smaller fleets equipped with passive gears.**

Overall, the method provides an opportunity to fine tune and optimize quota reallocation across the European Union member states to balance lowering environmental impacts and maximizing socioeconomic benefits.

Figure 1. Haddock fishing in the Celtic Sea total impacts for employment (FTE), gross value added (k€), and turnover (k€) before and after applying the environmentally driven quota reallocation scenarios in both France and Ireland (top). Plaice fishing in the Baltic Sea total impacts for employment (FTE), gross value added (k€), and turnover (k€) before and after applying the environmentally driven quota reallocation scenarios in Poland, Germany, Sweden, and Denmark (bottom). Scenario 1: Transfer 50% of the quota from vessels equipped with active gears to vessels equipped with passive gears of the same size. Scenario 2: Transfer 50% of the quota from vessels equipped with active gears to smaller vessels equipped with passive gears.



1. INTRODUCTION

The European Union's Common Fisheries Policy (CFP) primarily aims to ensure the sustainability of fisheries and to guarantee stable income and jobs for fishermen. This mission is reflected in particular in the management of the impact of fisheries on fish stocks through the establishment of Total Allowable Catches (TAC) that determine the volumes of fish that can be caught in a year. These TACs are then allocated among Member States, then within each country among producers according to their past fishing activities. The latter are established according to the average catch for each producer during the reference years of 2001, 2002 and 2003.

The current allocation of fishing quotas by the Member States does not allow fishing opportunities to be guided towards practices with a lower environmental impact and/or a positive effect on the social aspects of the sector (e.g., the creation of local jobs or the reduction of risks aboard fishing vessels). Therefore, there is a need to examine the reallocation of quotas in a way that would fulfil the environmental and social objectives. In order to inform political decisions, it is necessary to assess the socioeconomic impact of incorporating these criteria. Such consideration falls within the framework of Article 17 of the CFP of (EU) Regulation 1380/2013 that covers "Criteria for the allocation of fishing opportunities by member states" and states that 'when allocating the fishing opportunities available to them, as referred to in Article 16, Member States shall use transparent and objective criteria including those of an environmental, social and economic nature'.

In order to reduce the impact of fisheries on biodiversity, it seems crucial to guide fishing opportunities towards lower-impact fisheries. Therefore, policymakers need to be informed and the socioeconomic impact of incorporating environmental and social criteria in the allocation of quotas needs to be assessed. As shown in Table 1 below, the environmental impacts of bigger and smaller vessels, as well as that of active gears and passive gears have been assessed[1]. It shows that transitioning from bigger to smaller vessels and from active to passive gears would lower the impact of fisheries on the environment.

[1] Christelle Noirot, Céline Jacob, Morgan Raffray, Jean-Christophe Martin (Vertigo Lab), January 2022, "Study on Article 17 of the common fisheries policy. Methodological considerations of an allocation of fishing quotas based on social and environmental criteria", supported by the Greens-EFA group in the European Parliament

Table 1. Table showing the environmental impacts associated with fishing gears (Vertigo Lab, 2022)

Impacts	PASSIVE GEAR < 12m	PASSIVE GEAR 12–24m	PASSIVE GEAR > 24m	ACTIVE GEAR < 12m	ACTIVE GEAR 12–24m	ACTIVE GEAR > 24m
Unwanted catches	*Very weak*	*Weak*	*Weak*	*Moderate*	*Strong*	*Strong*
Impact on the seafloor	*Weak*	*Weak*	*Weak*	*Moderate-Strong*	*Strong*	*Strong*
Fuel usage for the landed volumes	*Strong*	*Strong*	*Weak - Moderate*	*Moderate*	*Very strong*	*Weak*
Total jobs for the landed volumes	*Very strong*	*Strong*	*Strong*	*Moderate*	*Moderate*	*Weak*

The objectives of this report are to address the socioeconomic impacts of quota reallocation for:

- Celtic Sea Haddock in France and Ireland
- Baltic Sea Plaice in Germany, Denmark, Poland, and Sweden.

Based on the ImpacTer model (described in APPENDIX II – IMPACTER MODEL), we obtained:

1. Direct, indirect, and induced impacts of fisheries per country. These results are matched up with landings, which are used as proxy data for quotas.
2. Impact multipliers per country and fishery are the benchmark to compute the socioeconomic impacts of quota reallocation.
3. Socioeconomic impacts of quota reallocation scenarios are computed.

2. OVERVIEW OF THE METHODOLOGY

2.1. Socioeconomic impact computation

The team at Vertigo Lab has run the *ImpacTer* model (full description in APPENDIX II – IMPACTER MODEL) to evaluate the socioeconomic impacts of specific fishing quota reallocation. The socioeconomic impacts that were assessed using three socioeconomic indicators:

- **Production:** this corresponds to the monetary value of the goods and services sold by a business or establishment. It is calculated based on the turnover, corrected for stock variations.
- **Value added:** this corresponds to the economic wealth created by a business or establishment. It is equal to the difference between production and intermediate consumption (i.e., purchases of non-durable goods and services destroyed or transformed during the production process: raw materials, energy products, provision of services, etc.). The sum of value added across all industries is defined as the gross domestic product (GDP) for the analysed economy.
- **The number of jobs:** this corresponds to the number of full-time equivalent (FTE) jobs (salaried and self-employed) that are supported by the production activity of a business or an establishment.

The impacts of fishing on the European economy (EU27 + UK) were assessed according to three impact levels:

- **Direct impact:** this corresponds to the production amounts, the value added and the number of fishing jobs.
- **Indirect impact:** this corresponds to the production amounts, the value added and the number of fishing jobs in supplier sectors in the upstream section of the fishing value chain. This includes direct suppliers, but also suppliers of suppliers, etc.
- **Induced impact:** this corresponds to the production amounts, the value added and the number of jobs in the sectors of activity (excluding the blue economy) that benefit from consumption by the employees who work in the fishing value chain, i.e., the employees of the European fishing sector, as well as the employees of suppliers.

Multipliers are relative indicators computed thanks to these three levels of impacts: direct, indirect, and induced. They represent the impacts of one million euros of revenues. Three multipliers exist:

- **Direct multiplier:** It is the relative direct impact of an activity. It is calculated using direct impacts (production, value added, and jobs) divided by the direct impacts of production. Therefore, it is possible to determine the relative direct impacts of an activity such that for 1M€ of revenue, it generates X amount of value added and jobs.
- **Type I multiplier:** It is the relative direct and indirect impacts of an activity, so it includes in addition to the outputs of an activity, the outputs of the suppliers directly in contact with the sector of interest. It is calculated using direct impacts plus the indirect impacts (production, value added, and jobs) divided by the direct impacts of production. Therefore, it is possible to determine the relative type I impacts of an activity such that for 1M€ of revenue, it generates X amount of value added and jobs.
- **Type II multiplier:** It is the relative direct, indirect, and induced impacts of an activity so, in addition to the outputs of an activity and the outputs of the suppliers directly in contact

with the sector of interest, it includes the outputs from consumption of employees in the sector plus consumption from the suppliers' employees. It is calculated using direct impacts plus the indirect impacts plus the induced impacts (production, value added, and jobs) divided by the direct impacts of production. Therefore, it is possible to determine the relative type II impacts of an activity such that for 1M€ of revenue, it generates X amount of value added and jobs.

To run the ImpacTer model on the different categories of fishing gears, we used data from the STECF (Scientific, Technical and Economic Committee for Fisheries) according to the method developed in Raffray et al, 2022[2]. The model was computed using the landing volumes per gear category at the chosen European countries' level and per fishing region (North Atlantic in these cases). The aggregated fishing gear categories were obtained by aggregating fishing gears into two segments: passive and active. The composition of the aggregated categories can be found in APPENDIX 1 – GEAR AGGREGATION. The length aggregation is based on the common fishing vessel classification: artisanal (<12m), semi-industrial (12m-24m), and industrial (>24m). In total, the six fishing categories are obtained, similar to Table 1: passive artisanal (P <12), passive semi-industrial (P 12-24), passive industrial (P >24), active artisanal (A <12), active semi-industrial (A 12-24), and active (A >24).

2.2. Quota reallocation hypotheses

Once the quota reallocation ratios have been selected and defined for the six fishing categories, the economic model was run with the new distribution. Theoretical cases of reallocation of fishing quotas among the different categories have been suggested by Vertigo Lab in partnership with the Our Fish team. This sensitivity analysis of quota allocation showed the contribution of quota allocation to the variability of production, value added and employment data.

In this study, we made the following assumptions:

- Total quotas remain constant for each Member State
- In the absence of data on quotas by gear category at the level of Member State, we used the landed volumes as a 'proxy' by assuming that quota volumes are equivalent to landed volumes
- The organisational and technical aspects of these quota reallocations are not taken into account here. They are only considered for evaluating the socioeconomic impacts. Also, reallocations are supposed to be immediate in our modelling i.e., they are not spread out over time in a piecemeal fashion
- Potential rebound effects of such reallocation are not examined but they are likely to be substantial such as social unrest resulting from a drastic change in fishing capabilities
- The structure of intermediate consumption (operating expenditures) does not change within each category between the baseline and the scenarios. Economies of scale could arise in the case of an increase in quotas within a single category

[2] Raffray, Morgan, Jean-Christophe Martin, et Céline Jacob. « Socioeconomic Impacts of Seafood Sectors in the European Union through a Multi-Regional Input Output Model ». *Science of The Total Environment*, August 2022, 157989. https://doi.org/10.1016/j.scitotenv.2022.157989.

- There is no sector creation. In the case where a country does not have the fleet that corresponds to a specific category where, or from which, the quota is reallocated, no reallocation will be considered within that country. For instance, if the scenario reallocates some volumes to artisanal passive gear vessels, it will only do so in countries that have this specific category
- The multipliers remain similar at the gear level but differ at the sectorial level as the weight of each subsector changes with quota reallocation.

2.3. Data selection

This study is based on the latest and reliable data available on STECF database. Table 2 shows which data have been kept and the rationale for selection. Year 2021 was unavailable for operational costs, so the reference year for operational costs is 2020 in the earliest cases.

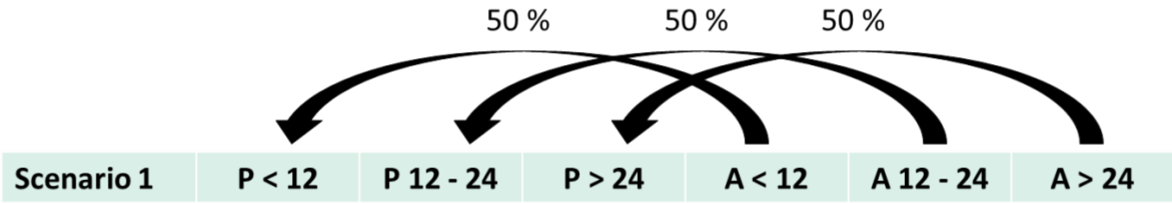
Table 2. Table describing the reasons why certain years were not chosen to be integrated in the model.

Country	Operational structure	Landing volumes	Comment
France	2020	*2020*	Year 2021 unavailable for landing volumes
Ireland	2020	2021	N/A
Poland	*2019*	2021	Year 2020 unreliable for operational costs
Germany	2020	2021	N/A
Sweden	2020	2021	N/A
Denmark	2020	2021	N/A

2.4. Quota reallocation scenarios

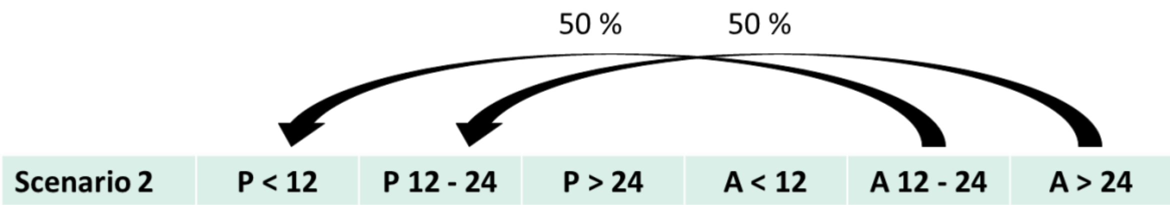
The scenarios were defined in partnership with the team at Our Fish. The first scenario provides a benchmark for reallocation as it focuses solely on fishing gears. The subsector typology (active, passive, less than 12 metres, 12 to 24 metres and more than 24 metres) remain unchanged in the scenario. In scenario 1, quotas are transferred between vessels of the same size, and moved from vessels using active gears (A) to vessels using passive gears (P) as shown in Figure 2 below.

Figure 2. Scenario 1 reallocation



Furthermore, as both the gear type and the vessel size are consequential for reducing environmental impacts (see Table 1), a second scenario is developed to evaluate the associated socioeconomic benefits. As such, the quotas are shifted from vessels using active gears (A) to vessels using passive gears (P) of a smaller size range (for instance from industrial vessels to semi-industrial vessels). The hypotheses in section 2.2 are applied to redistribution of landing volumes (Figure 3).

