

www.sintef.no





**SINTEF Fisheries and Aquaculture**  
International Projects and Consulting

**SINTEF Technology and Society**  
Economics and Logistics

**Fafo Institute for Labour and Social Research**

Address SINTEF:  
NO-7465 Trondheim, Norway  
Telephone: +47 4000 5350  
Enterprise No.: NO 980 478 270 MVA

Address Fafo:  
P.Box 2947 Toyen, NO-0608 Oslo, Norway  
Telephone: +47 2208 8600  
Enterprise No.: NO 986 343 113 MVA

# REPORT

TITLE

**Employment in the EU based on Farmed Norwegian Salmon**

AUTHOR(S)

SINTEF Fisheries and Aquaculture; Ulf Winther and Merete Gisvold Sandberg  
SINTEF Technology and Society; Arne Stokka, Inger Anne Setermo, Matthias Nowak, Lars Harald Vik and Håkon Hynne Fafo; Torunn Kvinge

CLIENT(S)

The Norwegian Federation of Trade Unions (LO)

REPORT NO. <b>SFH 80A056031</b>	CLASSIFICATION <b>Open</b>	CLIENTS REF. <b>Jørn Prangerød</b>	
CLASS. THIS PAGE	ISBN <b>82-14-03543-0</b>	PROJECT NO. <b>862003</b>	NO. OF PAGES/APPENDICES <b>52</b>
ELECTRONIC FILE CODE <b>Report_final300605.doc</b>		PROJECT MANAGER (NAME, SIGN.) <b>Ulf Winther</b>	CHECKED BY (NAME, SIGN.) <b>Trude Olafsen</b>
FILE CODE	DATE <b>2005-06-30</b>	APPROVED BY (NAME, POSITION, SIGN.) <b>Karl A. Almås</b>	

**ABSTRACT**

SINTEF and Fafo have carried out an analysis of employment effects of Norwegian salmon in the EU processing industry and indirect employment effects in other industries in the EU. Results are presented for five focus countries (Germany, Denmark, France, Poland and UK) and for EU in total. Employment effects are also presented for salmon farming in Scotland and Ireland, along with indirect employment effects in other industries in the EU. Consequences in terms of employment of protective measures against Norwegian salmon are discussed.

KEYWORDS	ENGLISH	NORWEGIAN
GROUP 1	Aquaculture	Akvakultur
GROUP 2	Food Processing	Foredling
SELECTED BY AUTHOR	Salmon processing	Lakseforedling
	Employment	Arbeidsplasser
	EU	EU

## TABLE OF CONTENTS

<b>1</b>	<b>Summary</b>	<b>3</b>
<b>2</b>	<b>Introduction and scope of the analysis</b>	<b>6</b>
<b>3</b>	<b>Definitions</b>	<b>7</b>
<b>4</b>	<b>Method and data</b>	<b>8</b>
<b>5</b>	<b>Supply of farmed Atlantic salmon to the EU</b>	<b>12</b>
5.1	Total supply of farmed Atlantic salmon 2003	12
5.2	Output of salmon products from processing	12
<b>6</b>	<b>Employment and turnover in the EU processing industry based on farmed Norwegian salmon</b>	<b>14</b>
6.1	Germany (D)	14
6.2	Denmark (DK)	14
6.3	France (F)	15
6.4	UK	15
6.5	Poland (POL)	16
6.6	Rest of the EU (other)	17
6.7	Total employment in processing	18
<b>7</b>	<b>Total effects of farmed Norwegian salmon in EU 25</b>	<b>19</b>
7.1	Discussion	20
<b>8</b>	<b>Employment in salmon farming in Scotland and Ireland</b>	<b>22</b>
<b>9</b>	<b>Protective measures - assessing consequences in terms of employment in the salmon processing industry</b>	<b>24</b>
9.1	Introduction	24
9.2	Supply of farmed Atlantic salmon	24
9.3	Demand for salmon and expected development in prices	29
9.4	The European Union salmon processing industry	33
9.5	Possible consequences of protective measures for employment	35
9.6	Conclusions	37
<b>10</b>	<b>References</b>	<b>39</b>
<b>11</b>	<b>Appendices</b>	<b>42</b>
11.1	Details on the Input-output database	42
11.2	Data from Kontali Analyse	45

## 1 Summary

### Processing of salmon- total EU

The main producing countries of farmed Atlantic salmon are Norway, Chile, UK, USA/Canada, Faeroe Islands, Ireland and Iceland. The total production of farmed salmon from these countries was 1,130,700 tonnes wfe in 2003 (Kontali Analyse). Of this volume 587,000 tonnes was supplied to the EU, either as import or as domestic production in Scotland and Ireland. Kontali Analyse has estimated that 368,000 tonnes wfe are processed in the EU salmon processing industry. The Norwegian share of these 368,000 tonnes was estimated to 230,000 tonnes wfe in 2003.

The total effects of salmon processing in the EU 25 are calculated by means of an input-output model. Total employment effects include: The direct employment in the salmon processing industry, the indirect employment in the supplying industries and the indirect employment effects in the rest of the economy.

The total effects of farmed Norwegian salmon are given below:

	<b>Total employment effects of Norwegian salmon in EU 2003 (FTE)</b>
Direct in salmon processing	8,100
Indirect employment in EU	9,700
<b>Total employment in EU based on Norwegian salmon</b>	<b>17,800</b>

Source: SINTEF / Fafo

Total employment in the EU supported by Norwegian Atlantic salmon is estimated to 17,800 FTE in 2003. Of this, 8,100 are directly employed in the processing industry, while 9,700 are indirect employment effects in the EU. This gives a multiplier effect of approximately 1.20 for total salmon processing in the EU, which is the same as for processed Norwegian salmon. The total turnover in the EU processing industry based on Norwegian farmed salmon was 1,315 million Euros in 2003.

Processing of farmed Atlantic salmon in total is estimated to support 30,910 FTEs in the EU, of which 14,210 are in the processing industry and 16,700 are indirect employment.

The indirect effects are spread on most types of industries. If we consider the directly supplying industries to salmon processing, we naturally find that fish farming (raw and frozen salmon) dominates, with more than 50% share of the input value. Trade and transport have a 18% share of input value, different manufactured products cover 14%, and different business services have a share of 11% of supplied input to the fish processing industry.

Induced consumption effects are not included in our calculations. Such effects can give a substantial rise in the number of indirect employment, but are not included here due to uncertainty of this kind of effects. In addition trading of farmed salmon, the Hotel/Restaurant/Catering market and processing in e.g. supermarkets are not included.

The total input to salmon processing has had only a small increase in tonnage from 2003 to 2005, while the Norwegian share of input has increased with 20,000 tonnes in 2004, and has a further

increase in 2005. However, because of increased efficiency in the processing industry there is probably only a small increase in total employment based on Norwegian salmon after 2003.

In the fish processing industry there are a significant number of part time and seasonal jobs, which are not calculated separately in this study but are included in the FTE figures. Other studies indicate that the total number of jobs, included part-time and seasonal jobs, can be an additional 20 – 50 % of the FTE estimated. Applied to the number of FTE based on Norwegian salmon (8,100) this would give a total number of employees (full time and part time) of 9,700 – 12,200 in the EU salmon processing industry.

The salmon processing industry is often located in rural areas or in other areas where alternative employment is not easily accessible.

### Processing of salmon - focus countries

The employments in the five focus countries Germany (D), Denmark (DK), France (F), Poland (POL) and UK are presented separately;

	Total employment effects of Norwegian salmon 2003 (FTE)				
	D	DK	F	POL	UK
<b>Norwegian salmon</b>					
Direct in salmon processing	780	1,370	1,900	1,610	170
Indirect employment in EU	1,200	1,700	2,300	600	200
<b>Total employment in EU based on Norwegian salmon</b>	<b>1,980</b>	<b>3,070</b>	<b>4,200</b>	<b>2,210</b>	<b>370</b>

Source: SINTEF / Fafo

The total employment in EU supported by Norwegian salmon in UK is likely to have risen since 2003 due to a decrease in UK production of farmed salmon of about 40,000 tonnes since 2003, while import of Norwegian salmon to UK is expected to increase with approximately 17,500 tonnes wfe from 2003 until the end of 2005.

Poland has had a significant increase in processing of farmed salmon, and employment (FTE) in salmon processing is estimated to have increased with 400 - 600 from 2003 to 2005. The share of Norwegian salmon in Poland is still almost 100 % so far in 2005.

The five focus countries are the most important countries for processing of Norwegian salmon and represents 67 % of the total employment in EU supported by Norwegian salmon.

### Salmon farming – Scotland and Ireland

Total production (slaughtered) of farmed Atlantic salmon in the EU, represented by Scotland and Ireland, amounted to 180,400 tonnes wfe in 2003. This production is almost 100% of the salmon farming activity in the EU. Scottish production represents 162,000 tonnes and Irish production 18,400 tonnes.

Salmon farming includes smolt and on-growing production.

	Salmon farming in the EU 2003 Full Time Equivalents (FTE)
In salmon farming in Scotland	1,440
In salmon farming in Ireland	390
Indirect employment	2,900
<b>Total employment salmon farming Scotland and Ireland</b>	<b>4,730</b>

Source: SINTEF / Fafo

The total direct and indirect employment (FTE) in salmon farming in the EU, represented by Scotland and Ireland was estimated to 4,730 in 2003. The indirect employment in EU amounts to 2,900, which gives an employment multiplier effect of 1.6.

The salmon farming industry in Scotland represented a direct employment of 1,440 FTEs and a total turnover of 512 million EURO in 2003, in Ireland the industry represented a direct employment of 390 FTEs and a turnover of 56 million EURO.

Most probably the employment in Scottish salmon farming has been reduced from 2003 because of reduced production of about 40,000 tonnes wfe and increased efficiency in the industry.

### **Protective measures – consequences in terms of employment**

Protective measures may result in lower supply of - and higher prices on Norwegian salmon. Salmon processing firms may move to countries which have no - or lower trade barriers towards EU and no protective measures towards Norwegian salmon (so-called tariff-jumping). To compensate for potentially higher costs of raw materials, salmon processing may also relocate within the EU to countries with relative low labour costs, for instance to the Eastern part (the Baltic countries, Poland). Several farming and processing firms in Chile, Norway, the UK and other EU member countries are subsidiaries of multinational enterprises. These enterprises are not only already established in different markets, but also have the necessary experience when further relocation of activities is an option.

In the medium and long run, only Chile seems to have the potential to increase the supply of farmed Atlantic salmon to the EU. Chile, however, has a very high degree of filleting. When frozen Chilean fillets compensate for fresh whole European salmon, this may result in some reduction in employment in filleting in the EU processing industry. Because of certain logistic challenges as well as customers' preferences, salmon processing companies in higher value-added segments might be less eager to relocate as well as to use frozen fillets than providers for the first price segment. Nevertheless, higher consumer prices due to increased prices on inputs, because of protective measures, will probably result in reduction in demand and hence reduction in employment in the salmon processing industry in the European Union - also in the high price segments.

## 2 Introduction and scope of the analysis

SINTEF Fisheries and Aquaculture, SINTEF Technology and Society and Fafo Institute for Labour and Social Research have been assigned by the Norwegian Federation of Trade Unions (LO) in cooperation with the European Federation of Trade Unions in the Food, Agriculture and Tourism Sectors (EFFAT) to undertake a study on the extent of employment within the European Union based on imports of farmed Atlantic salmon, with special focus on Norwegian salmon. The scope of our study includes the following main elements:

- *Analysing the direct and indirect economic effects of Norwegian salmon in EU today, focusing both on the number of jobs created in the fish processing industry and the employment effects generated in other industries.*
- *Give a broader perspective on the effects induced by reducing the supply of Norwegian salmon, i.e. evaluate alternatives to Norwegian salmon and the potential effects on employment in the EU.*

SINTEF Fisheries and Aquaculture has together with Fafo collected data and calculated employment in the fish processing industry. SINTEF Fisheries and Aquaculture had the main responsibility for producing economic figures for the salmon processing and farming industries. SINTEF Technology and Society has been responsible for constructing the database and model, and for calculating the indirect economic and employment effects. Fafo has had the main responsibility for assessing consequences of reduced supply of Norwegian salmon to the EU. Project manager has been Senior adviser Ulf Winther at SINTEF Fisheries and Aquaculture.