Figure 3. Scenario 2 reallocation



3. Results

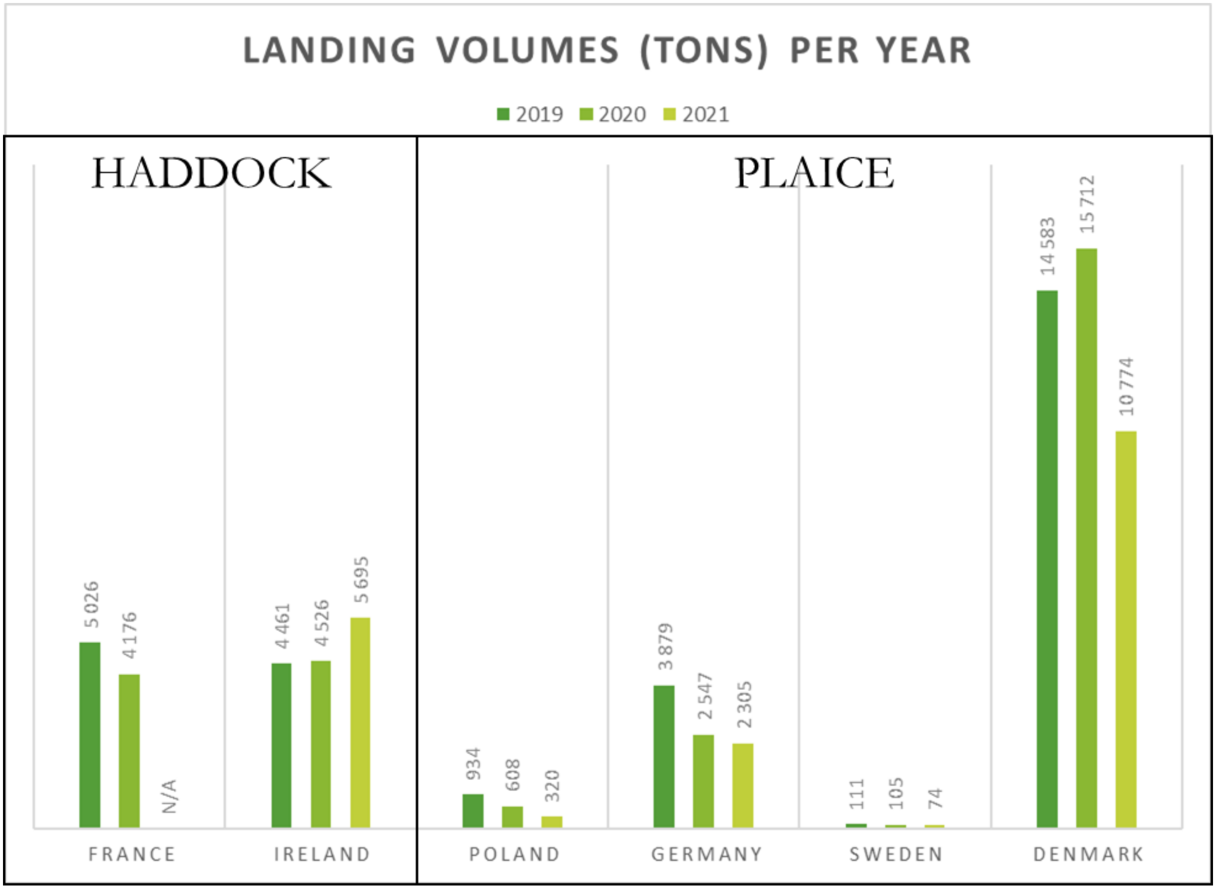
The results section presents the impacts of changes in quota distribution. As shown in Figure 4, the volumes landed between 2019 and 2021[3] are affected differently.

For haddock fishing in the Celtic Sea (North Atlantic Ocean fishing is used as a proxy), fishing has not varied between 2019 and 2021. Haddock fishing has increased in Ireland in 2021 whereas the year 2021 was not available in France.

For Baltic Sea (North Atlantic Ocean fishing used as a proxy) plaice fishing, there is a decreasing trend in landing volumes fishing in 2021 for all countries (Poland, Germany, Sweden, and Denmark), which is consistent with the Baltic Sea overall landing efforts[4].

The following sections adopt a prospective approach. They will dive into how landings affect socioeconomic performance and how quota redistribution between different fishing gears affect socioeconomic impacts according to the two scenarios previously described.

Figure 4. Landing volumes (in tons) for each year and each country between 2019 and 2021. The comparison was realised to obtain inputs on potential COVID-19 attributed changes.



[3] STECF 22 06 - EU Fleet Economic and Transversal data fleet segment accessible on the STECF website: https://stecf.jrc.ec.europa.eu/dd/fleet

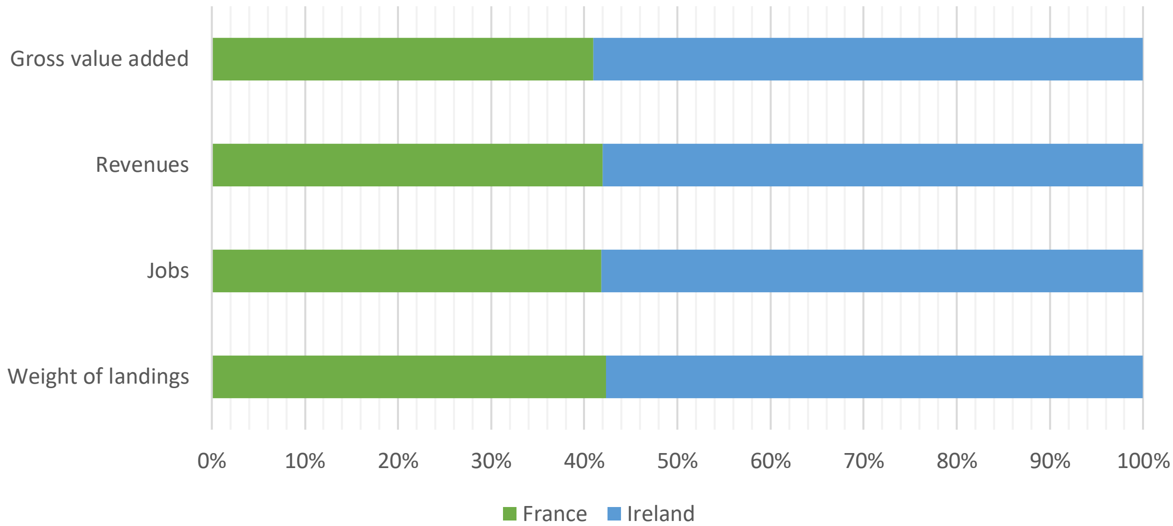
[4] European Commission. Joint Research Centre. et European Commission. Scientific, Technical and Economic Committee for Fisheries. The 2022 Annual Economic Report on the EU Fishing Fleet (STECF 22-06) (**p.94**). LU: Publications Office, 2022. https://data.europa.eu/doi/10.2760/120462

3.1. Haddock

Haddock fishing in the Celtic Sea has two main players in the European Union: France and Ireland. Demonstrated by Figure 5 below, the socioeconomic and landing performance are favouring Ireland at about 55% to 60% across all socioeconomic and landing indicators. While revenues, jobs, and landing volumes are roughly similar in distribution, the gross value added (or direct contribution to the GDP) over revenue ratio is lower for France. This indicates a more efficient performance in Ireland compared to France, which can be attributed to differences in both fleet distribution and nationally specific operational structures in between the two countries.

In the following subsections, the country overall structures and scenarios' impacts are discussed.

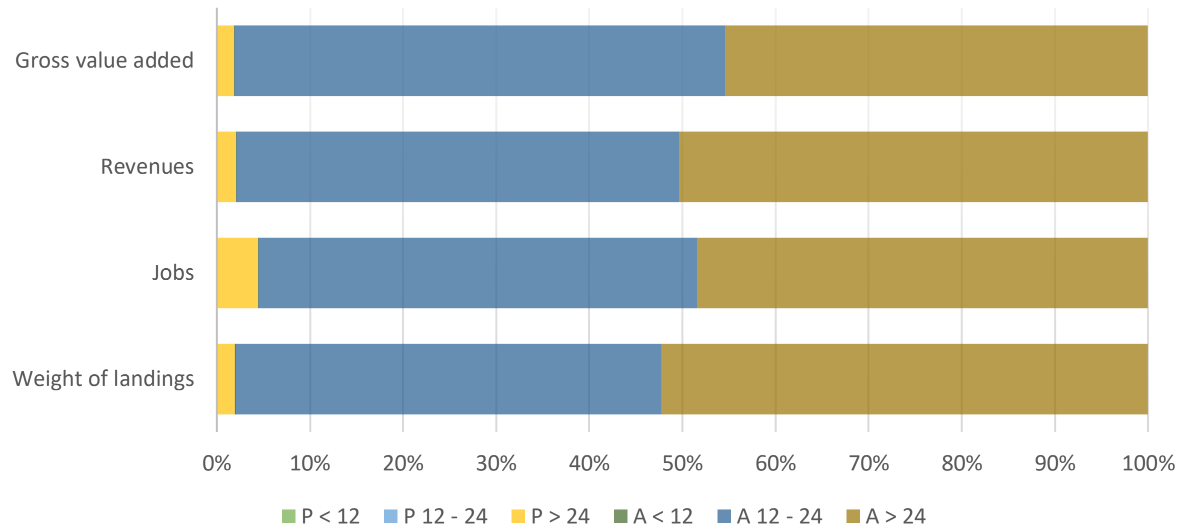
Figure 5. Haddock fishing distribution in terms of landing volumes, direct jobs, direct revenues, and direct gross value added between France and Ireland



3.1.1. France

Haddock fishing distribution in France is skewed toward active gears as fish are mostly caught by vessels with active gears as shown in Figure 6. More specifically, industrial (>24m) and semi-industrial (12m – 24m) comprise 97% of the volumes landed by French haddock fishermen. Haddock fishing in France is mostly supported by industrial active gear vessels (~52% of landings) for which the impacts on employment and contribution to the GDP is smaller than its volumes landed indicating that they have a smaller direct impact multiplier. Nevertheless, the job, turnover, and gross value-added type II multipliers for industrial active gear vessels (12 FTE/M€, €2.3M, and €1.09M respectively) are greater than the ones for the second most common vessel type, active gear semi-industrial (10.6 FTE/M€, €2.0M, €1.08M respectively) (full multiplier details in the appendices).

Figure 6. Haddock fishing distribution in terms of landing volumes, direct jobs, direct revenues, and direct gross value added in France by fishing gears and vessel sizes. Full details in the appendices.

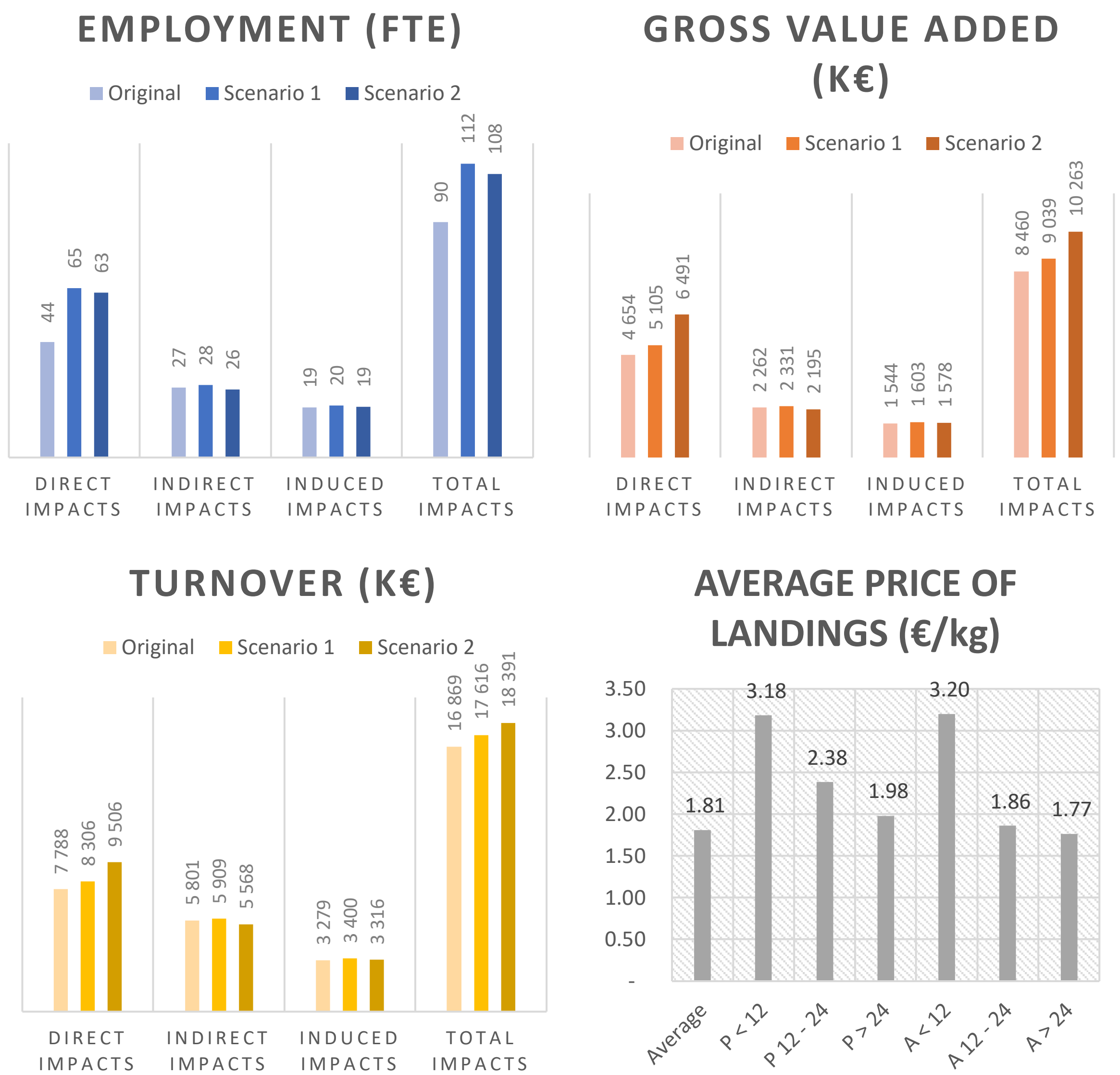


After running scenarios 1 and 2, the distribution of impacts for employment, gross value added, and turnover is modified to see whether the scenarios have a positive, neutral, or negative impact (Figure 7).

There is an increase in the number of direct jobs with both scenarios with a slightly larger increase following scenario 1, with +22 FTE for scenario 1 and +18 FTE for scenario 2. In terms of gross value added, scenario 2 (+21%), has a greater impact on the European GDP compared with scenario 1 (+7%), mainly driven by the direct impacts. For turnover, the variation is not as stark as for the GVA with scenario 1 increasing turnover by 4% and scenario 2 by 9%. The difference can be explained by the fact that scenario 2 favours smaller vessels with fewer operational costs. Scenario 1, on the other hand favours job opportunities (112 vs. 90 FTE, a 24% difference) because passive gear vessels are overall more labour intensive, especially at greater lengths.

The increase in turnover and value added is also explained by a higher price for haddock sold by smaller fleets. Thus, reallocating quotas to passive and smaller fleets leads to an increase in revenues and GDP contribution, especially since the turnover and value-added multipliers are relatively stable.

Figure 7. Direct, indirect, and induced impacts from the current haddock quota allocation in France and after both scenarios for employment in FTE, Gross Value Added in k€, and turnover in k€ have been applied. In addition, the average price of haddock landing is provided for the studied fleets.



The relative contribution of haddock fishing in France is shown in Table 3. The table confirms that increases in GDP contribution in scenario 2 is mainly driven by direct impacts as the direct multiplier is higher in scenario 2 than in scenario 1. Otherwise, scenario 2 seems to not perform as well as the other two cases. This indicates more direct contributions with less of a knock-on effect on the European Union territories.

One million euros generated by haddock fishing in France in the current quota allocation situation contributes to the European Union economy on average annually 11.6 FTE, €2.17M of turnover, and €1.09M of European GDP.

For scenario 1, one million euros generated by haddock fishing in France contributes to the European Union economy on average annually 13.5 FTE, €2.12M of turnover, and €1.09M of European GDP.

For scenario 2, one million euros generated by haddock fishing in France contributes to the European Union economy on average annually 11.4 FTE, €1.93M of turnover, and €1.08M of European GDP.

In input-output analyses, wealth leakage is mainly related to the import of goods and services needed for an economic activity. Sectors with high GVA type I multipliers generally create more wealth (direct impacts and the part of induced impacts linked to the supply chain's employees' consumption) and source more locally (indirect impacts and the part of induced impacts linked to the supply chain's employees' consumption). In other words, it represents the "made in Europe" part of the supply chain. The closer a type I multiplier in the gross value added is to 1, the more the supply chain is located within the EU27+UK borders. In that regard, the current quota distribution does not favour local European suppliers compared with scenario 1, and scenario 2 to a greater extent. In addition, the results show that scenario 1 and scenario 2 favour job creation and GDP creation within the European territory. More importantly, wealth leakages (connected to suppliers within the EU) are reduced by reallocating quotas from larger to smaller vessels with passive gears.

Overall, scenario 1, which reallocates 50% of the quotas from vessels equipped with active gears to vessels equipped with passive gears is the most beneficial. It leads to more job creation but lower value-added and turnover considering the current price structure of fish sold. If the price structure more strongly favoured vessels equipped with passive gears in general, scenario 1 would generate higher economic impacts. It would also lead to fewer wealth leakages.

Table 3. Table showing the impact multiplier of haddock fishing in France before and after the scenarios are ran. Direct multiplier is for the impact on the activity, type I multipliers are composed of direct and indirect (impacts on the supply chain) impacts, and type II multipliers are composed of direct, indirect, induced (impacts of employees' consumption) impacts. Reading example: 1M€ of revenues generated in the haddock fishing sector supports 5.66 direct jobs and 11.55 in total for 600k€ of direct GDP contribution and 1,09M€ in total under the current quota distribution. These multipliers differ with each scenario.

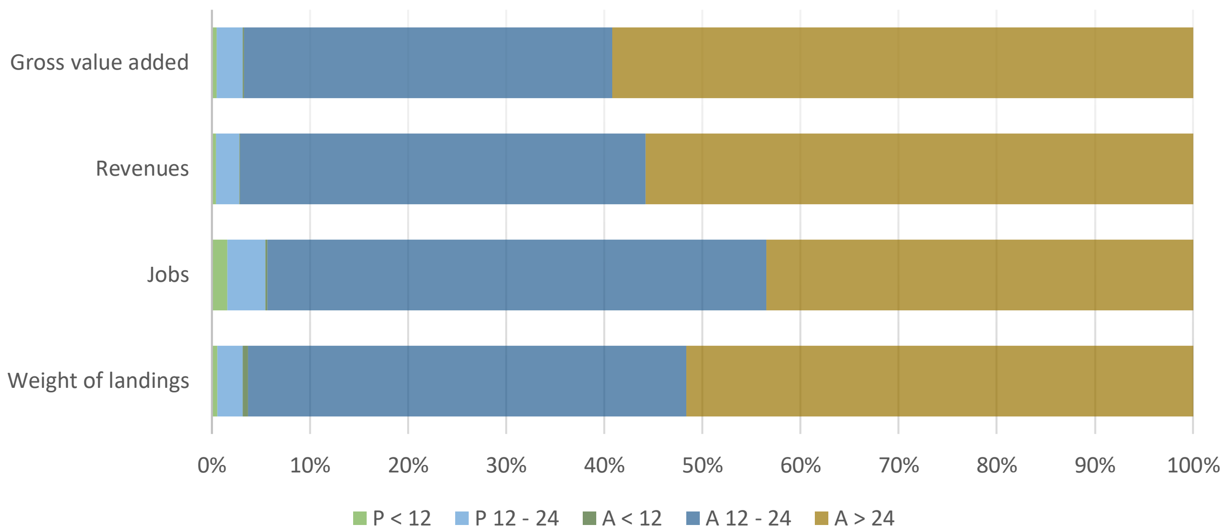
Haddock in France		**Original**	**Scenario 1**	**Scenario 2**
Jobs (FTE/M€)	**Direct**	5.66	7.80	6.62
	Type I	9.09	11.12	9.36
	Type II	11.55	13.52	11.39
Turnover	**Direct**	1.00	1.00	1.00
	Type I	1.74	1.71	1.59
	Type II	2.17	2.12	1.93
GVA	**Direct**	0.60	0.61	0.68
	Type I	0.89	0.90	0.91
	Type II	1.09	1.09	1.08

3.1.2. Ireland

Haddock fishing distribution in Ireland is skewed toward active gears as fish are mostly caught by vessels with active gears as shown in Figure 8. More specifically, industrial (>24m) and semi-industrial (12m – 24m) comprise 95% of the volumes landed by Irish fishermen. The industrial active gear subsector type II multipliers for job, turnover, and gross value added (6.6 FTE/M€, €1.6M, and €0.96M respectively) are smaller (or about the same for GVA) than the ones for the second most common vessel type, active gear semi-industrial (9.6 FTE/M€, €1.8M, €0.95M respectively). This difference is mainly explained by the impact on the supply chain as the operating costs are larger for semi-industrial active gear vessels than for industrial active gear vessels.

The presence of semi-industrial passive gear vessels is notable as the third biggest fleet for haddock fishing in Ireland. The higher job and GVA type II multipliers (respectively 11.4 FTE/M€ and €0.97M) make it important for scenario reallocation (full multiplier details in the appendices).

Figure 8. Haddock fishing distribution in terms of landing volumes, direct jobs, direct revenues and direct gross value added in Ireland by fishing gears and vessel sizes. Full details in the appendices.

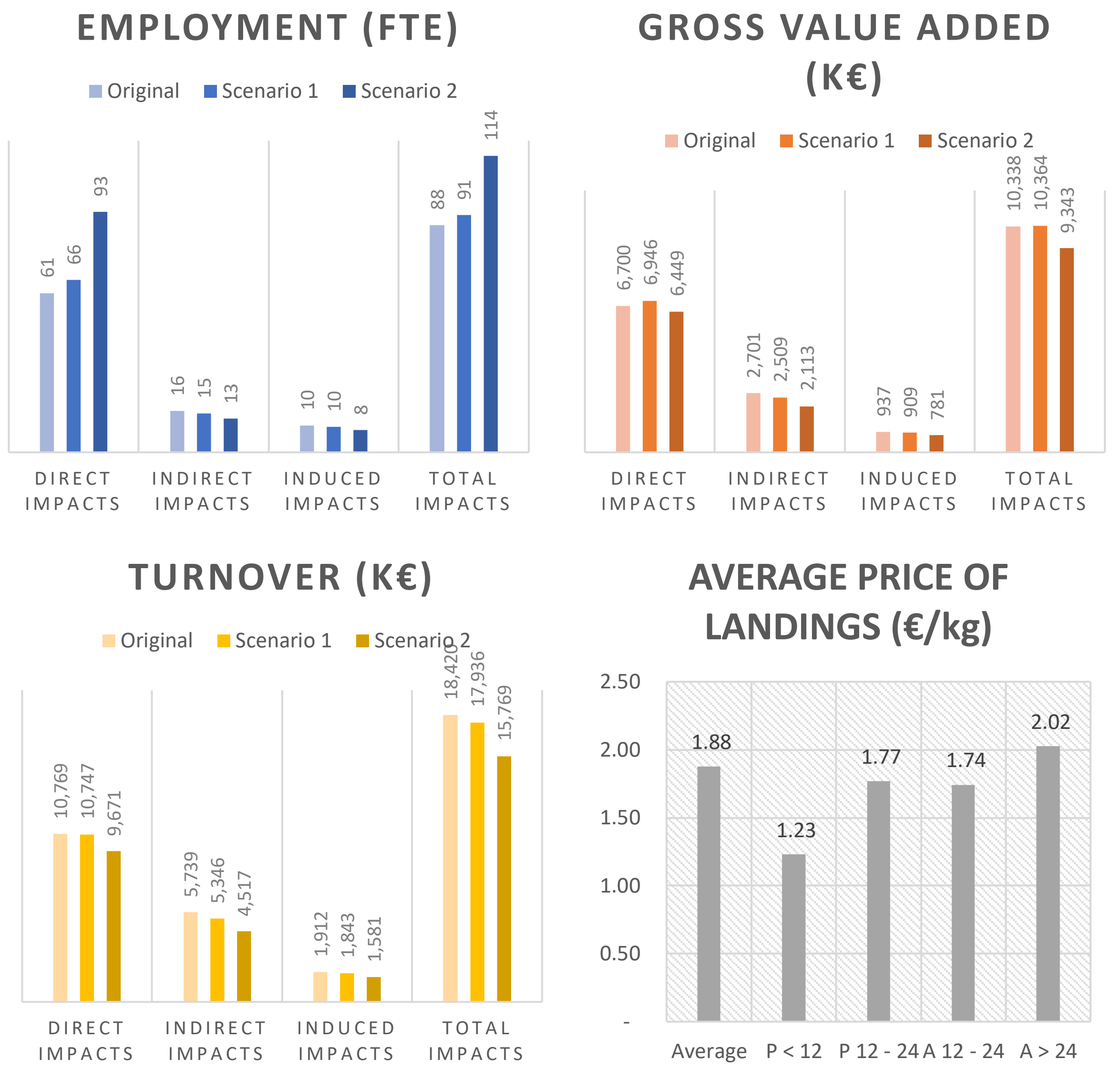


After running scenarios 1 and 2, the distribution of impacts for employment, gross value added, and turnover is modified to see whether the scenarios have a positive, neutral, or negative impact (Figure 9).

There is an increase in number of direct jobs with both scenarios with a substantial increase following scenario 2 (+26 FTE) compared with scenario 1 (+3 FTE). For gross value added, scenario 2 has a larger negative impact (-9.5%) on the European GDP, mainly driven by the induced impacts, which indicates lower wages and salaries at the subsector level (induced impacts are generated by direct and suppliers' employee's consumption, i.e., a higher salary leads to higher consumption). For turnover, the variation is similar for GVA with scenario 2 decreasing more (-14.5%) compared with scenario 1 (-3%). Whilst scenario 2 favours job creation the most, it has a negative impact on GDP contribution. Scenario 1 favours the status quo meaning that the socioeconomic indicators remain approximately stable.

The decrease in turnover and GDP contribution in scenario 2 can be attributed to lower prices for haddock sold by the main beneficiaries of the quota redistribution, namely artisanal and semi-industrial passive gear fleets. Thus, there is a need for reevaluating catches to provide similar turnover and GDP contributions to the EU territories by Irish fishermen.

Figure 9. Direct, indirect, and induced impacts from the current haddock quota allocation in Ireland and after both scenarios for employment in FTE, Gross Value Added in k€, and turnover in k€ have been applied. In addition, the average price of haddock landing is provided for the studied fleets.



The relative contribution of haddock fishing in Ireland is shown in Table 4. Surprisingly, unlike France, scenario 2 seems to perform well compared with the other two cases. This indicates more of a knock-on effect on the European Union territories than the other two cases.

One million euros generated by haddock fishing in Ireland in the current situation contributes to the European Union economy on average annually 8.1 FTE, €1.71M of turnover, and €0.96M of European GDP.

For scenario 1, one million euros generated by haddock fishing in Ireland contributes to the European Union economy on average annually 8.5 FTE, €1.67M of turnover, and €0.96M of European GDP.

For scenario 2, one million euros generated by haddock fishing in Ireland in the current situation contributes to the European Union economy on average annually 11.8 FTE, €1.63M of turnover, and €0.97M of European GDP.

In input-output analyses, wealth leakage is mainly related to the import of goods and services needed for an economic activity. Sectors with high GVA type I multipliers generally create more

wealth (direct impacts and the part of induced impacts linked to the supply chain's employees' consumption) and source more locally (indirect impacts and the part of induced impacts linked to the supply chain's employees' consumption). In other words, it represents the "made in Europe" part of the supply chain. The closer a type I multiplier in the gross value added is to 1, the more the supply chain is located within the EU27+UK borders. In that regard, the current quota distribution does not favour local European suppliers compared with scenario 1, and scenario 2 to a greater extent. In addition, the results show that scenario 1 and scenario 2 favour job creation and GDP creation within the European territory. More importantly, wealth leakages (connected to suppliers within the EU) are reduced by reallocating quotas from larger to smaller vessels with passive gears.