This report is the main report. A short version of this report was released 6 June 2005 (report no: SFH 80 A056030).

The study is financed by the Norwegian Fishery and Aquaculture Industry Research Fund, and has been conducted in the time period March to June 2005.

Many firms, institutions and individuals have contributed to this report through sharing their information with us. We would like to thank each of them for their cooperation.

Trondheim, Norway 30 June 2005  
Karl A. Almås, president SINTEF Fisheries and Aquaculture

### 3 Definitions

Direct employment = used for employment in the salmon processing industry and farming industry

EU = EU 25

FTE = Full Time Equivalent, i.e. one man-labour year.

Indirect effects = Effects in the delivering industries and all other industries supporting these activities

Indirect employment = employment in all industries delivering goods directly or indirectly to the processing industry and other industrial activities supporting these activities.

Processing industry = Processing industry includes slaughtering, primary and secondary processing. Trading of farmed salmon, the Hotel/Restaurant/Catering market and processing in e.g. supermarkets are not included.

Salmon = Farmed Atlantic salmon.

Salmon farming = includes smolt- and on-growing production. Slaughtering and transportation to processing plant or border are not included.

Total Labour Costs = Sum of compensation of employees plus other labour costs, i.e. the total costs related to employees.

WFE = Whole Fish Equivalent, i.e. whole fish that is starved and bled.



## 4 Method and data

This analysis is carried out by:

- a) Registering, tracing and calculating as detailed as possible, the direct economic and employment effects from salmon processing and salmon farming in the EU.
- b) Calculating the indirect effects by means of an input-output model for the whole EU.
- c) Making judgments on alternatives to Norwegian salmon

### Employment and turnover in the processing industry

Our work is based on public available statistics (e.g. EUROSTAT), other available published data (e.g. studies) as well as data from interviews with firms, organisations and research institutions.

Kontali Analyse has provided figures for supply and demand of farmed Atlantic salmon to the EU; in total, split on country of origin and product. Kontali Analyse has also provided overviews of product transformation and product value/turnover for farmed salmon (and specifically Norwegian salmon) in the processing industry.

The figures from Kontali are based on these main principles; Estimates of the total supply of farmed salmon to each country, hereof defining the input volume to the processing industry. Output from processing are estimated for main groups of products (fresh/frozen whole fish and fillets, smoked and added value) using standard conversion ratios. The derived volumes of output in product weight were multiplied with an average unit price to get the turnover. This was done separately for the five focus countries and for the rest of the EU as a whole (see Appendix 11.2).

Information for calculation of employment in other industries:

- **Total turnover** in processing industry in each country. Kontali figures are used as basis, cross-checked with surveys and other information from each country.
- **Labour costs and operational expenditure** as share of total turnover. The share is either provided directly from our sources (i.e. research institutions) in the actual countries; UK we used figures from Macpherson, 2003 and in Germany from Fisch-Informationeszentrum e.V, or estimated when missing. The estimate was made based on information from interviews and other sources. Labour cost includes all cost related to employment, also the cost of management.
- **Operational expenditure split on origin** (own country, rest of the EU, outside the EU). The split was made based on origin of the fish raw material and other costs.
- **Average cost of labour for one FTE** in the salmon processing sector were estimated using EUROSTAT figures for Manufacturing and more accurate information derived from the fish processing industry.

Based on the referred sources of information we have estimated:

- **Number of full time employment (expressed as FTE – Full Time Equivalent)** in the processing industry based on farmed Norwegian salmon and farmed salmon in total. This was done for each country using the absolute figure for Labour costs, divided by average cost of labour per person per year.

For quality assurance purposes our estimates were tested and/or discussed with representatives for the industry, organisations and research institutions.

### **Employment in the salmon farming industry in Scotland and Ireland and key figures for calculation of employment in other industries**

Kontali Analyse has provided figures for slaughtered volumes (tonnes wfe) of farmed Atlantic salmon, prices achieved per kg wfe, and information on production cost in salmon farming. Together with information from national production surveys, of e.g. size of smolt production, this formed the basis for the calculation of turnover.

Using the same method as for the processing industry; share of **labour costs** and **operational expenditures** of total turnover were estimated, **operational expenditure was split on origin** and the **number of FTEs** were calculated.

For quality assurance purposes our estimates were tested and/or discussed with representatives for the industry.

### **Model and data for calculation of indirect effects**

The indirect effects of processed salmon in EU are calculated by means of an input-output model. The input (the supply side) of the model is production in a country and imports, divided in intra-EU and extra-EU imports to that country. The output (the demand side) of the model consists of domestic intermediate deliveries for production, private consumption, other domestic final demand, and exports, divided in intra-EU and extra-EU exports. The model is demand-driven with fixed input coefficients for intermediate demand and a pool for intra-EU exports and imports.

At the commodity (or industry) level, the sum of intra-EU imports must add up to the intra-EU exports. Each country's import from EU is a function of the country's own output and final demand, and its export to EU is a function of aggregate EU import. The model describes the economic activities of 60 industries within the EU15-countries (except Greece and Luxembourg) added with Poland and Estonia. Adjustment scaling factors are used to achieve figures for EU25.

The magnitude of processed salmon industry in EU is calculated by comparing the following two situations:

1. Firstly, the employment situation in the economy in a normal situation is estimated with reference to year 2000 and 2003. This describes a status quo situation, with import of Norwegian salmon to the EU as before the effects of antidumping measures in 2005.
2. Secondly, the effect on the EU economy without the processing of salmon is found by omitting this industry from the data, country by country, and recalculating the model. This is done both for 2000 and 2003

By comparing the situations with and without these industries, one gets estimates for the employment in the EU countries due to processed salmon imported from Norway. In addition we

have also calculated the magnitude of employment in the EU from processing of other Atlantic salmon.

A similar calculation was carried out on the indirect employment in the EU from salmon farming in Ireland and Scotland (UK). Calculations were made with and without the salmon farming industries, and the difference gives the indirect effects from the salmon processing industry.

Much effort has been used to obtain the data necessary for the calculations. The main data source has been National accounts for the year 2000 from the Eurostat database (Input-Output tables at basic prices). For some countries the accounts were only available for earlier years, and this data were updated to year 2000 by use of indexes. Some countries do not prepare national accounts data in the standard Input-Output format and these data had to be transformed to the standard used in the analysis. To be able to calculate the effects in the whole EU, it was necessary to describe each country's exports and imports inside the EU. The National accounts in Eurostat give such a split of imports and exports (Intra-EU and Extra-EU). However, for some countries this split was missing, and a split was constructed on basis of data from the foreign trade statistics in combination with average data on split from other representative countries (especially on service products). Most of the data was available in Euro values, but some had to be transformed from national currencies.

The Eurostat data is specified for 60 industries/commodities, which comprises one fishing industry (catch and farming together) and one common industry for food and beverage products (including fish processing). Special estimates had to be made in order to get data for the salmon processing and farming industries. This was done by combining the data on fish processing industry in the National Accounts from Denmark, Sweden, Netherlands, Belgium (and partly Estonia and UK) with the specific (aggregate) data on salmon processing from the industry itself. Thus, data on fish processing was divided into 3 sub-categories: a) Processed Norwegian salmon, b) Other processed Atlantic salmon, and c) Other fish processing. For the 10 most important countries on salmon processing in EU, the two salmon processing industries were constructed. The database and model were correspondingly extended with input-output specifications for processing of Norwegian salmon and Atlantic salmon, while processing of other fish was included in the common industry of food and beverage products.

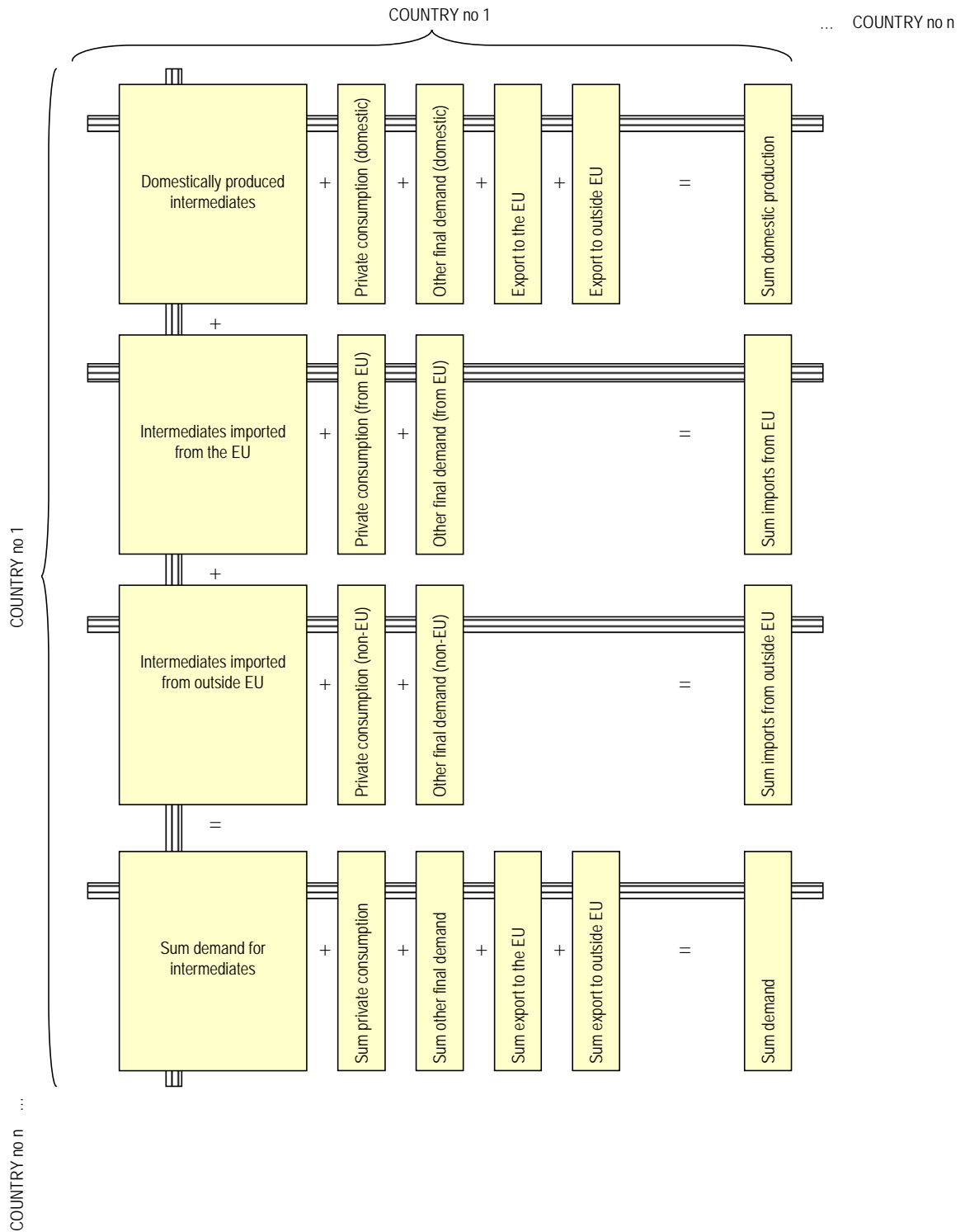
The indirect effects from salmon farming in EU were found in a similar way. A split of the fishing industry in a) fishing (catch) and b) Fish farming was made for two countries: Ireland and Scotland (UK). Data are obtained by combining national accounts data with specific data from the salmon farming industry. This made it possible to extend the database and model with data on fish farming.

By using price and volume indexes, the 2003 data for the salmon processing data were harmonized with the national accounts data for 2000. The demand figures on salmon processing industry at 2003 level were thus combined with the input-output structure on indirect effects at the 2000 level.

The purpose of the calculations is to give a measure of the direct and indirect magnitude which salmon processing and farming industries has on employment in the EU today. Such calculations can be carried out in many ways. The calculations are not pretending to give a picture of what will happen if these industries should vanish. In that case, certain counter forces and substitution effects are expected to come into action, and the final effect on the all over employment in EU is more complicated to estimate.

The data structure are summarized in the figure below, where the “lines” are illustrating the industries which are expanded by combining national accounts data with specific data from the industries.

**Figure 1 Data structure for each country**



## 5 Supply of farmed Atlantic salmon to the EU

### 5.1 Total supply of farmed Atlantic salmon 2003

The main producing countries of farmed Atlantic salmon are Norway, Chile, UK, USA/Canada, Faeroe Islands, Ireland and Iceland. The total production of farmed salmon from these countries was 1,130,700 tonnes wfe in 2003 (see table 1 below). Of this volume 587,000 tonnes was supplied to the EU, either as import or as domestic production in Scotland and Ireland.

**Table 1 Total production and supply to the EU of Atlantic farmed salmon in 2003**

Country	Tonnes wfe		
	Harvest quantity	Supplied to EU	To processing in EU
Norway	508,000	361,000	
Chile	281,000	23,800	
UK	162,000	139,500*	
USA/Canada	110,000	600	
Faeroe Islands	47,100	41,900	
Ireland	18,400	18,200*	
Iceland	4,200	1,700	
<b>Total</b>	<b>1,130,700</b>	<b>586,700</b>	<b>368,000</b>

Source : Kontali Analyse

\*excluded fish exported out of EU

Of the volume supplied to the EU, Kontali Analyse has estimated that 368,000 tonnes wfe are processed in the EU salmon processing industry (for UK and Ireland pure harvesting/gutting is not seen as a part of processing). The Norwegian share of these 368,000 tonnes was estimated to 57% or 230,000 tonnes wfe in 2003.

The total export of Norwegian salmon to the EU was 361,000 tonnes wfe in 2003 and 230,000 tonnes of this was further processed by the EU processing industry.

### 5.2 Output of salmon products from processing

As table 2 shows, the 230,000 tonnes (wfe) of Norwegian salmon going to the EU processing industry, is estimated to give an output of 142,000 tonnes of products with a sales value for the processing industry of 1,305 million EURO. The main part of the products produced is smoked, with other added value products and fillets to follow.

The EU salmon processing industry is estimated to produce 227,000 tonnes of products in total at a sales value of 2,300 million Euro in year 2003.

**Table 2      Processing of Atlantic salmon in the EU for year 2003**

	<b>Input to processing tonnes wfe</b>	<b>Output in product weight tonnes</b>	<b>Value in million Euro</b>
Norwegian salmon	230,000	142,000	1,305
Total salmon	368,000	227,000	2,300

*Source Kontali Analyse/SINTEF*

## 6 Employment and turnover in the EU processing industry based on farmed Norwegian salmon

This chapter presents the calculated direct employment and the turnover in the EU salmon processing industry. The employment is presented as number of Full Time Equivalents (FTEs), the same as one man-labour year.

As set in the definitions chapter the processing activities carried out in the Hotel, Catering and Restaurants Sector or by Supermarkets themselves are not included in this analysis.

### 6.1 Germany (D)

The processing of salmon in Germany is dominated by smokers, processing relatively few standard products. A substantial part of smoked salmon is exported out of the country, but generally the main part of the salmon products are for the home market.

Our analysis estimate the input of salmon to processing to be around 32.000 tonnes wfe in year 2003 with an output of around 20,000 tonnes of product weight.

**Table 3 Direct employment and turnover of salmon processing in Germany in 2003**

	Salmon processing in Germany 2003	
	Direct employment Full Time Equivalents (FTE)	Turnover (Million €)
<b>Based on Norwegian salmon</b>	<b>780</b>	<b>190</b>
Based on Total salmon	920	225

Source: SINTEF / Fafo

The employment in the German processing industry based on Norwegian farmed salmon is estimated to 780 FTEs in 2003 and the sales value for the processing industry is estimated to 190 million Euros in year 2003 (Table 3).

### 6.2 Denmark (DK)

Denmark is an important country for Norwegian salmon, not just as a processor of salmon but also as a transit country. Large volumes of Norwegian salmon is exported to Denmark, in 2003 summing up to 113,000 tonnes wfe (Kontali Analyse).

The Danish salmon processing industry is mainly characterised by the smoking industry, but also produces large volumes of fresh and frozen fillets and other prepared products. Our analysis estimate the input to processing to be around 67,000 tonnes wfe in year 2003, with an output of around 42,000 tonnes of product weight.

**Table 4 Direct employment and turnover of salmon processing in Denmark in 2003**

	Salmon processing in Denmark 2003	
	Direct employment Full Time Equivalents (FTE)	Turnover (Million €)
<b>Based on Norwegian salmon</b>	<b>1,370</b>	<b>250</b>
Based on Total salmon	1,710	310

Source : SINTEF / Fafo

The employment in the Danish processing industry based on Norwegian farmed salmon is estimated to 1,370 FTEs in 2003 and the sales value for the processing industry is estimated to 250 million Euros in year 2003 (Table 4).

### 6.3 France (F)

France is an important country for Norwegian salmon and large volumes of Norwegian salmon are exported to France. In 2003 74,000 tonnes wfe was exported directly from Norway, in addition the export of whole fish from Denmark with Norwegian origin was around 10,000 tonnes, this summing up to 85,000 tonnes wfe (Kontali Analyse).

The French salmon processing industry is dominated by the smoking industry. In 2003 they produced 23,000 tonnes of smoked products with a sales value of around 380 million Euros (ADEPALE, 2003). The range of products is large, from first-price products to high-quality advanced products. The French processing sector is sophisticated compared to Denmark, Germany and Poland, in the sense that they have a larger product assortment. The products produced are mainly for the home market, with only a small share going to export.

Our analysis estimate the total input of salmon to processing to be around 76,000 tonnes wfe in 2003, with an output of around 42,000 tonnes of product weight.

**Table 5 Direct employment and turnover of salmon processing in France in 2003**

	Salmon processing in France 2003	
	Direct employment Full Time Equivalents (FTE)	Turnover (Million €)
<b>Based on Norwegian salmon</b>	<b>1,900</b>	<b>370</b>
Based on Total salmon	2,800	540

Source: SINTEF / Fafo

The employment in the French processing industry based on Norwegian farmed salmon is estimated to 1,900 FTEs in 2003 and the sales value for the processing industry is estimated to 370 million Euros in year 2003 (Table 5).

### 6.4 UK

UK had a total supply of 185,000 tonnes wfe of Atlantic salmon in 2003, of this 162,000 tonnes came from domestic production and 22,000 tonnes from import.



The UK processing industry consists of primary and secondary processors, where the harvesting of domestic farmed salmon takes place with the primary processors. Of the focus countries in this analysis, UK is the only country having domestic production of salmon and is therefore treated differently than the other focus countries. The turnover and activity related to harvesting is included in the figures and estimates of employment. Analysis made in Scotland by Macpherson Research and Sea Fish Industry Authorities have been used as a basis for calculations of the size and cost structure of the industry.

Our analysis estimate the input to processing to be around 85,000 tonnes wfe (excluded harvesting/gutting) in 2003 with an output of around 53,000 tonnes of product weight. The main part of these products is fresh fillets/portions, smoked fish and other prepared or value added products.

**Table 6 Direct employment and turnover of salmon processing in UK in 2003**

	Salmon processing in UK 2003	
	Direct employment Full Time Equivalents (FTE)	Turnover (Million €)
<b>Based on Norwegian salmon</b>	<b>170</b>	<b>25</b>
Based on Total salmon	4,290	650

Source: SINTEF / Fafo

The employment in the UK processing industry based on Norwegian farmed salmon is estimated to 170 FTEs in 2003 and the sales value for the processing industry is estimated to 25 million Euros in year 2003 (Table 6).

The total employment in EU supported by Norwegian salmon in UK is likely to have risen since 2003 due to a decrease in UK production of farmed salmon of about 40,000 tonnes since 2003, while import of Norwegian salmon to UK is expected to increase with approximately 17,500 tonnes wfe from 2003 until the end of 2005 (see chapter 7).

## 6.5 Poland (POL)

In 2003 the import of Atlantic salmon was 22,500 tonnes wfe (Kontali Analyse), 98% of this being Norwegian. In 2004 the export from Norway further increased to around 29,000 tonnes.

During the last four-five years the Polish salmon processing industry has experienced a high growth rate. This is partly due to so-called tariff jumping as companies from other European countries exported input for processing to Poland. Poland joined the European Union in 2004, but there were practically no tariffs on imports from Poland to EU after the membership was agreed upon. Furthermore, the country has relatively low labour costs. There are four relatively large salmon processing companies in Poland. Besides, there exist several small firms which smoke different kind of fish.

The Polish salmon processing industry is still relatively labour intensive. Shift work and seasonal labour is quite common. In 2005 the employment in the Polish salmon processing industry is estimated to equal about 2000 man-years (FTE). Several of the processing companies are expanding their capacity as a continued market growth is expected.

Our analysis estimate the total input of salmon to processing to be around 18,000 tonnes wfe in 2003, with an output of around 11,000 tonnes of product weight.

**Table 7 Direct employment and turnover of salmon processing in Poland in 2003**

	Salmon processing in Poland 2003	
	Direct employment Full Time Equivalents (FTE)	Turnover (Million €)
<b>Based on Norwegian salmon</b>	<b>1,610</b>	<b>90</b>
Based on Total salmon	1,610	90

Source : SINTEF / Fafo

The employment in the polish processing industry based on Norwegian farmed salmon is estimated to 1,610 FTEs in 2003 and the sales value for the processing industry is estimated to 90 million Euros in 2003 (Table 7).

Poland has had a significant increase in processing of farmed salmon, and employment in salmon processing is estimated to have increased with 400 - 500 FTEs from 2003 to 2005. The share of Norwegian salmon in Poland is still almost 100 % so far in 2005.

## 6.6 Rest of the EU (other)

The rest of the countries in the EU 25 (excl. Denmark, Germany, France, UK and Poland) have been treated as a unit. The main countries contributing here are; Belgium, Finland, Italy, Netherlands, Spain, Sweden and Ireland.

Our analysis estimate the total input of salmon to processing to be around 90,000 tonnes wfe in 2003, with an output of around 55,000 tonnes of product weight.

**Table 8 Direct employment and turnover of salmon processing in the EU countries except the five focus countries in year 2003**

	Salmon processing in "other" 2003	
	Direct employment Full Time Equivalents (FTE)	Turnover (Million €)
<b>Based on Norwegian salmon</b>	<b>2,270</b>	<b>390</b>
Based on Total salmon	2,880	485

Source : SINTEF / Fafo

The employment in the processing industry in rest of EU (other) based on Norwegian farmed salmon is estimated to 2,270 FTEs in 2003 and the sales value for the processing industry is estimated to 390 million Euros in year 2003. The Netherlands, Belgium and Spain counts for the main part of this employment.

## 6.7 Total employment in processing

Table 9 summaries the direct employment in the EU salmon processing industry (from chapter 6.1 to 6.6).