Overall, scenario 2, which reallocates 50% of the quotas from vessels equipped with active gears to smaller vessels equipped with passive gears is the most beneficial. It leads to more job creation but lower value-added and turnover considering the current price structure of fish sold. If the price structure more strongly favoured vessels equipped with passive gears in general, scenario 2 would generate higher economic impacts. It would also lead to fewer wealth leakages.

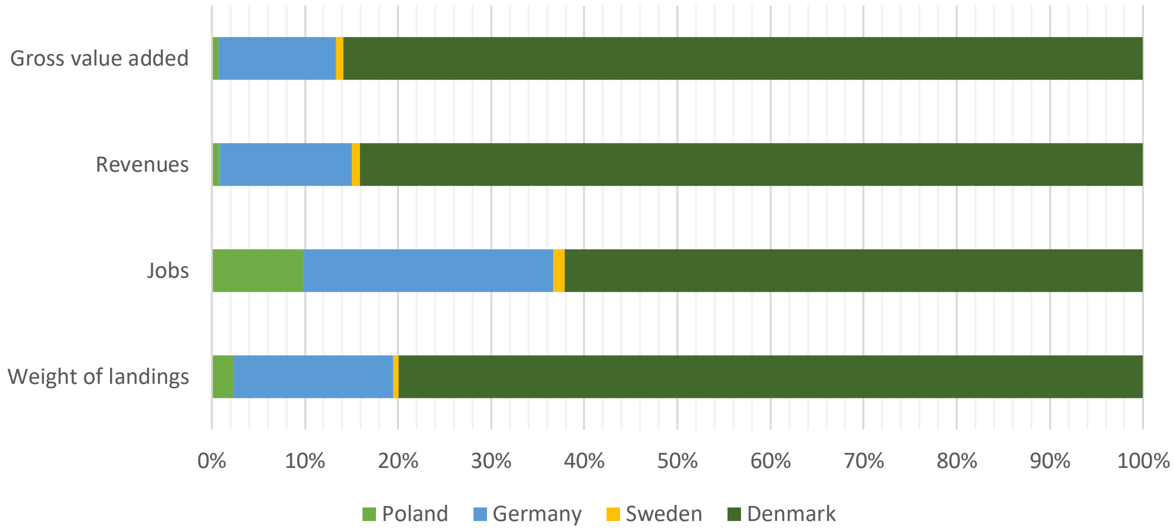
Table 4. Table showing the impact multiplier of haddock fishing in Ireland before and after the scenarios are ran. Direct multiplier is for the impact on the activity, type I multipliers are composed of direct and indirect (impacts on the supply chain) impacts, and type II multipliers are composed of direct, indirect, induced (impacts of employees' consumption) impacts. Reading example: 1M€ of revenues generated in the haddock fishing sector supports 5.7 direct jobs and 8.13 in total for 620k€ of direct GDP contribution and 960 k€ in total under the current quota distribution. These multipliers differ with each scenario.

Haddock in Ireland		**Original**	**Scenario 1**	**Scenario 2**
Jobs (FTE/M€)	**Direct**	5.70	6.17	9.58
	Type I	7.17	7.57	10.92
	Type II	8.13	8.49	11.79
Turnover	**Direct**	1.00	1.00	1.00
	Type I	1.53	1.50	1.47
	Type II	1.71	1.67	1.63
GVA	**Direct**	0.62	0.65	0.67
	Type I	0.87	0.88	0.89
	Type II	0.96	0.96	0.97

3.2. Plaice

Plaice fishing in the Baltic Sea has four main players in the European Union: Poland, Germany, Sweden, and especially Denmark. Demonstrated by Figure 10 below, the socioeconomic and landing performance are favouring Denmark, which composes about 80% of the socioeconomic and landing indicators except employment. The latter indicator shows that two countries, Germany and Poland, have a job intensive plaice fishing sector compared with Denmark. Revenues and added value are roughly distributed similarly but the distribution differs with landing volumes. This indicates that most of the added value from plaice fishing is grabbed by Denmark. This difference can be attributed to the fleet overall structure differences between the countries. In the following subsections, the country overall structures and scenarios' impacts are discussed in greater detail.

Figure 10. Plaice fishing distribution in terms of landing volumes, direct jobs, direct revenues, and direct gross value added between Poland, Germany, Sweden, and Denmark



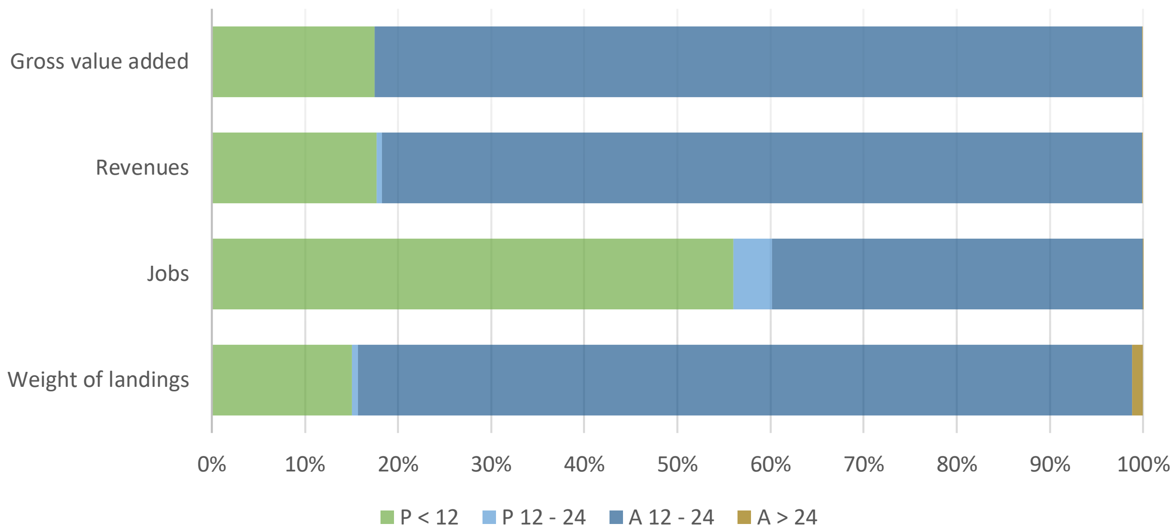
3.2.1. Poland

Plaice fishing distribution in Poland is difficult to read and interpret as the data are inconsistent. For instance, 525 vessels in Poland, manned with 1 035 FTE generated €3.7M in revenues in 2020[5]. The resulting job intensity is about 280 FTE/M€, which would be 20 times larger than the French job intensity. For this reason, the results in Poland may be taken with a grain of salt.

As shown in Figure 11, volumes landed, revenues and value added are generated at 82% by semi-industrial active gear vessels. As with the previous point about job intensity, it appears that 55% of the jobs to catch plaice in the Baltic Sea are on small artisanal (<12m) vessels with passive gears. The presence of a semi-industrial passive gear fishing sector is noted, especially in job intensity as the value is not retained at their sublevel.

Job, turnover, and gross value-added type II multipliers for semi-industrial active gear vessels (50 FTE/M€, €2.0M, €1.02M respectively) are smaller (or about the same for GVA) than the one for the second most common vessel type, passive gear artisanal (245 FTE/M€, €2.0M, €1.03M respectively). This difference is mainly explained by the impact on the supply chain. The operating costs are larger for semi-industrial active gear vessels than for artisanal passive gear vessels (full multiplier details in the appendices).

Figure 11. Plaice fishing distribution in terms of landing volumes, direct jobs, direct revenues, and direct gross value added in Poland by fishing gears and vessel sizes. Full details in the appendices.



After running scenarios 1 and 2, the distribution of impacts for employment, gross value added, and turnover is modified to see whether the scenarios have a positive, neutral or negative impact (Figure 12).

There is an increase in the number of direct jobs with both scenarios with a larger increase following scenario 1 (+50 FTE). For gross value added, scenario 1 and scenario 2 contribute differently to the European GDP, as they seem to be inverted in their effects on either direct, and indirect and induced impacts. Scenario 1 demonstrates greater impacts on the value chain and consumption indicating higher wages and salaries. Scenario 2 has greater impacts on direct impacts indicating a more efficient operating cost structure, which in turn reduces the impacts on the supply chain. Overall, the total GVA impacts on the EU27 + UK remain stable, although it shows that

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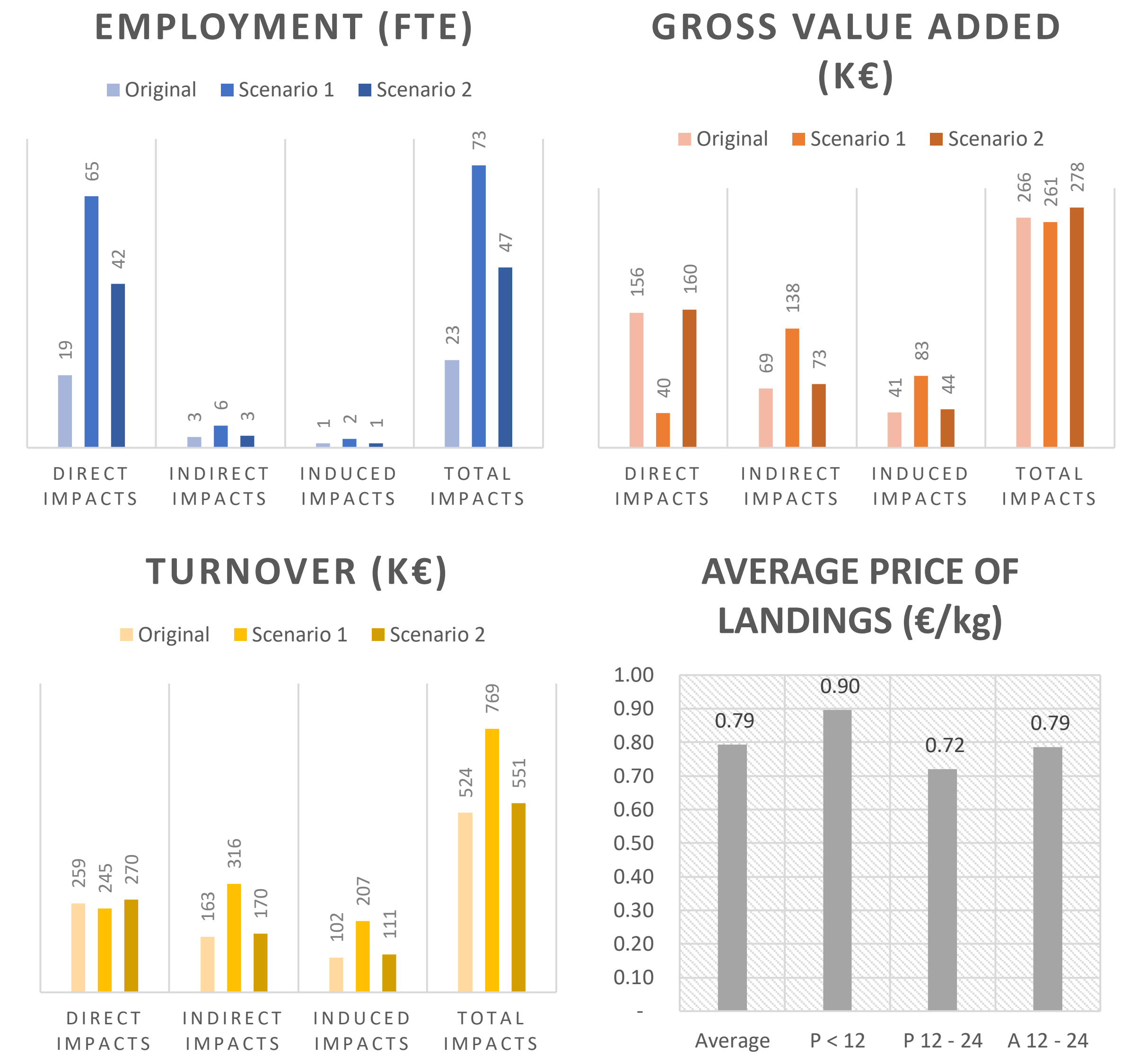
[5] European Commission. Joint Research Centre. et European Commission. Scientific, Technical and Economic Committee for Fisheries. The 2022 Annual Economic Report on the EU Fishing Fleet (STECF 22-06) (**p.366**). LU: Publications Office, 2022. https://data.europa.eu/doi/10.2760/120462

scenario 2 may favour impacts directly related to the fishing sector. For turnover, similar to employment, scenario 1 has greater impacts (+47%) than scenario 2 (+5%).

The higher contribution in value added and turnover can also be attributed to the higher plaice price for artisanal and passive fishing vessels. Thus, since scenario 2 reallocates more quota to the latter fleet, there is a higher increase in turnover and GDP contributions, especially since the turnover and value-added multipliers are relatively stable.

Figure 12. Direct, indirect, and induced impacts from the current plaice quota allocation situation in Poland and after both scenarios for employment in FTE, Gross Value Added in k€, and turnover in k€ have been applied. In addition, the average price of plaice landing is provided for the studied fleets.



The multipliers for plaice fishing shown in Table 5 are a composite of the six vessel type multipliers weighed by the amount of plaice landed. Therefore, whilst the vessel gear and length multiplier remain similar, the composite plaice fishing multiplier changes with reallocated quotas.

One million euros generated by plaice fishing in Poland in the current allocation situation contributes to the European Union economy on average annually 87.5 FTE, €2.02M of turnover, and €1.03M of European GDP.