**Table 9 Direct employment and turnover of salmon processing in EU in year 2003**

	Full time equivalents (FTE) 2003						
	D	DK	F	POL	UK	Other	EU total
<b>Based on Norwegian salmon</b>	<b>780</b>	<b>1,370</b>	<b>1,900</b>	<b>1,610</b>	<b>170</b>	<b>2,270</b>	<b>8,100</b>
Based on total salmon	920	1,710	2,800	1,610	4,290	2,880	<b>14,210</b>

Source: SINTEF / Fafo

### Comments:

- Employment in FTE does not give full credit to the total importance of employment in the salmon processing industry since part time jobs and seasonal jobs are not visualised.
- The fish processing is characterised by a significant number of part time jobs and seasonal workers.
- Other studies indicate that the total number of jobs, included part-time jobs and seasonal jobs can be an additional 20 – 50 % of the FTE estimated (Seafish Industry Authorities, 2000). Applied to the number of FTE based on Norwegian salmon from our study (8,100) this would give a total number of employees (full time and part time) of 9,700 – 12,200 directly in the EU salmon processing industry.
- The salmon processing industry is often located in rural areas or in other areas where alternative employment is not easily accessible.

## 7 Total effects of farmed Norwegian salmon in EU 25

The total effects of salmon processing in the EU are calculated by means of the input-output model. The calculations cover both economic and employment effects, but only the employment effects are reported here. Initially, calculations were carried out for EU15 plus Poland and Estonia, while the figures for “Other countries” are scaled by a Population factor to cover the EU25.

Total employment effects include:

- a) The direct employment in the salmon processing industry (cf. chapter 7.7)
- b) The indirect employment in the supplying industries and
- c) The indirect employment effects in the rest of the economy

Induced consumption effects are not included. The demand effects from the production of different investment deliveries (for example different equipment and buildings) are neither considered.

The total effects of farmed Norwegian salmon are given in Table 10.

**Table 10 Total employment effects of Norwegian salmon in EU (FTE)**

	Full time equivalents (FTE) 2003						
	D	DK	F	POL	UK	Other	EU total
<b>Norwegian salmon</b>							
Direct in salmon processing	780	1,370	1,900	1,610	170	2,270	<b>8,100</b>
Indirect employment in EU	1,200	1,700	2,300	600	200	3,700	<b>9,700</b>
<b>Total employment in EU based on Norwegian salmon</b>	<b>1,980</b>	<b>3,070</b>	<b>4,200</b>	<b>2,210</b>	<b>370</b>	<b>5,870</b>	<b>17,800</b>

Source: SINTEF / Fafo

Total employment in the EU supported by Norwegian Atlantic salmon is estimated to 17,800 FTE in 2003 (Table 10). Of this, 8,100 are directly employed in the processing industry, while 9,700 are indirect employment effects in the EU. This gives a multiplier effect of approximately 1.20 for processed Norwegian salmon in the EU.

There is a wide variation between the countries in indirect effects measured by the multipliers. This ranges from Germany’s multiplier of 1,54 to UK’s 0,94 and Poland with only 0,34. This variation is due to different factors. The degree of the processing level may vary, and the domestic supplying industries may participate at different levels. In addition, the general interaction levels between industries, both domestic and towards the rest of the EU may vary. In case the supplying and interaction abilities are less developed, the effects leak out through higher import levels.

The five focus countries are the most important countries for processing of Norwegian salmon and represents 67 % of the total employment in EU supported by Norwegian salmon.

The employment effect from all processing of farmed salmon in the EU is given in the next table.

**Table 11 Total employment effects of all salmon in EU (FTE)**

	Full time equivalents (FTE) 2003						
	D	DK	F	POL	UK	Other	EU total
<b>Total salmon</b>							
In salmon processing	920	1,710	2,800	1,610	4,290	2,880	14,210
Indirect employment in EU	1,400	2,200	3,400	600	4,100	5,100	16,800
<b>Total employment in EU based on total salmon</b>	<b>2,320</b>	<b>3,910</b>	<b>6,200</b>	<b>2,210</b>	<b>8,390</b>	<b>7,880</b>	<b>31,010</b>

Source: SINTEF / Fafo

Processing of farmed Atlantic salmon in total is estimated to support 31,010 FTEs in the EU, of which 14,210 are in the processing industry and 16,800 are indirect employment. This gives a multiplier effect of approximately the same size as for processed Norwegian salmon. The total turnover in the EU processing industry based on all farmed salmon was 2,300 million Euros in 2003.

### *The situation today*

From 2003 to 2004 the total supply of farmed Atlantic salmon to the EU did not change significantly (Kontali Analyse). Norwegian supply, however, increased by approximately 20,000 tonnes wfe, while the Scottish and Irish supply decreased.

First six months of 2005 the total supply to the EU is expected to increase approximately 3-5 % from 2004. The Norwegian share is expected to be unchanged (ref.: Kontali Analyse).

If we assume that the share of total supply going to processing remains unchanged, this implies that the Norwegian input to processing has increased from 2003. However, because of increased efficiency in the processing industry there is probably only a small increase in total employment based on Norwegian salmon after 2003.

Some countries had a reduction in employment from 2003 to 2005. E.g. sources in Denmark have stipulated a reduction of 150 – 250 FTE from 2003 to 2005. Poland has had a significant increase in processing of farmed salmon during the last three years and direct employment (FTE) in 2005 based on farmed salmon in total is estimated to be 2,000 – 2,200. The share of Norwegian salmon in Poland is still almost 100 % so far in 2005.

UK stands out among the countries. It is the only country with a salmon farming activity, and their figures include slaughtering and packing in primary processing. UK therefore has a larger extent of primary processing compared to the other EU countries.

## **7.1 Discussion**

Our calculations are considered to be conservative in the sense that consumption effects are not included. Such effects may increase the overall effects in the calculations by a substantial factor.

The validity of consumption effects is uncertain, however, since different counter measures, like unemployment insurance will maintain some of the income disposable for consumption.

The indirect effects are spread on most types of industries. If we look at the supplying industries, we naturally find that fish farming (raw and frozen salmon) dominates, with more than 50% share of the input value. Trade and transport have a 18% share of input value, different manufactured products cover 14%, and different business services have a share of 11% of supplied input to the fish processing industry.

Additional indirect effects mainly occur in much the same industries as the supplier effects. Here we also get some (forward) indirect effects in the hotel and restaurant industries, and in catering and institutional care industries.

The calculations are based on a general fish processing input structure, since we do not have registrations on the specific input structure for salmon processing (cf. Appendices). Except for the different types of fish, we consider this to be a reliable method for calculating (aggregate) indirect effects. We consider that the aggregate groups of indirect industry effects (as presented above) are representative for the salmon processing industry. However, the detailed distribution of the indirect effects is more uncertain, and will therefore not be reported.

A detailed (multi-national) and an aggregate version of the model are available. For these calculations, we have chosen the aggregate version, combined with a detailed specification for each country. This means that indirect economic and employment effects related to the salmon processing industry in a particular country is calculated for the whole EU. We have distinguished between input deliveries from a) own country, b) rest of the EU and c) outside EU. This distribution is different for Norwegian and other Atlantic salmon processing, and affects to some extent the levels of the indirect effects in EU.

## 8 Employment in salmon farming in Scotland and Ireland

Salmon farming (finfish) in Scotland constituted of 84 companies farming at 328 active sites and staffing a total of 1,306 persons in 2002 (Scottish Fish Farms, Annual Production Survey, 2002). In all 55 companies were engaged in smolt production in 2002, staffing a total of 405 persons. The production of Atlantic salmon has increased steadily every year up to 2003, from where it rapidly has decreased (see Table 11). The industry is mainly located in the Western parts of Scotland, in the Orkney Islands and the Shetland Island.

Salmon farming in Ireland constitutes of 16 finfish producers and 29 smolt producers in 2003. Of these 29 smolt producers, the Regional Fisheries Boards (RFB) accounts for eight, which are producing smolt to help augment depleted river stocks. The Irish salmon industry produces a substantial part of organic salmon (16% of harvested volume in 2004). The harvest quantities have been reduced since 2001.

**Table 12 Harvest quantities of Atlantic salmon in 2003-2005**

	Harvest quantities (tonnes wfe)		
	2003	Prognosis 2004	Estimate 2005
Salmon farming in Scotland	162,000	138,000	120,000-125,000
Salmon farming in Ireland	18,400	12,100	-

Source: Kontali Analyse AS

Total production (slaughtered) of farmed Atlantic salmon in the EU, represented by Scotland and Ireland, amounted to 180,400 tonnes wfe in 2003. Of this Scottish production represents 162,000 tonnes and Irish production 18,400.

Salmon farming includes smolt and on-growing production of Atlantic salmon.

**Table 13 Employment and turnover in EU salmon farming in 2003.**

	Salmon farming in the EU 2003	
	Full Time Equivalents (FTE)	Turnover (Million €)
In salmon farming in Scotland	1,440	512
In salmon farming in Ireland	390	56
Indirect employment	2,900	-
<b>Total employment salmon farming Scotland and Ireland</b>	<b>4,730</b>	-

Source: SINTEF / Fafo

The total direct and indirect employment (FTE) in the EU, represented by Scotland and Ireland was estimated to 4,730 in 2003. The indirect employment in EU amounts to 2,900, which gives an employment multiplier effect of 1,6.

The main supporting product to the salmon farming industry is the production of fish feed from the food and beverage industry, which may amount to 50% of total input value. The support of smolt and spawn from the farming industry itself is also substantial and may count for around

15% of the input value. For the rest of the supply, 10% consists of manufactured products of different kinds, (dominated by plastics, paper products, chemicals and fabricated metal products), 10% consist of trade and transport products and 10% of different business service products.

The salmon farming industry in Scotland represented a direct employment of 1,440 FTEs and a total turnover of 512 million EURO in 2003, in Ireland the industry represented a direct employment of 390 FTEs and a turnover of 56 million EURO.

The most recent production surveys undertaken by the two countries state the number of employees in smolt- and salmon farming, full-time and part-time, to be approximately 1,600 in Scotland (unpublished results) and 520 in Ireland for 2003 (FRS and BIM).

The total EU production of Atlantic salmon decreased with 12 % from 180,400 tonnes wfe in 2003 to approximately 158,000 tonnes in 2004. The Scottish production was reduced with approximately 25,000 tonnes, while the Irish production was reduced with 6,300 tonnes. A further reduction in Scottish production is expected for year 2005; Kontali stipulates the production in 2005 to be 120,000-125,000 tonnes wfe (see Table 1). Most probably the employment in Scottish salmon farming is reduced from 2003 because of reduced production (in volume) and increased efficiency in the industry.

For the processing industry in UK the reduction in domestic production of salmon is compensated with increased import of salmon. UK has increased its import of Norwegian salmon with 3,000 tonnes wfe in 2004 and further with 4,000 tonnes the first four months of 2005 (ref. Norwegian Export Council). If the increase continues throughout the year, it gives a total expected increase of 17,500 tonnes wfe from 2003 until the end of 2005. This would correspond to an increase of almost 100% from 2003 to 2005.

If we assume that most of this fish is processed, this indicate that processing based on Norwegian salmon has increased it share of the employment in UK processing industry since 2003.



## **9 Protective measures - assessing consequences in terms of employment in the salmon processing industry**

### **9.1 Introduction**

The European Commission passes from time to time regulations aiming to protect the EU salmon processing industry. In this chapter, we will examine the possible consequences of protective measures (anti-dumping tariffs, minimum prices, safe-guards, etc) on employment in the processing industry within the European Union. In section 9.2, we will take a closer look at supply of input, followed in section 9.3 by an assessment of the development in prices and demand for processed salmon. Section 9.4 includes a presentation of the European Union processing industry, while possible consequences of protective measures on employment are discussed in section 9.5. Section 9.6 concludes.

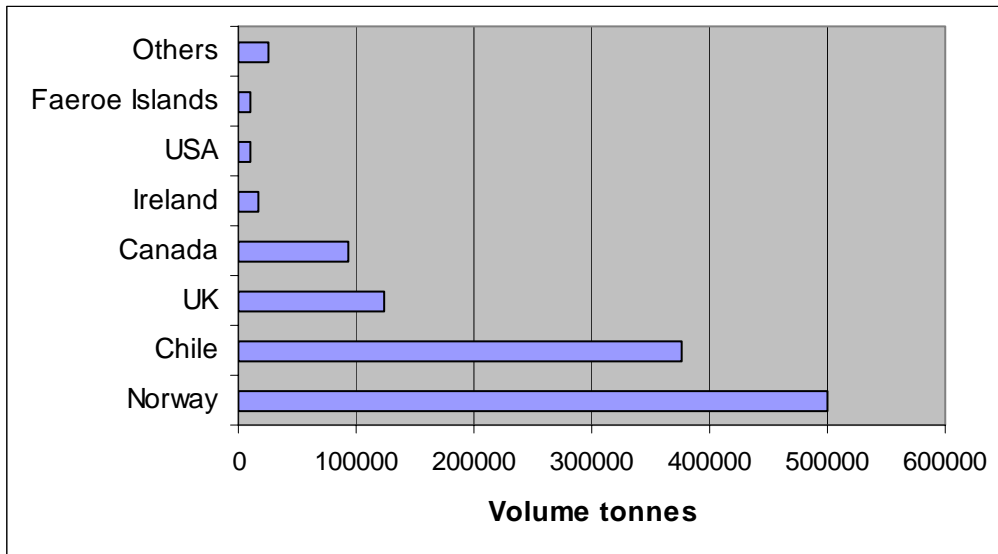
### **9.2 Supply of farmed Atlantic salmon**

The four largest suppliers of farmed Atlantic salmon in the world are Norway, Chile, UK and Canada. USA constitutes the main market for Canada as well as for Chile, while the European Union is the core Norwegian market for Atlantic salmon. Japan is the second most important market for Chilean as well as for Norwegian exports of farmed salmon (see Myrland 2003, Nielsen 2003). UK mainly produces for local demand.

Farmed Atlantic salmon production capacities have expanded considerably over the last decades, mainly in Chile and Norway. The Chilean market share has been growing partly because Norway had relatively bad terms-of-trade towards the Euro and the Yen in 2002 (see Myrland 2003). The main explanations for Chile's increasing market share have, however, been adoption of best-practice technologies, exploitation of economies of scale, and lower labour and feed input costs (see Bjørndal, Pena, Tveterås and Tveterås 2004).

Figure 2 shows the estimated potential supply of farmed Atlantic salmon for 2005. In the short term, a potential reduction in Norwegian supply may not be easily replaced by an increased supply from EU member countries. Moreover, in the longer run, Scotland and Ireland will most likely be faced with certain capacity restrictions. Future growth in supply will probably to a large extent have to come from Chile. As is apparent from Figure 2, compared to Chile and Norway, other providers of farmed salmon are still relatively small.

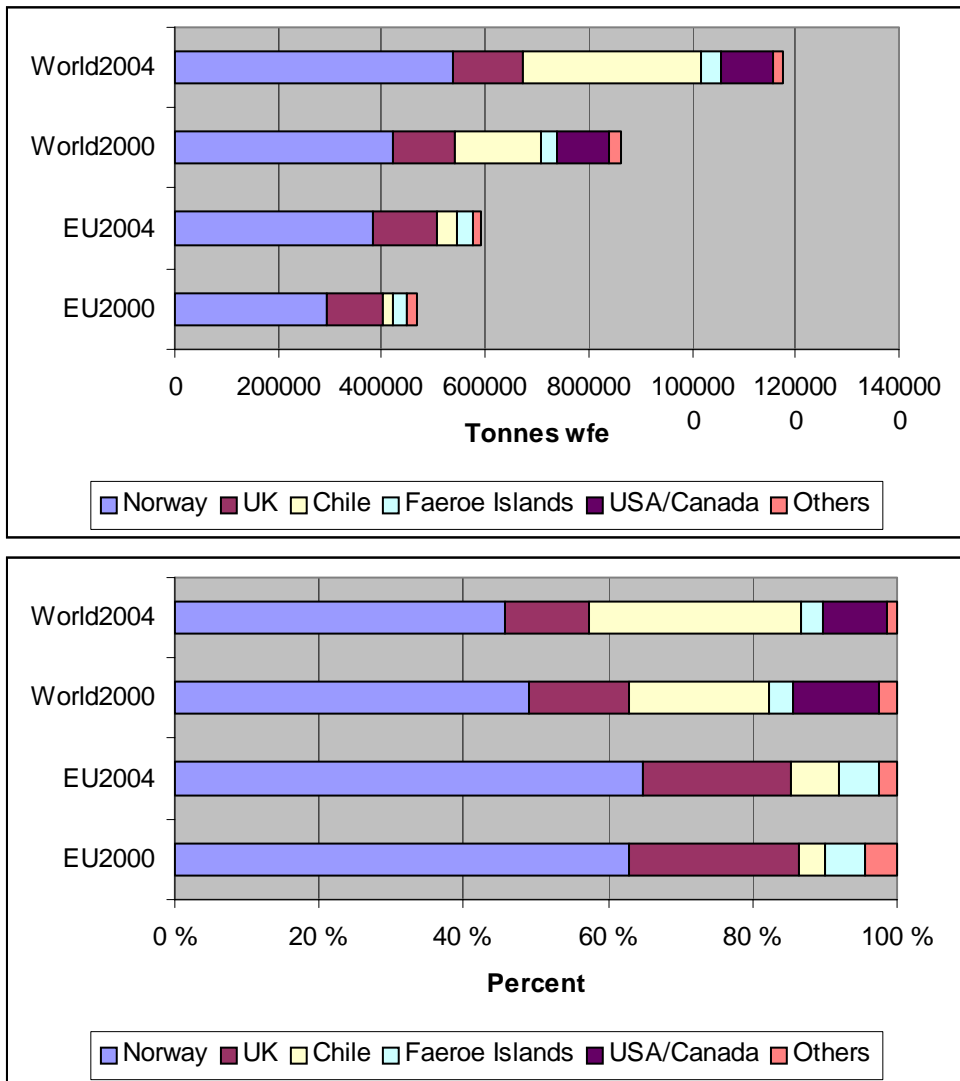
**Figure 2 Estimated volumes to be slaughtered 2005**



Source: FHL

Figure 3a shows the growth in the supply of farmed Atlantic salmon from 2000 to 2004. It is noticeable from Figure 3b that, although Norway is the world's leading supplier of farmed Atlantic salmon, the Norwegian market share decreased from 49 percent in 2000 to 46 percent in 2004. UK and USA/Canada also experienced a small decline in market shares; while the winner was Chile with a growth in market shares from 19 percent in 2000 to 29 percent in 2004 (see Figure 3b). According to Tveterås (2004), in 2002, 78 percent of Norwegian exports were head-on gutted fish whereas 80 percent of Chilean exports were fillets.

**Figure 3 a and b. Total world supply of farmed Atlantic salmon and supply to the European Union by the most important suppliers. Total and relative shares.**



Source: Own calculation based on data provided by Kontali

Salmon production has witnessed significant restructuring over recent years and there are a relatively small number of major players in Norway, EU as well as in Chile (see Tveterås and Kvaløy 2004 and Tveterås 2004).

**Table 14 Companies ranked by global production of salmon and rainbow trout 2003 (in metric tonnes)<sup>1</sup>**

Company	Headquarter	Total production 2003	Norway	UK	Chile	Canada	USA	Other countries
Nutreco	Netherlands	178500	70000	32000	59000	12500		5000
Pan Fish	Norway	86100	31100	20500		9800	12000	12700
Fjord Seafood	Norway	72500	35000	7000	28000		2500	
Stolt Sea Farm	Norway	70500	15000	6000	24000	25000	500	
Cermaq	Norway	48500		8000	32500	8000		
Aquachile	Chile	48000			48000			
Pesquera Camanchaca	Chile	37000			37000			
Cultivos Marinos Chiloe	Chile	34500			34500			
Salmones Multiexport	Chile	34000			34000			
Pesquera Los Fiordos	Chile	33000			33000			

Source: Tveterås and Kvaløy (2004:9)

Table 14 indicates the ten largest global companies for farming of salmon and rainbow trout in 2003. It is apparent from Table 14 that the five largest companies have farming facilities in several countries<sup>2</sup>. In 2003, the Norwegian-based enterprise Pan Fish produced almost the same amount of farmed salmon in the UK as the UK-based company Scottish Seafarmers. Furthermore, the Norwegian based company Stolt Sea Farm had a higher production of farmed salmon and rainbow trout in Canada than the largest Canadian producer George Weston/ Connors (see Table 1 in Tveterås and Kvaløy 2004).

According to Tveterås and Kvaløy (2004), the vertical coordination in the supply chain - from salmon aquaculture production to the supermarkets – is a relatively recent phenomenon. “Most obvious is the rise of large, horizontal and vertical integrated companies, with direct ownership of production activities from hatcheries to fish processing and exporting. But we have also seen the emergence of long-term contractual supplier-customer relationships between aquaculture producing companies and processors or retail chains. “ Tveterås and Kvaløy (2004:4)

One reason for vertical integration might be EU regulations. When major players have production as well as processing sites in different countries inside and outside the European Union, they may find it easier to adjust to circumvent protective measures.

From 2000 to 2004, the Norwegian market share in the European Union increased (from 62 percent in 2000 to 65 percent in 2004). The British market share has decreased (from 24 percent in 2000 to 21 percent in 2004) and Chilean salmon has grown in significance (from 4 percent in 2000 to 7 percent in 2004). There has been no change in the Faeroe Island’s market position while

<sup>1</sup> The total production of farmed Atlantic salmon was, according to Kontali, 1130700 tonnes wfe in 2003. Although trout is included in Table 4.1, comparing these figures gives an indication that the ten largest companies produced nearly half of the supplied Atlantic salmon in 2003.

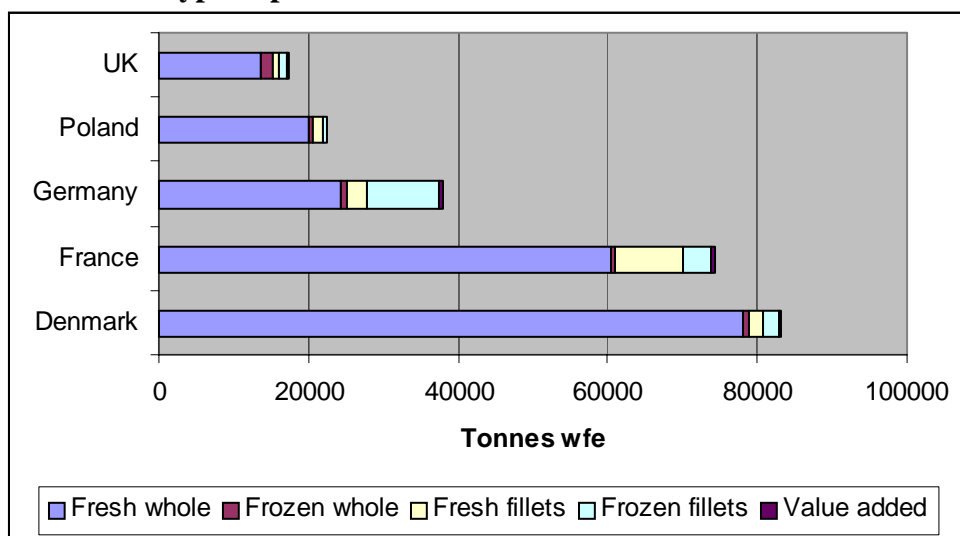
<sup>2</sup> An intentional merger between Nutreco’s salmon-farming (Marine Harvest) and Stolt Seafood’s farming has recently been approved by the European Commission (see Fiskaren 13.4.2005).

the market share of both Iceland and Ireland in the European Union dropped between 2000 and 2004. The most important countries in terms of salmon processing in the European Union are Denmark, France, Germany, Poland and the UK, and hence we will focus on these five countries. Norway primarily exports fresh head-on gutted salmon to the European Union (see Figure 3). However, Norway is also the main supplier of imported fillets to Denmark, France, Poland and the UK. Compared to head-on gutted salmon, volumes of filleted salmon are relatively small as the countries in focus (except Germany) produce more fresh and frozen fillets for consumption than they import (see Figure 5).