For scenario 1, one million euros generated by plaice fishing in Poland contributes to the European Union economy on average annually 298 FTE, €3.13M of turnover, and €1.06M of European GDP.

For scenario 2, one million euros generated by plaice fishing in Poland in the current situation contributes to the European Union economy on average annually 173 FTE, €2.04M of turnover, and €1.03M of European GDP.

In input-output analyses, wealth leakage is mainly related to the import of goods and services needed for an economic activity. Sectors with high GVA type I multipliers create more wealth (direct impacts and the part of induced impacts linked to the supply chain's employees' consumption) and source more locally (indirect impacts and the part of induced impacts linked to the supply chain's employees' consumption). It represents the "made in Europe" part of the supply chain. The closer a type I multiplier in the gross value added is to 1, the more the supply chain is located within the EU27+UK borders. In that regard, the current quota distribution favours local European suppliers compared to scenario 1 (0.87 compared with 0.72 respectively) and is similar to scenario 2 (0.87 compared with 0.86). In addition, the results show that scenario 1 and scenario 2 favour job creation but not GDP creation within the European territory. More importantly, wealth leakages are increased by moving quotas to passive gears like in scenario 1.

Overall, scenario 1, which reallocates 50% of the quotas from vessels equipped with active gears to vessels equipped with passive gears is the most beneficial. It leads to more job creation but lower turnover considering the current price structure of fish sold. If the price structure more strongly favoured vessels equipped with passive gears in general, scenario 1 would generate higher economic impacts. Nevertheless, choosing scenario 1 would lead to more wealth leakages.

Table 5. Table showing the impact multiplier of plaice fishing in Poland before and after the scenarios are ran. Direct multiplier is for the impact on the activity, type I multipliers are composed of direct and indirect (impacts on the supply chain) impacts, and type II multipliers are composed of direct, indirect, induced (impacts of employees' consumption) impacts. Reading example: 1M€ of revenues generated in the plaice fishing sector supports 72 direct jobs and 87 in total for 600k€ of direct GDP contribution and 1.03 M€ in total under the current quota distribution. These multipliers differ with each scenario.

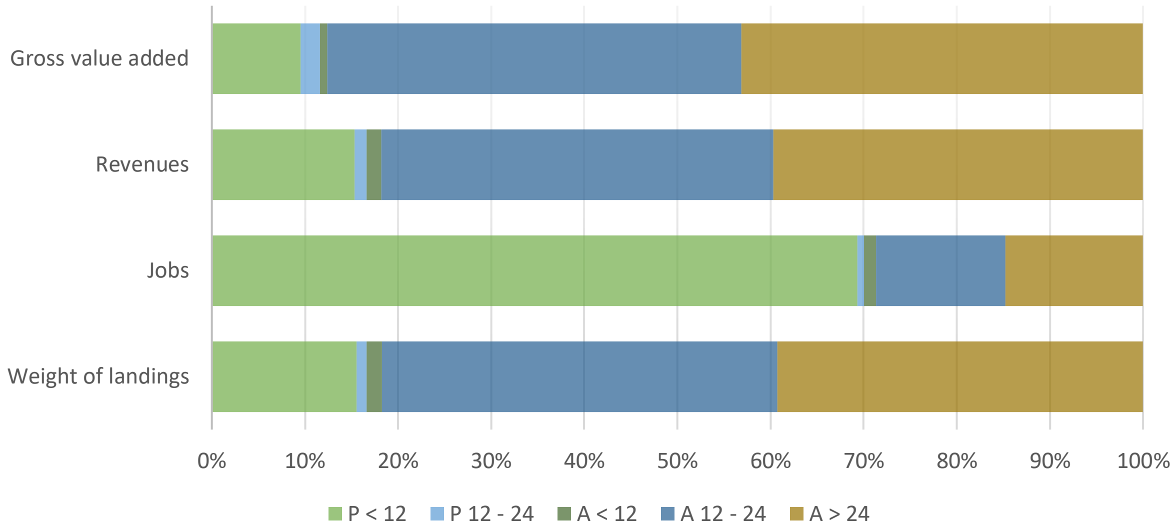
Plaice in Poland		**Original**	**Scenario 1**	**Scenario 2**
Jobs (FTE/M€)	**Direct**	72.47	265.45	157.21
	Type I	83.22	289.04	168.56
	Type II	87.46	298.21	173.02
Turnover	**Direct**	1.00	1.00	1.00
	Type I	1.63	2.29	1.63
	Type II	2.02	3.13	2.04
GVA	**Direct**	0.60	0.16	0.59
	Type I	0.87	0.72	0.86
	Type II	1.03	1.06	1.03

3.2.2. Germany

As shown in Figure 13, volumes landed, revenues and value added are generated at 82% by industrial and semi-industrial active gear vessels. Most of the remainder is generated by artisanal passive gear vessel that are less impactful on the environment.

Employment, turnover, and gross value-added type II multipliers for industrial and semi-industrial active gear vessels (9.6 FTE/M€ on average, €1.8M on average, €1.0M on average respectively) are smaller (or about the same for GVA) than the one for the third most common vessel type, passive gear artisanal (60 FTE/M€, €2.4M, €0.99M respectively). This difference is mainly explained by the fact that artisanal vessels are more job intensive as they need more people to fish the same amount (full multiplier details in the appendices).

Figure 13. Plaice fishing distribution in terms of landing volumes, direct jobs, direct revenues, and direct gross value added in Germany by fishing gears and vessel sizes. Full details in the appendices.

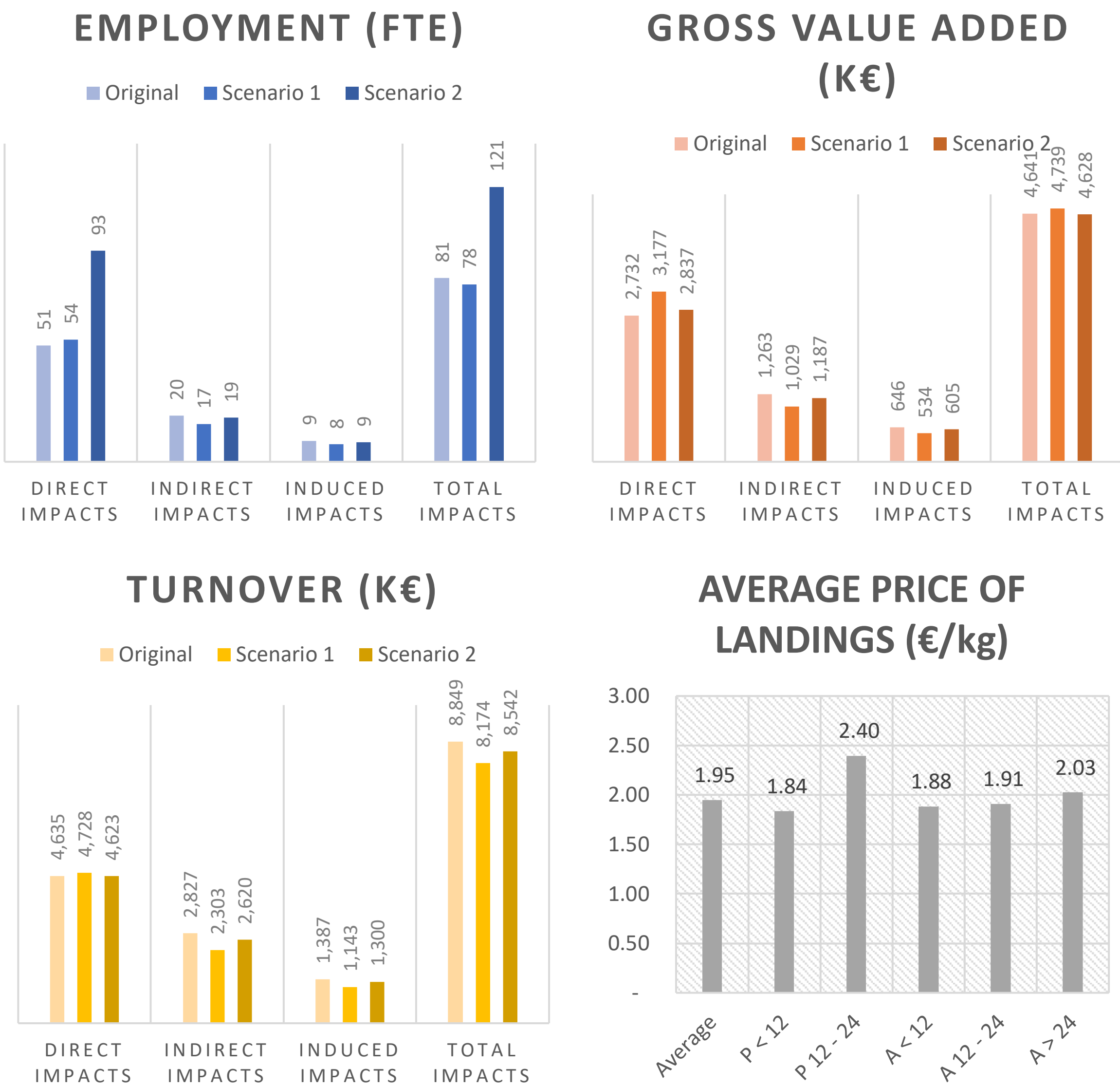


After running scenarios 1 and 2, the distribution of impacts for employment, gross value added, and turnover is modified to see whether the scenarios have a positive, neutral, or negative impact (Figure 14).

There is an increase in number of jobs (+40FTE) with scenario 2 mainly driven by a significant increase in direct jobs. For gross value added, scenario 1 and scenario 2 have similar contribution to the current situation, **indicating that a change in quota allocation would not damage the fishing sector contribution to the EU GDP**. As the reallocation has varying direct impacts across all indicators, the indirect and induced impacts remain homogeneous across all indicators, indicating that the supply chain would not suffer from a change in quota allocation. Overall, the total impacts onto the EU27 + UK remain stable, although it shows that scenario 2 may favour impacts directly related to the fishing sector in terms of job creation.

The lower turnover and value-added contributions can be attributed to the lower plaice price for artisanal passive gear vessels. Thus, reallocating quotas to fleets that sell plaice at lower prices diminishes the turnover and GDP contributions, especially since the value added and turnover multipliers are relatively constant. Reevaluating the plaice prices for passive artisanal fleets should be the priority to get similar turnover and GDP contributions.

Figure 14. Direct, indirect, and induced impacts from the current plaice quota allocation situation in Germany and after both scenarios for employment in FTE, Gross Value Added in k€, and turnover in k€ have been applied. In addition, the average price of plaice landing is provided for the studied fleets.



The multipliers for plaice fishing shown in Table 6 are a composite of the six vessel type multipliers weighed by the amount of plaice landed. Therefore, whilst the vessel gear and length multiplier remain similar, the composite plaice fishing multiplier changes with reallocated quotas.

One million euros generated by plaice fishing in Germany in the current situation contributes to the European Union economy on average annually 17.4 FTE, €1.91M of turnover, and €1M of European GDP.

For scenario 1, one million euros generated by plaice fishing in Germany contributes to the European Union economy on average annually 16.5 FTE, €1.73M of turnover, and €1M of European GDP.

For scenario 2, one million euros generated by plaice fishing in Germany in the current situation contributes to the European Union economy on average annually 26.2 FTE, €1.85M of turnover, and €1M of European GDP.

In input-output analyses, wealth leakage is mainly related to the import of goods and services needed for an economic activity. Sectors with high GVA type I multipliers generally create more

wealth (direct impacts and the part of induced impacts linked to the supply chain's employees' consumption) and source more locally (indirect impacts and the part of induced impacts linked to the supply chain's employees' consumption). In other words, it represents the "made in Europe" part of the supply chain. The closer a type I multiplier in the gross value added is to 1, the more the supply chain is located within the EU27+UK borders. In that regard, the quota distribution in the scenarios favours local European suppliers compared to the current allocation (0.89 and 0.87 compared with 0.86 respectively). In addition, the results show that scenario 1 and scenario 2 favour job creation and GDP within the European territory. More importantly, wealth leakages decrease by moving quotas to passive gears like in scenario 1 and scenario 2.

Overall, scenario 2, which reallocates 50% of the quotas from vessels equipped with active gears to smaller vessels equipped with passive gears is the most beneficial. It leads to more job creation but lower value-added and turnover considering the current price structure of fish sold. If the price structure favour more strongly smaller vessel equipped with passive gears, scenario 2 would generate similar economic impacts compared with the current situation. In addition, it would lead to slightly less wealth leakages.

Table 6. Table showing the impact multiplier of plaice fishing in Germany before and after the scenarios are ran. Direct multiplier is for the impact on the activity, type I multipliers are composed of direct and indirect (impacts on the supply chain) impacts, and type II multipliers are composed of direct, indirect, induced (impacts of employees' consumption) impacts. Reading example: 1M€ of revenues generated in the plaice fishing sector supports 11.0 direct jobs and 17.4 in total for 590k€ of direct GDP contribution and 1 M€ in total in current quota distribution. This reading can be applied to all multipliers across the scenarios.