From 2000 to 2003, there was an increase in Norwegian exports of farmed salmon to France, Germany and the UK, while the exports to Denmark decreased. One explanation for the decline in the Danish market could be the relocation of processing to Poland to circumvent tariffs before Poland joined the European Union in 2004.

The supply of Norwegian head-on gutted salmon to Germany and France is probably even larger than shown in Figure 4. A substantial quantity of salmon that is passing from Norway through Denmark to other European countries is registered in the statistics as Danish supply. For instance, in 2003 Danish supply to Germany of whole salmon in Tonnes wfe was equal to 47 percent of the registered Norwegian supply. The similar figure for France was 16 percent.

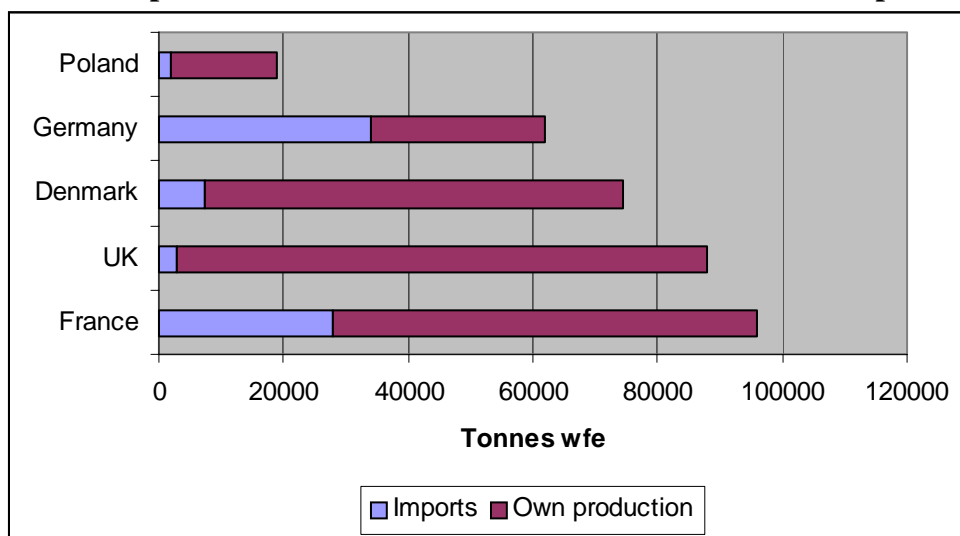
**Figure 4 Supply of Atlantic farmed salmon from Norway to the countries in focus 2003 by type of product<sup>3</sup>**



Source: Own calculation based on data provided by Kontali

<sup>3</sup> Fresh whole in the meaning of head-on gutted salmon

**Figure 5 Supply of fresh and frozen fillets of Atlantic farmed salmon in the countries in focus 2003 by source (imports and own production), included fillets for own production of smoked salmon and other value added products.**



Source: Own calculation based on data provided by Kontali

To sum up this section; Norway is the main supplier of farmed Atlantic salmon to the European Union. Supply of salmon is to a large extent processed locally within the EU.

### 9.3 Demand for salmon and expected development in prices

There are at least three different prices in the salmon market: the producer price which the farmer receives, the price the importing processing company pays and the consumer price on retailed processed salmon. Tariffs, transportation costs and exporters' margins will result in a difference between the farmer's revenue and the European Union processing industry's outlays. When farming takes place in a different country than where the processing takes place, and the countries have different currencies, terms-of-trade will also play a role for the divergence between exporters' and importers' price levels. Furthermore, demand does not only depend on the cost of salmon, but may also shift as a result of changes in consumers' preferences, development in prices for close substitutes or due to changes in household incomes.

According to Nielsen (2003), there is a link between markets as well as prices for salmon in USA, Japan and Europe. Taking into account terms-of-trade, transportation costs and tariffs, prices equalize in different markets (Myrland 2003). Equivalently, Asche, Hartmann and Jaffry (2004) find that the price on farmed Atlantic salmon sold in the European Union probably does not differ between suppliers, i.e., French processing companies pay similar prices for both Scottish and Norwegian salmon. The reason is that price signals are transmitted from the retail market in France, to Norwegian and Scottish salmon exporters. In other words, because Norwegian and Scottish salmon compete in the European Union, price levels for Norwegian and Scottish farmed salmon correlate<sup>4</sup>. To quote Asche, Hartmann and Jaffry (2004:16-17) at length,

”While Norwegian and Scottish salmon obviously do not compete at the producer level, the high degree of price transmission gives the close link. This also implies that measures at any point in the supply chain are to a large extent transmitted to the producer prices, and

<sup>4</sup> See also Asche, Gordon and Hannesson (2002) and Asche and Steen (2002)

that all measures that restricts Norwegian production or market access will be beneficial for Scottish producers.”

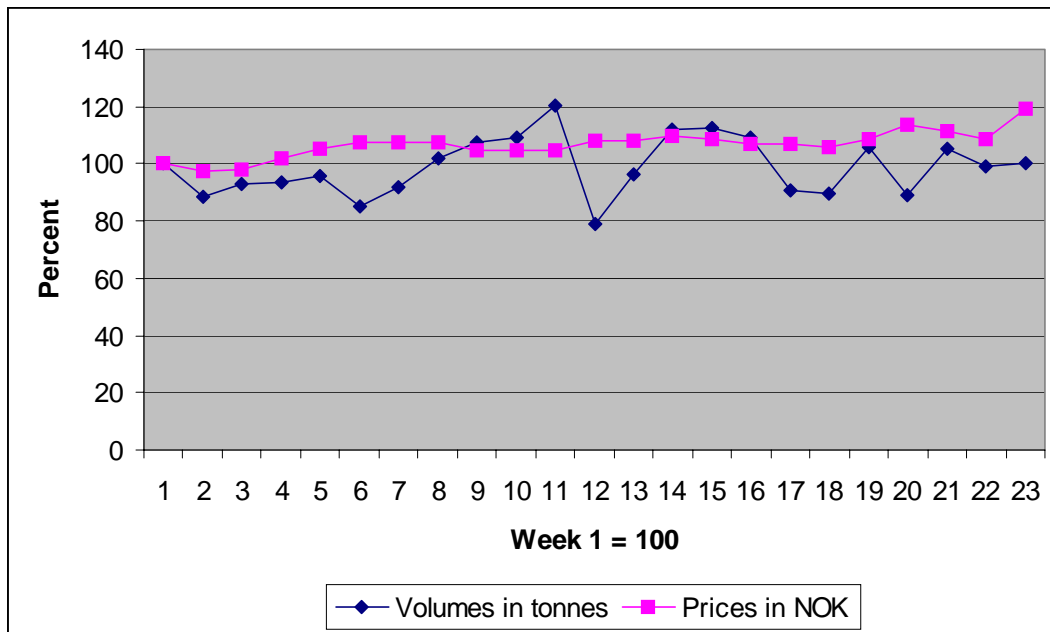
In the short term a potential reduction in Norwegian supply cannot be fully compensated for and the processing industry will face higher prices on their raw material. If salmon processing companies have binding agreements with supermarkets or other customers concerning quantities delivered as well as prices for these deliveries, the processing companies will maintain their demand for farmed salmon independent of the market price of this input<sup>5</sup>. In other words, in the short run, the processing industry will have relatively inelastic demand and prices on farmed salmon will probably rise as supply declines. Therefore, tariffs on Norwegian salmon are in the short run transmitted to the European Union salmon processing industry. Previous research indicates that demand is relatively inelastic in the short term. Hence, according to Asche (1997), the demand for fresh and frozen salmon in the European Union changes relatively slowly due to changes in prices:

“Only about 10% of the adjustment of a disequilibrium movement takes place instantaneously. The magnitude on the short-run price elasticities is also very low. However, more than 60% of the adjustment takes place after three periods for all the product forms. Still, it takes an entire year before the change is fully reflected in the demand. That there is a significant adjustment time before demand fully reflects changes in prices and other factors, implies that there are substantial adjustment costs for the purchasers of salmon. This is also reflected in the small magnitudes of the short-run own-price. The short-run demand schedules are therefore very steep, and the conditions for influencing the market by regulations in the short-run are quite favourable. However, for regulations to increase prices, it is of course also required that the regulator be able to control supply. ” Asche (1997:234-235)

---

<sup>5</sup> “Much of the salmon is purchased by processors. Although one would not expect large adjustment cost between different product forms of salmon, brands and origin may be important in the marketing of the product. Hence, marketing costs may affect the dynamic adjustment. There also seem to be more or less formal bindings between some exporters and importers (Lines 1995). If these bindings are formal, they will directly limit the adjustment possibilities for the importer’s demand. More commonly, the bindings are informal. However, because of considerations about quality and delivery reliability (i.e. the exporter’s reputation), the adjustment possibilities may be limited. “ Asche (1997:226). [Lines, R. (1995), Strategies for Competitive Export Firms: Analysis of Market Behavior in three European Markets. Bergen: Centre for Research in Economics and Business Administration. SNF-Report 15/95.]

**Figure 6 Development in supplies of farmed Atlantic salmon from Norway and farm gate prices week 1-23 2005.**



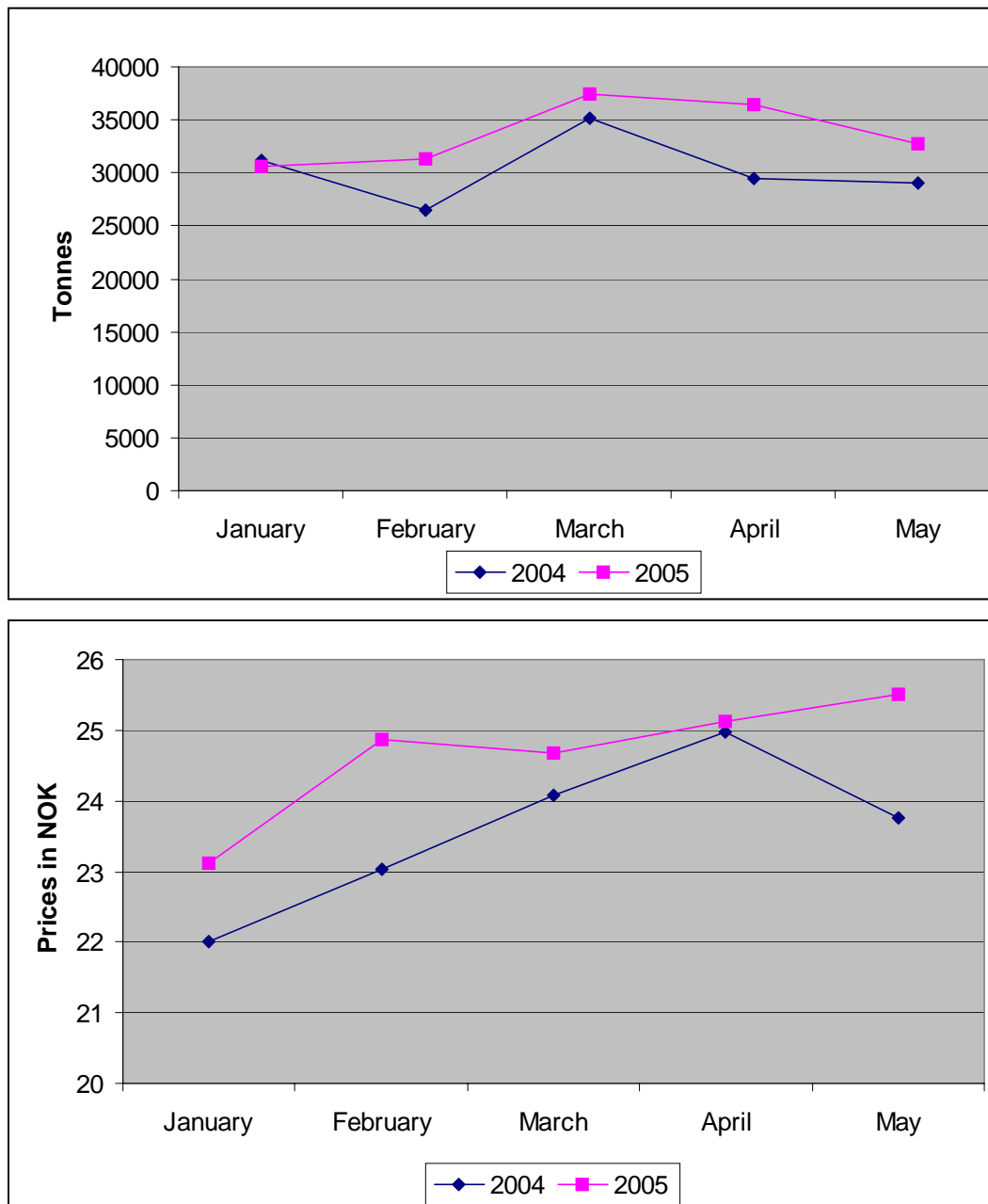
Source: Own calculation based on data from Statistic Norway – [www.ssb.no](http://www.ssb.no)

On the 27<sup>th</sup> of April 2005, the European Commission imposed tariffs on farmed Atlantic salmon from Norway. From Figure 5 it is observable that farm gate prices did not fall as a result of the tariffs. On the contrary, on an average there has been an increase in the farm gate prices in the weeks following the 27<sup>th</sup> of April, although volumes stayed quite constant over the relevant period.