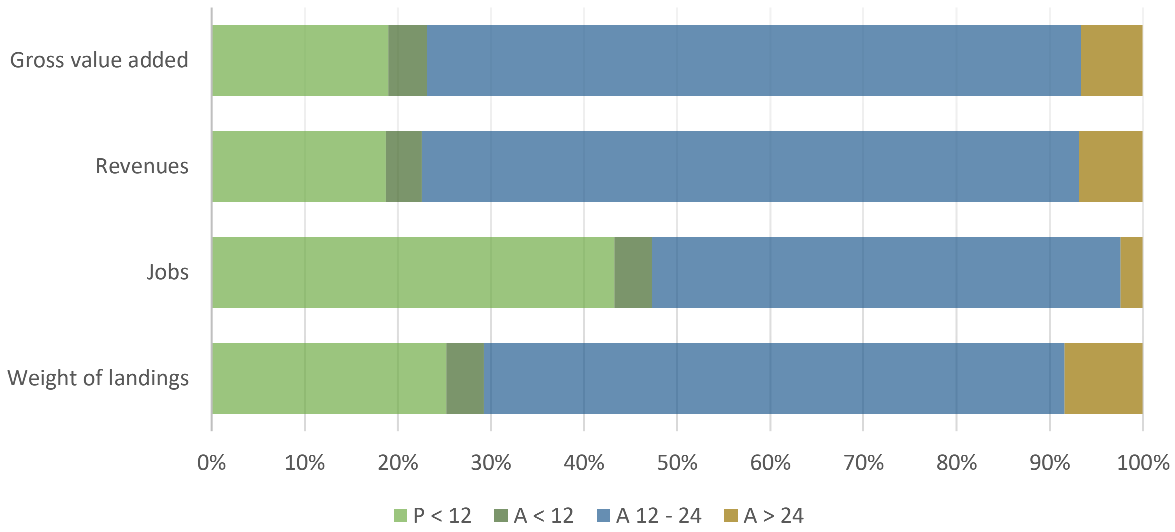
Plaice in Germany		**Original**	**Scenario 1**	**Scenario 2**
Jobs (FTE/M€)	**Direct**	11.04	11.38	20.09
	Type I	15.42	14.88	24.28
	Type II	17.43	16.49	26.16
Turnover	**Direct**	1.00	1.00	1.00
	Type I	1.61	1.49	1.57
	Type II	1.91	1.73	1.85
GVA	**Direct**	0.59	0.67	0.61
	Type I	0.86	0.89	0.87
	Type II	1.00	1.00	1.00

3.2.3. Sweden

As shown in Figure 15, 70% of volumes landed, revenues and value added are generated by semi-industrial active gear vessels. Most of the remainder is generated by artisanal passive gear.

The job turnover type II multiplier for semi-industrial active gear vessels is smaller than the one for artisanal passive gear fleet (10 FTE/M€ vs 23 FTE/M€). The type II GVA multiplier is similar at about 1.0 and is smaller for smaller fleets in terms of turnover (2.0 vs 1.9 respectively). This difference is mainly explained by the fact that artisanal vessels are more job intensive as they need more people to fish the same amount and they have fewer operating expenditures so that has affected the multipliers differently (full multiplier details in the appendices).

Figure 15. Plaice fishing distribution in terms of landing volumes, direct jobs, direct revenues and direct gross value added in Sweden by fishing gears and vessel sizes. Full details in the appendices.

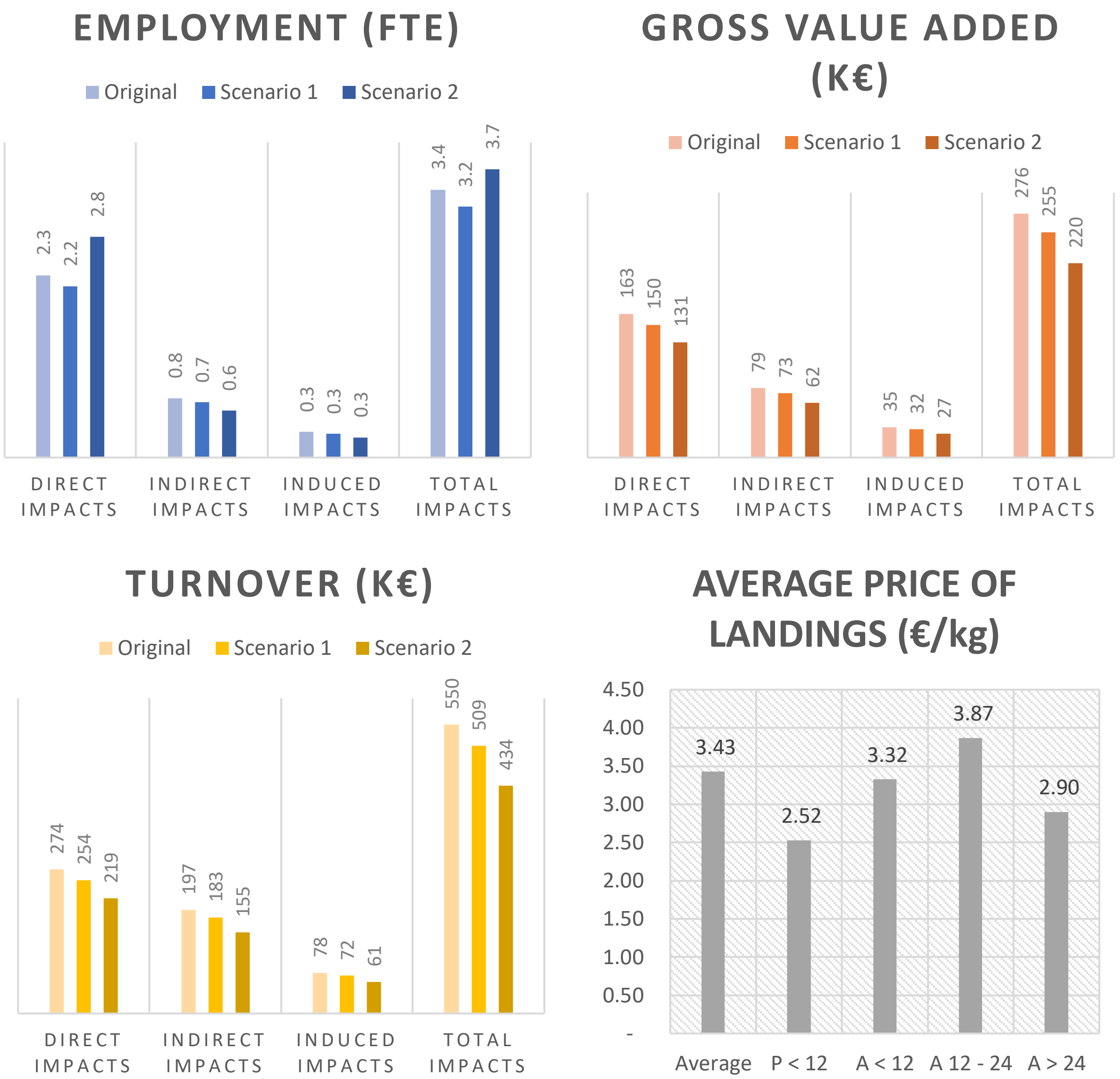


After running scenarios 1 and 2, the distribution of impacts for employment, gross value added, and turnover is modified to see whether the scenarios have a positive, neutral, or negative impact (Figure 16). The difference in impacts between both scenarios results from the existing, impactful, transfers in between fleets. For instance, in scenario 1, few quota transfers could be realised because there is not a passive gear semi-industrial fleet to transfer quota from the active gear semi-industrial fleet. In this case, the second scenario had more redistribution.

There is an increase in the number of direct jobs with scenario 2 (+0.5 FTE) mainly driven by a significant increase in direct jobs. For gross value added, scenario 1 and scenario 2 have lower contributions than the status quo (respectively -7.7% and -20%), indicating that a change in the vessel operating structure would reduce the fishing sector contribution to the EU GDP. The reallocation has direct impacts which vary across all indicators. The indirect and induced impacts are the most impacted across all indicators, which suggests that the supply chain would differ with quota reallocation. Overall, the total impacts onto the EU27 + UK differ from the current allocation. It would generate more jobs but would decrease the sector contribution to the European Union GDP.

The lower turnover and GDP contributions can be attributed to lower plaice prices for artisanal passive gears compared with other fleets. It is especially flagrant through scenario 2, in which quotas are redistributed mainly to the artisanal passive fleet. A priority should be given to reevaluate the prices of fish sold by this fleet to equate the turnover and GDP contributions.

Figure 16. Direct, indirect, and induced impacts from the current plaice quota allocation situation in Sweden and after both scenarios for employment in FTE, Gross Value Added in k€, and turnover in k€ have been applied. In addition, the average price of plaice landing is provided for the studied fleets.



The multipliers for plaice fishing shown in Table 7 are a composite of the six vessel type multipliers weighed by the amount of plaice landed. Therefore, whilst the vessel gear and length multiplier remain similar, the composite plaice fishing multiplier changes with reallocated quotas.

One million euros generated by plaice fishing in Sweden in the current situation contributes to the European Union economy on average annually 12.4 FTE, €1.91M of turnover, and €1M of European GDP.

For scenario 1, one million euros generated by plaice fishing in Sweden contributes to the European Union economy on average annually 12.5 FTE, €2M of turnover, and €1.01M of European GDP.

For scenario 2, one million euros generated by plaice fishing in Sweden in the current situation contributes to the European Union economy on average annually 16.7 FTE, €2M of turnover, and €1M of European GDP.

In input-output analyses, wealth leakage is mainly related to the import of goods and services needed for an economic activity. Sectors with high GVA type I multipliers generally create more

wealth (direct impacts and the part of induced impacts linked to the supply chain's employees' consumption) and source more locally (indirect impacts and the part of induced impacts linked to the supply chain's employees' consumption). In other words, it represents the "made in Europe" part of the supply chain. The closer a type I multiplier in the gross value added is to 1, the more the supply chain is located within the EU27+UK borders. In that regard, the quota distribution in the scenarios does not differ in its impacts to local European suppliers compared to the current allocation (all at 0.88). In addition, the results show that scenario 1 and scenario 2 favour job creation and GDP within the European territory. More importantly, wealth leakage remains the same by moving quota to passive gears like in scenario 1 and scenario 2. The results demonstrate that investing in a smaller less impactful fleet would keep the industry outputs to similar levels.

Overall, scenario 2, which reallocates 50% of the quotas from vessels equipped with active gears to smaller vessels equipped with passive gears is the most beneficial. It leads to more job creation but lower GDP contribution and turnover considering the current price structure of fish sold. If the price structure favour more strongly smaller vessel equipped with passive gears, scenario 2 would generate similar economic impacts compared with the current situation and it would not generate more wealth leakages.

Table 7. Table showing the impact multiplier of plaice fishing in Sweden before and after the scenarios are ran. Direct multiplier is for the impact on the activity, type I multipliers are composed of direct and indirect (impacts on the supply chain) impacts, and type II multipliers are composed of direct, indirect, induced (impacts of employees' consumption) impacts. Reading example: 1M€ of revenues generated in the plaice fishing sector supports 8.4 direct jobs and 12.4 in total for 590k€ of direct GDP contribution and 1.01 M€ in total in current quota distribution. This reading can be applied to all multipliers across the scenarios.

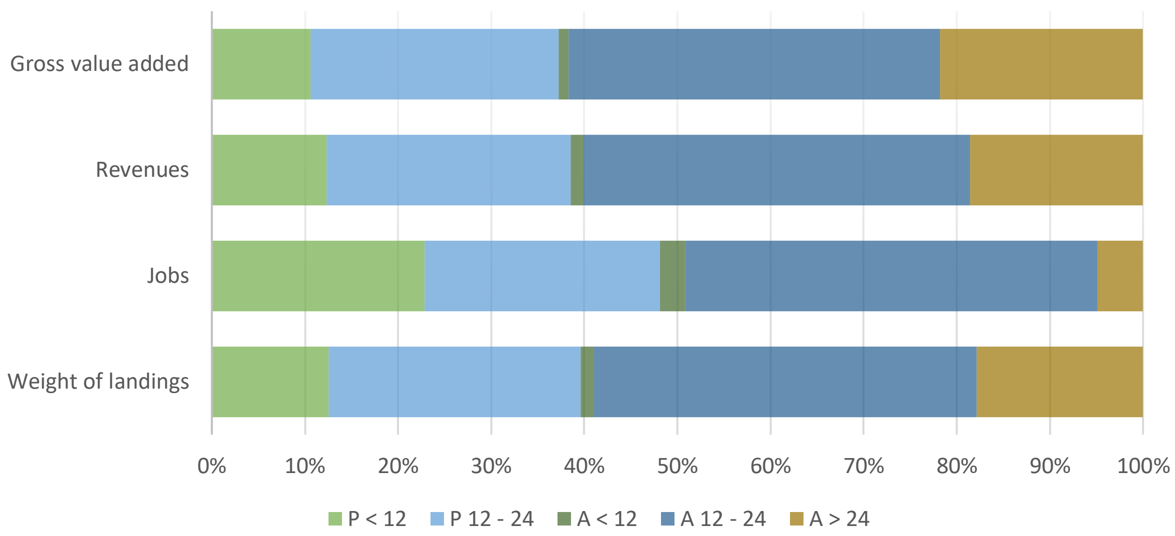
Plaice in Sweden		Original	Scenario 1	Scenario 2
Jobs (FTE/M€)	Direct	8.43	8.57	12.80
	Type I	11.18	11.32	15.54
	Type II	12.38	12.53	16.71
Turnover	Direct	1.00	1.00	1.00
	Type I	1.72	1.72	1.71
	Type II	2.00	2.00	1.98
GVA	Direct	0.59	0.59	0.60
	Type I	0.88	0.88	0.88
	Type II	1.01	1.01	1.00

3.2.4. Denmark

As shown in Figure 17, 65% of volumes landed, revenues and value added are generated by semi-industrial active and passive gear vessels, showing the predominance of mid-range size boats in Denmark. Most of the remainder is generated by artisanal passive gear and industrial active gear vessels that are on the opposite range in terms of environmental impacts.