Over a year, there are normally some variations in volumes and prices on farmed salmon. In Figure 7a and b, we compare volumes and prices in the period January-May 2005 with the situation in 2004. While volumes are at the same level in January of the two consecutive years, volumes are thereafter somewhat larger in 2005 than in 2004. Nevertheless prices are also higher (except in April) in 2005 than the year before.



**Figure 7a and b. Development in supply and prices on farmed Atlantic salmon from Norway, January-May 2004-2005.**



Source: Own calculation based on data from Statistic Norway – [www.ssb.no](http://www.ssb.no)

In the long run, prices of farmed Atlantic salmon to the processing industry will probably depend on different factors such as development in demand in the USA, Asia and Europe, development in supply (production capacity, farming productivity, labour costs), governmental instructions or company agreements concerning minimum prices (if these minimum prices are higher than the prices established in the marketplace), etc.

In general, protective measures paradoxically may lead to less and not more competition in the salmon market, as it is mainly large firms that seek shelter behind the protective measures. Hence, the intended weakening of foreign firms may strengthen the market power of local businesses. At the same time, the protective measures may make it easier for local and foreign salmon producers

to achieve price-agreements, while it will be the processing industry and/or consumers who will suffer (see Erhvervs- og byggestyrelsen 2004 and Asche and Steen 2003).

Will there be interdependence between producer prices and consumer prices? Asche and Steen (2002) conducted an analysis on different distribution levels of fresh whole salmon in France by applying data on the farm gate price, the French import price and wholesale prices. They found a stable relationship between the production price and the export price.

“This relationship is stable also through all the links in the value chain for traditional outlets. However, for the supermarket part of the chain, there is not a stable relationship for fresh fillets, although there are for whole fresh salmon. This gives an indication that supermarkets can have scope for exploiting market power. Hence, the closer we get to the consumer level the more scope we find for strategic behaviour.” Asche and Steen (2002:53)

In the medium and longer term, the salmon processing industry will probably adapt to higher prices on inputs and reduce the quantity of smoked salmon supplied and other value-added products. This again may result in higher prices for processed salmon in the consumer markets.

As mentioned above, demand will not only depend on the development of salmon prices, but also consumer preferences, development in prices on close substitutes and consumers' purchasing power. Own price elasticity reports the percentage change in demanded quantity for salmon due to one percentage change in the price of salmon. There exists a comprehensive literature on estimated own price elasticities on salmon. Due to data constraints, these elasticities are mostly estimates based on producers' prices.<sup>6</sup> Erhvervs- og byggestyrelsen (2003) reports 22 different findings of demand elasticities for salmon, varying from  $-0.60$  to  $-5.0$  that is from inelastic to elastic demand, the unweighted average being  $-2.0$ . Asche and Steen (2003) reports unitary elasticity and accentuate that when a good (like salmon) has become more known, demand will also become more inelastic.

#### **9.4 The European Union salmon processing industry**

On average, more than half of the imported salmon to Denmark, France and Poland is processed locally, while about 45 percent of the total supply to the UK (imports and local produced farmed salmon) is processed within the UK. The equivalent figure for Germany is 30 percent (see Figure 8).

While in Denmark, Poland and the UK almost 100 percent of the supplied smoked salmon and other value-added products are produced locally, Germany and France imports, to some extent, smoked salmon (see Figure 9.). Rustad (2005) reports that Chilean smoked salmon has been on sale in French supermarkets, but only for a short period of time.

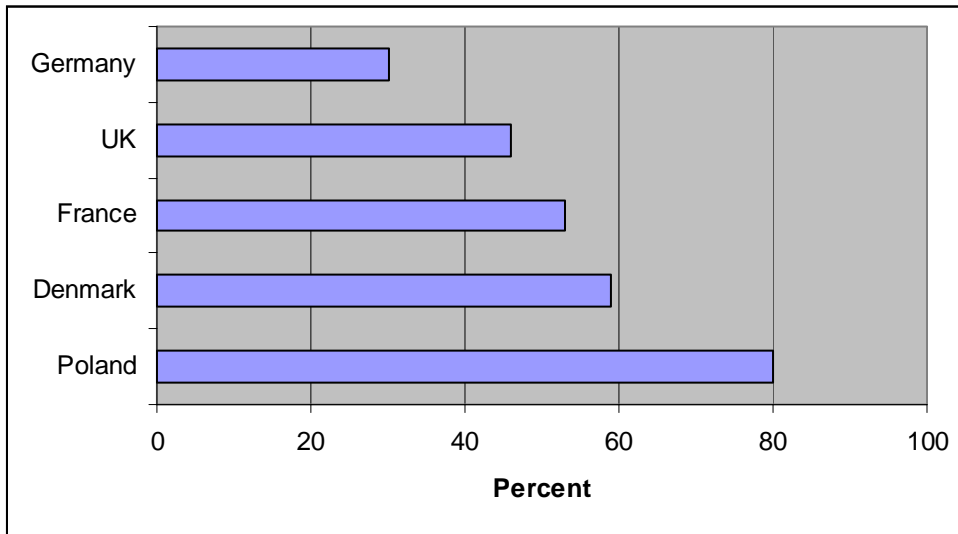
As long as Chile also pays ordinary tariffs on exports of smoked salmon to the European Union, we may not expect local products to be replaced by Chilean smoked salmon<sup>7</sup>. However, relocation of the processing industry to Chile may, in the long run, be an option, depending on the development in prices on raw material and labour costs in the European Union as well as in Chile.

---

<sup>6</sup> Nevertheless, there are reasons to believe that not only prices, but also elasticities could be “transmitted” through the value chain (see for instance Asche et al. 1998). In other words, the producers' demand elasticity and the consumers' demand elasticities may be similar.

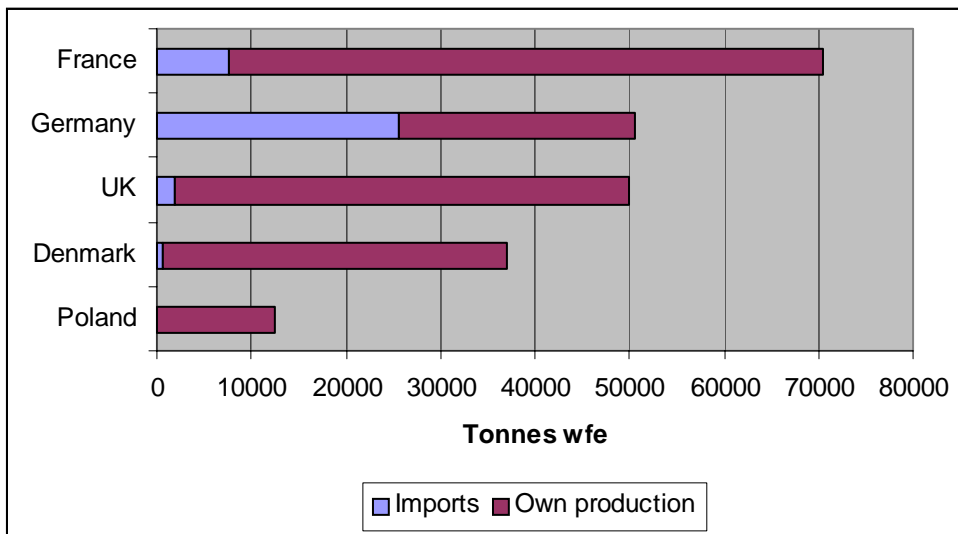
<sup>7</sup> Until the 31.th of December 2005, the duty on Chilean smoked Atlantic salmon from Chile to the European union is 13 percent (see [http://europa.eu.int/comm/taxation\\_customs/dds/cgi-bin/](http://europa.eu.int/comm/taxation_customs/dds/cgi-bin/))

**Figure 8 Percentage of supply of farmed Atlantic salmon, which is processed locally in the countries in focus\***



Source: Own calculation based on data provided by Kontali  
 \* Harvesting and gutting is not considered

**Figure 9 Supply of smoked salmon and other value-added products by own production and imports 2003 in the countries in focus**



Source: Own calculation based on data provided by Kontali

Freshness is the most important characteristic of salmon for French processors buying inputs. Processors usually find it easier to assess the quality of whole fish because the skin indicates the salmon’s age. 98 percent of salmon used in the French smoking industry is head-on gutted fish. Most of the companies using so-called pre-rigor<sup>8</sup> fillets are not French owned, but have strong relations to Norway (see Rustad 2005).

<sup>8</sup> Fillets prepared before onset of rigor mortis. This is regarded as a quality pre since time from slaughter to transportation is minimized.

### 9.5 Possible consequences of protective measures for employment

The following scenarios will be discussed when assessing possible consequences of protective measures on employment in the EU salmon processing industry:

- Norwegian supply of head-on gutted salmon is partly compensated by an increased supply of fillets
- Prices on smoked salmon and other value-added products are rising
- Some salmon processing companies will have to close down. This may especially be the case for companies with relatively long-term binding price-agreements with customers, while, at the same time prices on inputs are growing
- Relocation of production and/ or processing between countries

Some or all situations may occur at the same time.

Will it be possible to replace fresh Norwegian salmon with frozen fillets from Chile as input in the processing industry? “Just-in-time” deliveries and fresh raw materials are essential for smoked salmon and other value-added products in the medium- and upper-quality segments. Furthermore, in the upper-quality segments, consumers are concerned about the origin of farmed salmon (European salmon is preferred) as well as local processing (to some extent French consumers prefer French products, etc). Some companies have branded their products as Norwegian salmon (especially Danish and Polish companies) and therefore will not consider using Chilean inputs<sup>9</sup>.

Frozen fillets may, however, be used in the first price segment of smoked salmon. There are, nevertheless, some challenges concerning logistics when using frozen fillets from Chile. Due to the large distance, companies in the processing industry have to buy whole containers of frozen fillets. According to representatives of the industry, deliveries take about five weeks by ship, which means that it will be necessary to keep stocks.

The question then is whether it will be profitable to replace Norwegian salmon with fresh Chilean fillets. Although production costs in farming may be lower in Chile than in Europe, transport costs still contribute to relatively high prices on airborne fresh Chilean salmon. Costs could be reduced if a return-freight system is introduced. Furthermore, when prices on European salmon rise over a certain level, fresh Chilean salmon will probably be imported.

If the differences in prices on deliveries of head-on gutted fish and fillets from Norway (tariffs, transportation and minimum prices considered) are small, the EU salmon processing industry may, to some extent, choose to replace Norwegian whole fish with Norwegian fillets. Transportation costs are the same for one truck of head-on gutted fish as for one truck of fillets, while a larger part (about 25% more) of the fish can be used as inputs when already filleted (see Rustad 2005). Especially in firms which, recently made sizeable investments in filleting equipment, there are however, high costs connected with readjustments that is, using fillets instead of fresh head-on gutted fish.