Interestingly, the type II multipliers follow a similar pattern in between active and passive semi-industrial sectors. Whilst job and turnover multipliers are lower for semi-industrial passive gears than for semi-industrial active gears (respectively 6.8 FTE/M€ vs 7.5 FTE/M€ and €1.59M vs €1.66M), the contribution to the GDP is the opposite (respectively €0.94M and €0.93M). Passive gear follows the same pattern as the job and turnover type II multipliers are higher (€11.6M and €11.73M), the contribution to the GDP is lower (€0.9M). The results are interesting and could indicate a specific structure for semi-industrial passive gear vessels that render them less job intensive for a higher contribution to the GDP (full multiplier details in the appendices).

Figure 17. Plaice fishing distribution in terms of landing volumes, direct jobs, direct revenues and direct gross value added in Denmark by fishing gears and vessel sizes. Full details in the appendices.



After running scenarios 1 and 2, the distribution of impacts for employment, gross value added, and turnover is modified to see whether the scenarios have a positive, neutral or negative impact (Figure 18).

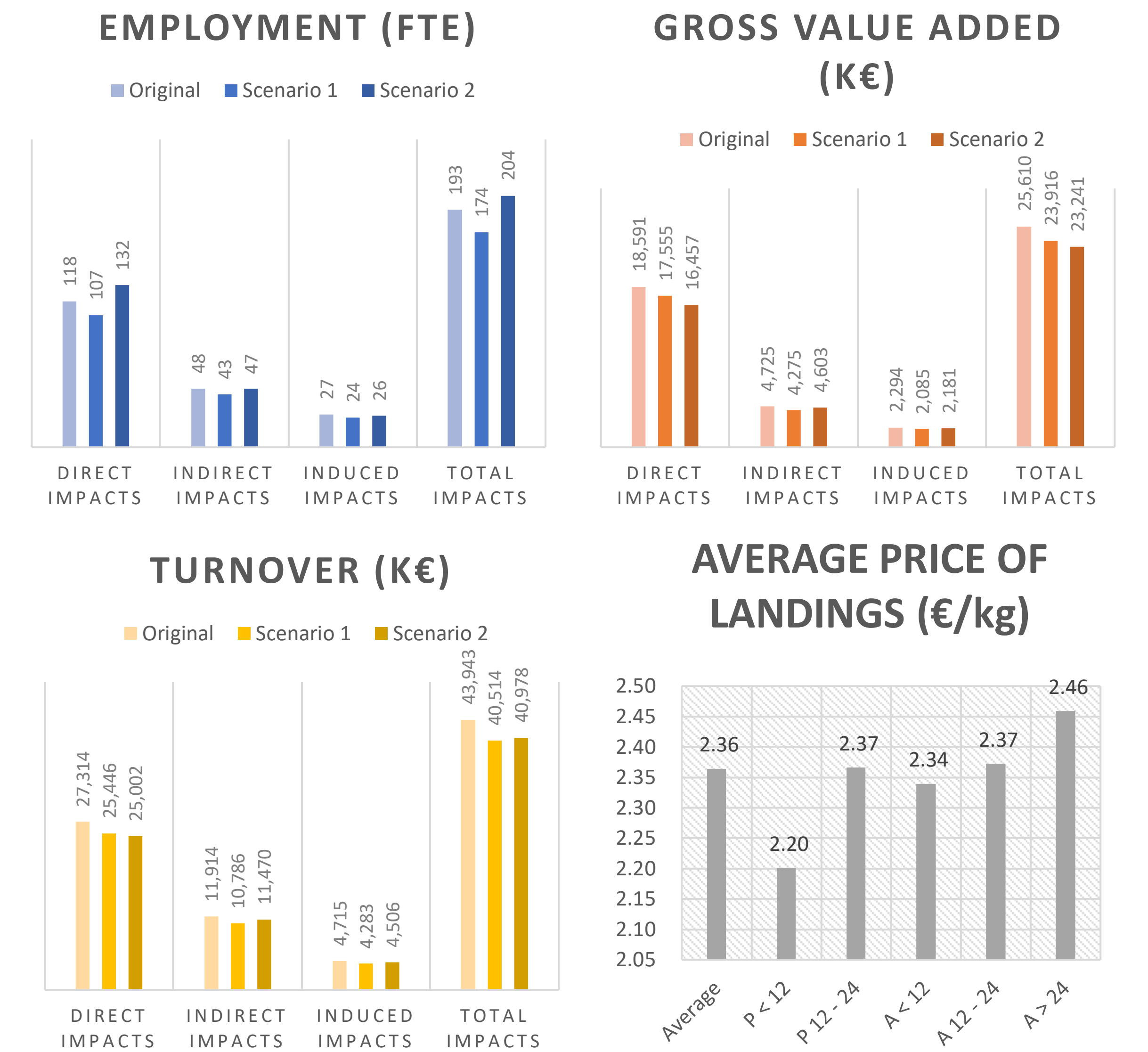
Scenario 2 leads to more job creation (+11 FTE) than scenario 1 (-19 FTE), which can be explained by the absence of an industrial passive gear fishing fleet. Thus, fewer quotas were reallocated in scenario 1 than in scenario 2. The number of jobs increases in scenario 2 was mainly driven by an increase in direct jobs.

For gross value added, scenario 1 and scenario 2 have lower contributions (respectively -6.7% and -9.7%) than the current quota distribution. This would reduce the fishing sector contribution to the EU GDP. Similar patterns are observed for turnover as scenarios 1 and 2 contribute less to the sector revenue stream (respectively -7.8% and -6.7%).

Overall, the total impacts onto the EU27 + UK differ from the current allocation. It would generate more jobs (only for scenario 2) but would decrease the sector contribution to the European Union GDP.

The lower turnover and GDP contributions can be attributed to lower plaice prices for artisanal passive gears compared with other fleets. It is especially flagrant through scenario 2, in which quotas are redistributed mainly to the artisanal passive fleet. A priority should be given to reevaluate the prices of fish sold by this fleet in order to equate the turnover and GDP contributions.

Figure 18. Direct, indirect, and ind uced impacts from the current plaice quota situation in Denmark and after both scenarios for employment in FTE, Gross Value Added in k€, and turnover in k€ have been applied. In addition, the average price of plaice landing is provided for the studied fleets.



The multipliers for plaice fishing shown in Table 7 are a composite of the six vessel type multipliers weighed by the amount of plaice landed. Therefore, whilst the vessel gear and length multiplier remain similar, the composite plaice fishing multiplier changes with reallocated quotas.

One million euros generated by plaice fishing in Denmark in the current situation contributes to the European Union economy on average annually 7.1 FTE, €1.61M of turnover, and €0.94M of European GDP.

For scenario 1, one million euros generated by plaice fishing in Denmark contributes to the European Union economy on average annually of 6.9 FTE, €1.59M of turnover, and €0.94M of European GDP.

For scenario 2, one million euros generated by plaice fishing in Denmark in the current situation contributes to the European Union economy on average annually of 8.2 FTE, €1.64M of turnover, and €0.93M of European GDP.

In input-output analyses, wealth leakage is mainly related to the import of goods and services needed for an economic activity. Sectors with high GVA type I multipliers generally create more wealth (direct impacts and the part of induced impacts linked to the supply chain's employees' consumption) and source more locally (indirect impacts and the part of induced impacts linked to the supply chain's employees' consumption). In other words, it represents the "made in Europe" part of the supply chain. The closer a type I multiplier in the gross value added is to 1, the more the supply chain is located within the EU27+UK borders. In that regard, the quota distribution in the scenarios does not differ in its impacts to local European suppliers compared to the current allocation (all at 0.94). In addition, the results show that scenario 2 favours job creation but not GDP within the European territory. More importantly, wealth leakage remains the same by moving quotas to passive gears like in scenario 1 and scenario 2. The results demonstrate that investing in a smaller less impactful fleet would lead to a marginal decrease in economic outputs in the industry.

Overall, scenario 2, which reallocates 50% of the quotas from vessels equipped with active gears to smaller vessels equipped with passive gears is the most beneficial. It leads to more job creation but lower value-added and turnover considering the current price structure of fish sold. If the price structure favour more strongly smaller vessel equipped with passive gears, scenario 2 would generate more revenue with a slight decrease in GDP contribution compared with the current situation. Nonetheless, it would generate additional wealth leakages.

Table 8. Table showing the impact multiplier of plaice fishing in Denmark before and after the scenarios are ran. Direct multiplier is for the impact on the activity, type I multipliers are composed of direct and indirect (impacts on the supply chain) impacts, and type II multipliers are composed of direct, indirect, induced (impacts of employees' consumption) impacts. Reading example: 1M€ of revenues generated in the plaice fishing sector supports 4.3 direct jobs and 7.0 in total for 680k€ of direct GDP contribution and 640 k€ in total in current quota distribution. This reading can be applied to all multipliers across the scenarios.

Plaice in Denmark		**Original**	**Scenario 1**	**Scenario 2**
Jobs (FTE/M€)	**Direct**	4.33	4.21	5.26
	Type I	6.08	5.91	7.15
	Type II	7.06	6.86	8.18
Turnover	**Direct**	1.00	1.00	1.00
	Type I	1.44	1.42	1.46
	Type II	1.61	1.59	1.64
GVA	**Direct**	0.68	0.69	0.66
	Type I	0.85	0.86	0.84
	Type II	0.94	0.94	0.93

4. CONCLUSION & RECOMMENDATIONS

A 2019 report from the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services[6] (IPBES) finds fishing is the most important driver in the loss of biodiversity and the degradation of marine ecosystems. The damages are mainly caused by bigger vessels equipped with active gears that destroy the seabed, kill unwanted fish and marine animals, and generate large amounts of CO_2 emissions. Thus, there is a need to examine quota reallocation that fulfil environmental and social objectives, without undermining the fishing sector's socioeconomic and cultural fabric.

The use of the ImpacTer model has permitted not only the assessment of the direct socioeconomic impacts of fisheries, but also the indirect and induced impacts. The assessment of the latter two demonstrates the knock-on effects of the haddock and plaice fishing sectors onto other sectors of the EU27 + UK economy and consequently their interdependences.

This study sheds light on the opportunities offered by Article 17 of the CFP. Using several assumptions, it is possible to assess the socio-economic consequences of different quota reallocation scenarios. The reallocation of quotas in favour of environmental and social criteria appears to positively impact employment. Interestingly, the most beneficial scenarios changed depending on the country and the fishery. For haddock fishing for instance, scenario 1 was more beneficial in terms of job impacts whereas for Ireland, scenario 2 was more beneficial. Nevertheless, it was the opposite for the economic indicators (Gross Value Added and Turnover). Throughout the case studies, the question of prices of landings sold by each fleet had a substantial importance on the economic impacts of quota reallocation.

The results demonstrate that the link to the territory, through national specificities, is crucial in the calculation of the socioeconomic impacts of fisheries and highlights the importance of evaluating quota reallocation to maximise both environmental and socioeconomic benefits on a case-by-case basis. Although a static approach was used and the suggested reallocations focused on low impact gears, different combinations can be computed with gradual reallocation overtime.

Consequently, three main indicators and analyses should be considered in future quota reallocation evaluations:

- Social and environmental impacts linked with different fishing techniques and vessels. Further consideration should be given to address and measure the environmental impacts. More accurate data could provide more accuracy in environmentally driven quota distribution.
- Socioeconomic benefits of quota reallocation, which can be greatly impacted. Since the potential substantial rebound effects are difficult to evaluate, more data should be shared to evaluate the impacts of quota reallocation on the fishing industry socioeconomic characteristics.
- Prices of fish have substantial effects on economic benefits in absolute values. Special attention should be given to encourage price positive price reevaluation of smaller vessels equipped with passive gears.

[6] Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES), *Global assessment report on biodiversity and ecosystem services*, 2019.

APPENDIX I – GEAR AGGREGATION

Gear	Aggregated gear
DFN	Passive
DRB	Active
DTS	Active
FPO	Passive
HOK	Passive
MGO	Active
MGP	Active
PG	Passive
PGO	Passive
PGP	Passive
PMP	Passive
PS	Active
TBB	Active
TM	Active

APPENDIX II – IMPACTER MODEL

The ImpacTer model developed by Vertigo Lab is based on the input-output economic analysis developed by economist Wassily Leontief, winner of the 1973 Nobel Prize in Economics. It is a robust economic model that is well known in academic circles. It is currently used to evaluate the socio-economic impact of economic activities (e.g., studies related to the territorial anchorage of companies) and the socio-economic impact of public policies. The BEA, the American equivalent of INSEE, has developed an input-output model, the RIMS model, in order to assess the socio-economic impact of public policies at the federal level in the United States of America.

The ImpacTer model was originally based on the Input-Output Tables (or IOTs), one of the two tables of the National Accounts. They are produced annually at the national level by INSEE and published on the EUROSTAT platform according to a nomenclature of activities in 64 branches. This nomenclature is based on the NAF codes used by INSEE to classify economic activities. The input-output tables record in a coherent framework and for a calendar year both the amount of purchases of the various goods and services made by the sectors of activity, as well as the amount of sales of goods and services depending on whether they are domestic or imported. For example, this table gives the amount of production in agriculture, with a breakdown between the sector's purchases of goods and services from its suppliers (e.g., seeds, plant protection products, animal feed), as well as its value added broken down into compensation of employees, payment of taxes and profits. This table also provides information on the amount of sales of agricultural products to resident producer clients according to their economic activity (e.g., sales to agri-food industries), to resident households (e.g., direct sales to final consumers) and to non-resident clients (exports).

However, Vertigo Lab is now able to mobilise other input-output tables according to the geographical scale studied: WIOD for the global scale, EUROREGIO for the European and regional scales. From the input-output table, the ImpacTer model is able to estimate three types of impacts (shown in the figure below):

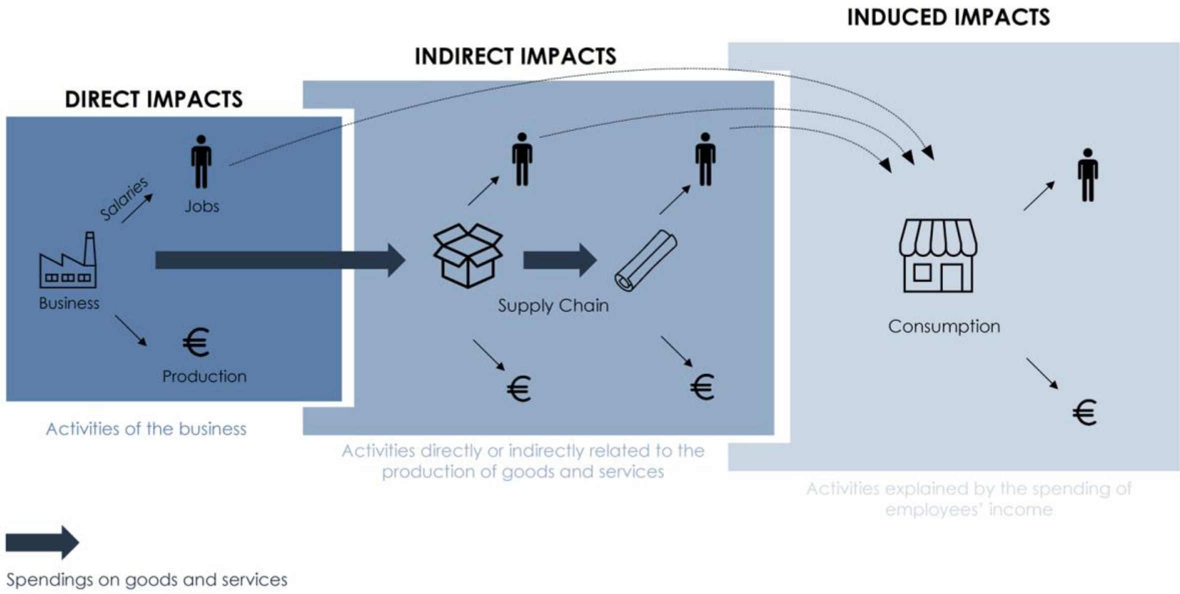
- Direct impacts: these are the impacts for the organizations/sectors directly concerned by the activity or project under study (i.e., cyclologistics companies for the study of cyclologistics.
- Indirect impacts: these are the impacts for the organizations in the chain of suppliers of the direct activities (this incorporates suppliers, but also suppliers of suppliers, etc., going up the entire value chain).
- Induced impacts: these are the impacts explained by the expenses of the employees who work in the organizations impacted directly and indirectly (via the supplier chain) by the study activity.

The various impacts (direct, indirect, and induced) are calculated by the ImpacTer model from the values of the multipliers for each sector of activity. They indicate the amounts of production, added value and jobs that are generated in the economy following an expenditure of one euro on a good or service. There are as many multipliers as there are sectors of activity and socio-economic indicators.

The calculation of the value of the multipliers is used to assess the ripple effects (or domino effects) that an expenditure or an activity generates on the whole economy of the territory. The higher the value of a multiplier, the greater the impact of the expenditure on other sectors of the economy.

The graph below illustrates the calculation of multipliers for the case of bread production.

The multiplier effect of spending one euro on a baguette on the local economy (fictitious example, source: Vertigo Lab)



Suppose a consumer buys €1 of bread from a bakery. The expenditure of one euro by this consumer corresponds to the value of the turnover for the bakery. With this euro, the bakery buys 30-euro cents of flour from the mill. This expenditure of 30 cents by the bakery corresponds to the value of the turnover for the mill. With this revenue of 30-euro cents, the miller buys 15 euro cents worth of wheat from the farmer. These 15-euro cents of purchase by the milling company correspond to the turnover of the farmer. The direct and indirect impacts correspond to the sum of the turnover that is generated by this euro coming from the purchase of the baguette by the consumer, i.e., 1 € + 0.30 € + 0.15 € = 1.45 €. Moreover, the income generated by this euro from the baguette is used to pay the baker, the miller and the farmer. This income is used to consume goods and services partly produced on the territory. In this example, the consumption of this income generates a turnover of 20 cents for the territory. Thus, the total impact (direct, indirect, and induced) of spending a baguette is €1.45+ €0.20 = €1.65. Each euro purchased for a baguette generates €1.65 in sales in the region, all impacts combined.

The input-output model, like any economic model, is based on a number of assumptions:

- Returns to scale are constant: a doubling of production requires doubling all purchases of goods and services and doubling the number of workers. In other words, the production process is assumed to be stable.
- The model is linear: the multiplier effect is assumed to be constant. Each additional euro consumed in a good or service generates the same additional impact (no threshold effects). The model does not take into account the scarcity of resources (natural

resources, human resources, etc.), which limits the socio-economic impact of an increase in economic activity in a territory.

- The results are dependent on the level of disaggregation of economic activities (aggregation bias). The results are more accurate for input-output tables that adopt a disaggregated nomenclature of activities.

Appendix III – Socioeconomic weight

HADDOCK – FRANCE

Gears	Landing volumes (kg)	Jobs (FTE)	Revenues (k€)	Gross value added (k€)
P < 12	282,73	0,01	0,92	0,69
P 12 - 24	2 189,14	0,04	5,30	3,88
P > 24	78 713,10	1,92	155,98	82,12
A < 12	234,95	0,00	0,78	0,56
A 12 - 24	1 912 439,43	20,75	3 703,50	2 454,03
A > 24	2 182 454,22	21,35	3 921,96	2 113,02

HADDOCK – IRELAND

Gears	Landing volumes (kg)	Jobs (FTE)	Revenues (k€)	Gross value added (k€)
P < 12	33 080,75	0,97	41,53	32,90
P 12 - 24	147 044,04	2,38	260,44	177,59
A < 12	30 257,28	0,14	9,79	6,97
A 12 - 24	2 543 346,94	31,19	4 445,81	2 516,94
A > 24	2 941 394,90	26,69	6 011,19	3 965,80

PLAICE - POLAND

Gears	Landing volumes (kg)	Jobs (FTE)	Revenues (k€)	Gross value added (k€)
P < 12	48 122,30	10,53	45,89	27,45
P 12 - 24	2 050,00	0,78	1,48	0,00
A 12 - 24	266 298,60	7,48	211,75	129,43
A > 24	3 644,90	0,00	0,20	0,14

PLAICE - GERMANY

Gears	Landing volumes (kg)	Jobs (FTE)	Revenues (k€)	Gross value added (k€)
P < 12	357 946,00	35,47	710,35	261,07
P 12 - 24	24 435,00	0,38	58,62	55,05
A < 12	38 581,00	0,67	73,92	23,31
A 12 - 24	978 308,00	7,11	1 950,97	1 214,51
A > 24	905 622,00	7,55	1 841,44	1 177,69

PLAICE - SWEDEN

Gears	Landing volumes (kg)	Jobs (FTE)	Revenues (k€)	Gross value added (k€)
P < 12	18 751,00	1,00	51,29	30,88
A < 12	3 007,00	0,09	10,68	6,73
A 12 - 24	46 467,00	1,17	193,79	114,24
A > 24	6 245,00	0,06	18,68	10,78

PLAICE - DENMARK

Gears	Landing volumes (kg)	Jobs (FTE)	Revenues (k€)	Gross value added (k€)
P < 12	1 351 954,00	27,10	3 359,90	1 968,26
P 12 - 24	2 915 506,00	29,85	7 160,86	4 960,99
A < 12	154 387,00	3,26	397,58	189,74
A 12 - 24	4 429 737,00	52,40	11 313,57	7 416,62
A > 24	1 922 524,00	5,80	5 081,70	4 055,36

APPENDIX IV – IMPACT MULTIPLIERS BY COUNTRY AND FLEET

HADDOCK

FRANCE	JOB DIRECT MULTIPLIER	JOB TYPE I MULTIPLIER	JOB TYPE II MULTIPLIER	TURNOVER DIRECT MULTIPLIER	TURNOVER TYPE I MULTIPLIER	TURNOVER TYPE II MULTIPLIER	GVA DIRECT MULTIPLIER	GVA TYPE I MULTIPLIER	GVA TYPE II MULTIPLIER
HADDOCK FISHING	5,66	9,09	11,55	1,00	1,74	2,17	0,60	0,89	1,09
P < 12	7,45	9,61	11,28	1,00	1,46	1,74	0,75	0,93	1,07
P 12 - 24	6,89	9,24	11,03	1,00	1,50	1,80	0,73	0,93	1,08
P > 24	12,34	16,47	19,36	1,00	1,87	2,36	0,53	0,87	1,10
A < 12	5,99	8,41	10,24	1,00	1,52	1,83	0,72	0,92	1,07
A 12 - 24	5,60	8,47	10,58	1,00	1,62	1,99	0,66	0,91	1,08
A > 24	5,44	9,38	12,17	1,00	1,85	2,33	0,54	0,87	1,09

IRELAND	JOB DIRECT MULTIPLIER	JOB TYPE I MULTIPLIER	JOB TYPE II MULTIPLIER	TURNOVER DIRECT MULTIPLIER	TURNOVER TYPE I MULTIPLIER	TURNOVER TYPE II MULTIPLIER	GVA DIRECT MULTIPLIER	GVA TYPE I MULTIPLIER	GVA TYPE II MULTIPLIER
HADDOCK FISHING	5,70	7,17	8,13	1,00	1,53	1,71	0,62	0,87	0,96
P < 12	23,47	24,35	24,90	1,00	1,29	1,39	0,79	0,92	0,97
P 12 - 24	9,12	10,44	11,35	1,00	1,44	1,61	0,68	0,89	0,97
A < 12	13,96	15,05	15,79	1,00	1,41	1,55	0,71	0,91	0,97
A 12 - 24	7,02	8,71	9,79	1,00	1,61	1,81	0,57	0,85	0,95
A > 24	4,44	5,77	6,64	1,00	1,48	1,64	0,66	0,89	0,96

PLAICE

POLAND	JOB DIRECT MULTIPLIER	JOB TYPE I MULTIPLIER	JOB TYPE II MULTIPLIER	TURNOVER DIRECT MULTIPLIER	TURNOVER TYPE I MULTIPLIER	TURNOVER TYPE II MULTIPLIER	GVA DIRECT MULTIPLIER	GVA TYPE I MULTIPLIER	GVA TYPE II MULTIPLIER
PLAICE FISHING	72,47	83,22	87,46	1,00	1,63	2,02	0,60	0,87	1,03
P < 12	229,46	240,90	245,38	1,00	1,61	2,02	0,60	0,87	1,03
P 12 - 24	529,18	572,38	589,07	1,00	3,31	4,85	0,51	0,51	1,12
A 12 - 24	35,32	45,69	49,79	1,00	1,62	2,00	0,61	0,87	1,02
A > 24	18,73	27,09	30,50	1,00	1,53	1,84	0,67	0,89	1,02

GERMANY	JOB DIRECT MULTIPLIER	JOB TYPE I MULTIPLIER	JOB TYPE II MULTIPLIER	TURNOVER DIRECT MULTIPLIER	TURNOVER TYPE I MULTIPLIER	TURNOVER TYPE II MULTIPLIER	GVA DIRECT MULTIPLIER	GVA TYPE I MULTIPLIER	GVA TYPE II MULTIPLIER
PLAICE FISHING	11,04	15,42	17,43	1,00	1,61	1,91	0,59	0,86	1,00
P < 12	49,93	56,91	59,94	1,00	1,91	2,36	0,37	0,79	1,00
P 12 - 24	6,46	7,13	7,50	1,00	1,09	1,14	0,94	0,98	1,01
A < 12	9,11	16,59	19,77	1,00	2,00	2,47	0,32	0,77	0,99
A 12 - 24	3,64	7,68	9,54	1,00	1,56	1,84	0,62	0,87	1,00
A > 24	4,10	7,84	9,61	1,00	1,55	1,81	0,64	0,88	1,00

SWEDEN	JOB DIRECT MULTIPLIE R	JOB TYPE I MULTIPLI ER	JOB TYPE II MULTIPLIE R	TURNOVER DIRECT MULTIPLIER	TURNOVER TYPE I MULTIPLIER	TURNOVER TYPE II MULTIPLIER	GVA DIRECT MULTIPLIER	GVA TYPE I MULTIPLIER	GVA TYPE II MULTIPLIER
PLAICE FISHING	8,43	11,18	12,38	1,00	1,72	2,00	0,59	0,88	1,01
P < 12	19,53	22,27	23,41	1,00	1,69	1,96	0,60	0,88	1,00
A < 12	8,59	11,11	12,20	1,00	1,65	1,91	0,63	0,89	1,01
A 12 - 24	6,01	8,78	10,00	1,00	1,73	2,01	0,59	0,88	1,01
A > 24	2,97	5,73	6,97	1,00	1,77	2,06	0,58	0,87	1,00

DENMARK	JOB DIRECT MULTIPLI ER	JOB TYPE I MULTIPLI ER	JOB TYPE II MULTIPLIE R	TURNOVER DIRECT MULTIPLIER	TURNOVER TYPE I MULTIPLIER	TURNOVER TYPE II MULTIPLIER	GVA DIRECT MULTIPLIER	GVA TYPE I MULTIPLIER	GVA TYPE II MULTIPLIER
PLAICE FISHING	4,33	6,08	7,06	1,00	1,44	1,61	0,68	0,85	0,94
P < 12	8,06	10,42	11,58	1,00	1,53	1,73	0,59	0,81	0,90
P 12 - 24	4,17	5,85	6,81	1,00	1,42	1,59	0,69	0,86	0,94
A < 12	8,20	11,12	12,64	1,00	1,70	1,96	0,48	0,76	0,89
A 12 - 24	4,63	6,51	7,58	1,00	1,47	1,66	0,66	0,84	0,93
A > 24	1,14	2,18	2,81	1,00	1,30	1,41	0,80	0,91	0,96

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