---

<sup>9</sup> In accordance with EU regulations, salmon processors have to inform their customers about the origin of the salmon processed.

A replacement of Norwegian whole salmon with fresh fillets from Ireland and Scotland would cause employment growth in the Scottish and Irish industry. However, because Scotland and Ireland have limited capacities for an increase in supply to other EU member countries, this development is most unlikely. More likely is a situation in which frozen fillets from Chile replace whole fresh salmon. Using frozen fillets will probably to some extent reduce employment in filleting<sup>10</sup>.

In general, whether companies will compensate for the reduction in the supply of whole salmon by using Chilean salmon will depend on several factors, like costs connected with the different forms of inputs, transportation, stock-keeping, processing, consumer's preferences, etc. Such calculations will also be relevant for the UK processing industry if prices on whole salmon rise.

**Table 15 Stipulated employment in filleting based on 2003-figures. Examples**

Countries	Total		Based on Norwegian salmon	
	Volumes (Tonnes wfe)	Man-years	Volumes (Tonnes wfe)	Man-years
Denmark	67000	490	53600	390
France	68000	500	47600	350
Germany	28000	200	25200	180
Poland	17000	120	17000	120
UK	85000*	620	8500	60
Total EU25	355000	2590	227200	1660

\* *Harvesting and gutting not considered*

In Table 15, employment in filleting in the European Union processing industry is calculated. Average productivity in fillet-production is assumed to be 137 tonnes per man-year. This assessment is based on interviews with representatives of the processing industry and other industry-specific information. We assume the average productivity to be the same in all the EU countries. An assessment of man-years for filleting can be calculated by dividing the tonnes of processed head-on gutted salmon with this productivity measure.

As discussed above, if higher prices on inputs give higher consumer prices on processed salmon, we may expect reduction in demand. Depending on how easy it is to lay off employees, when sales volumes are reduced by 20 percent, number of employees may also drop by 20 percent with unitary own price elasticity in demand. To illustrate possible consequences if prices rise with 20 percent, we estimate reduction in employment (measured in full time equivalents) in the processing industry (with an own price elasticity of  $-2.0$  (elastic demand) and  $-1.0$  (unitary elastic demand)). The results are presented in Table 16.

<sup>10</sup> On the other hand, a number of employees are still needed for defreezing of the fish and preparing it for the smoking process.

**Table 16 Estimates of reduction in employment (FTE) in the processing industry when prices rise by 20 percent. Examples based on estimated employment (FTE) in 2003.**

Countries	Own-price elasticity in demand –2.0				Own-price elasticity in demand –1.0			
	Total		Based on Norwegian salmon		Total		Based on Norwegian salmon	
	Estimated man-years	Estimated reduction in man-years	Estimated man-years	Estimated reduction in man-years	Estimated man-years	Estimated reduction in man-years	Estimated man-years	Estimated reduction in man-years
Denmark	1710	680	1370	550	1710	340	1370	270
France	2800	1120	1900	760	2800	560	1900	380
Germany	920	370	780	310	920	190	780	160
Poland	1610	640	1610	640	1610	320	1610	320
UK	4290	1720	170	70	4290	860	170	30
Total EU25	14210	5680	8100	3240	14200	2840	8100	1620

In these examples, with elastic demand, a rise in price with 20 percent gives a reduction in demand and man-years corresponding to 40 percent. With unitary elasticity the effect is half as large. Taking the multiplier-effect and part-time employment into consideration, however, the total number of redundant employees will be higher than the figures shown above in Table 16.

Salmon processing companies may move to countries that have lower or no trade barriers with the European Union and no protective measures on Norwegian salmon (tariff-jumping in processing). According to Nielsen (2003), farmed salmon from Chile, Norway and the Faeroe Islands are, to some extent, sent to China for processing and re-exported to the European Union as value added products. To compensate for possible higher costs on raw materials, salmon processing may also relocate to countries within the European Union with relatively low labour costs, for instance, to Eastern Europe (the Baltic countries, Poland). It is difficult to assess what implications the closing down and relocation of processing companies will have on the industry. Danish and German companies have, to some extent, already relocated salmon processing sites to Poland.

## 9.6 Conclusions

As described in this chapter, producers within the European Union cannot easily replace Norwegian salmon as input in the processing industry. Potential reduction in Norwegian supply of head-on gutted salmon therefore most likely will be compensated by Chilean supply of frozen fillets.

If Chilean farmed salmon gains a better foothold on the European Union market, this may result in a reduction of market shares for farmed salmon from the Faeroe Islands, Iceland, Ireland, Norway and Scotland. A part of the Norwegian farming industry may be relocated to Chile (tariff-jumping in farming). Moreover, regional relocation in the supply of smoked salmon and other value-added products may take place, either through tariff-jumping in processing or by firms moving eastwards within the European Union to save on labour costs. Several farming and processing companies in Chile, Norway, the UK and other EU member countries are controlled by multinational enterprises, which are partly vertically integrated. In other words, these enterprises control the whole or parts of the value chain. They are not only already established in different markets, but also have the necessary experience when the relocation of activities is an option.

When frozen Chilean fillets compensate for fresh whole European salmon, this may result in some reduction in employment in filleting in the EU processing industry. Because of certain logistic challenges as well as customers' preferences, salmon processing companies in higher value-added segments might be less eager to relocate as well as to use frozen fillets than providers for the first price segment. Nevertheless, higher consumer prices due to increased prices on inputs, because of protective measures, will probably result in reduction in demand and hence reduction in employment in the salmon processing industry in the European Union - also in the high price segments.

## 10 References

ADEPALE 2004, France. Saumon et truite fumés, rapport économique 2003. (In French).

Asche, F. (1997), Dynamic Adjustment in Demand Equations. *Marine Resource Economics* 12, pp 221-237

Asche, F. (2004), Konsekvenser av nye adgangsbegrensinger til EU. Laksekonferansen 4.11.2004. (In Norwegian)

Asche, F., Flaaten, O., Isaksen, J. R. and Vassdal, T. (1998), Derived Demand and Price Relationships: An Analysis of the Norwegian Cod Sector, in Eide and Vassdal (eds.) Proceedings of the 9th International Conference of the International Institute for Fisheries Economics and Trade – Tromsø, Norway 1998

Asche, F. and Steen, F. (1999), Demand for wild caught and farmed fish in the European Union. SNF Centre for Research in Economics and Business Administration, Report No 56/99

Asche, F. and Steen, F. (2002), The Norwegian market for fish: The distribution channels and demand conditions. Bergen: Institute for Research in Economics and Business Administration. SNF Report 05/02

Asche, F., Gordon, D. V. and Hannesson, R. (2002), Tests for Market Integration and the Law of one Price: The Market for Whitefish in France. Bergen: Institute for Research in Economics and Business Administration. SNF Report 58/02

Asche, F. and Steen, F. (2003), When protective measures lead to increased market power; A case study of the European Union Salmon Market. Discussion paper 27/03

Asche, F., Hartmann, J. and Jaffry, S. (2004), Price Transmission and Market Integration: Vertical and Horizontal Price Linkages for Salmon. Stavanger University College. Working Paper 151/2004

Bjørndal, T., Pena, J., Tveterås, R. og Tveterås, S. (2004), Firm concentration and vertical integration in salmon farming: empirical evidence from Chile and Norway, Proceeding from EAFE XVIth annual conference, Rome, 5.-7. April 2004.

Eurostat: <http://epp.eurostat.cec.eu.int/>

Erhvervs- og byggstyrelsen (2004), Antidumping – den særlige beskyttelsestold. Retfærdig handel eller ren protektionisme? [www.ebst.dk](http://www.ebst.dk). (In Danish)

Fisch-Informationeszentrum e.V, 2005, Germany. Fisch Wirtschaften Daten und Fakten 2004.

Fiskaren (<http://www.intrafish.no/norsk/abonnement/>)

Larsen, I. K. (2003), Verdiskaping ved fisketransporter. TØI rapport 651/2003. Sammendrag. (In Norwegian)



- Macpherson Research (2003). Salmon & Trout processing. A review of the Industry in Scotland in 2001.
- Macpherson Research (2003). The Scottish Salmon Smoking Industry, 2002 Review.
- Myrland, Ø. (2002), A Note on Measuring the Effects of Exchange Rate Changes on Norwegian Exports of Seafood. NCFS Working Paper Series in Economics and Management. No 01/02
- Myrland, Ø. (2003), EU avtalen – Gull og Gråstein – Presentasjon Aqua Nor 2003, Trondheim 14. August. (In Norwegian)
- Myrland, Ø. (2004), Gir økt størrelse markedsmakt? Noen betraktninger rundt eksportstatistikken. Laksekonferansen 4.11.2004. (In Norwegian)
- Nielsen, M. (2003), Beregningsgrundlag for uforarbejdet fisk i Danmark, Arbeidspapir til Fiskeriets Økonomi 2003. Fødevarerøkonomisk Institut. Afdelingen for fiskeøkonomi og – forvaltning. (In Danish)
- OFIMER (2005, France). Les chiffres clés de la filiere peche et aquaculture en France. Edition 2005
- PACEC (1998), The economic Impact of Scottish salmon Farming FINAL REPORT
- Production and employment survey 2003 for Atlantic Salmon, BIM, Ireland
- Rustad, K. (2005), Markedsmuligheter for foredlet laks i Frankrike. Publisert (Norwegian Export Council). (In Norwegian)
- SALMAR, Margins along the European seafood value chain. Impact of the salmon industry on market structure(EU-project), 2001. Dynamics of the Sea Food Industry in France.
- Scottish Fish Farms Annual Production Survey, 2002. Fisheries Research Services, Scotland
- Seafish Industry Authorities, 2005. 2004 Survey of the UK Fish Processing Industry. Key Features.
- Seafish Industry Authorities, 2000. 2000 Survey of the UK Sea Fish Processing Industry.
- Steen, F. and Salvanes, K.G. (1999), Testing for market power using a dynamic oligopoly model, *International Journal of Industrial Organization* 17, pp 147-177
- Steen, F., Asche, F. and Salvanes, K.G. (1998), The supply of salmon in EU: A Norwegian aggregated supply curve, [www.nfh.uit.no/dok/IIFET98proceedings/156.html](http://www.nfh.uit.no/dok/IIFET98proceedings/156.html)
- Stokka, A. et. al. (forthcoming), A documentation of an interregional input-putput model with extended salmon industries for the EU
- Tveterås, R. (2004), Markeder og produksjon i den globale sjømatnæringen. Foreløpig versjon 15. september. (in Norwegian) Unpublished paper.

Tveterås, R. and Kvaløy, O. (2004), Vertical Coordination in the Salmon Supply Chain. Centre for Research in Economics and Business Administration, Working Paper No 7/04

**Kontali list of Sources;**

Statistics Norway  
Servicio Nacional de Aduanas  
Statistics Canada  
BTS  
Forvus  
Statistics Denmark  
Statistical Bureau of the Faeroe Islands  
Ireland Central Statistics Office  
US Bureau of Census  
De Nederlandsche Bank  
Ofimer  
EUROSTAT

## 11 Appendices

### 11.1 Details on the Input-output database

Collecting the data necessary to describe the detailed relation between processing of Norwegian salmon and other industries for several countries has been very challenging. The main sources of information are the national accounts for each country, in addition to employment data. The data needed from national accounts are input-output tables (IOTs) and supply and use tables (SUTs).

The employment effect is calculated in man years. Data for man years were not available at Eurostat. For five countries these data were received from the statistical bureau of the country, and for the other countries they were available at the OECD database. In this project the employment effect of the import of salmon to EU was calculated for sixty sectors. However, the data for man years from the OECD database were only divided into six sectors. The transformation of the data for man years from six sectors into sixty sectors was done by use of figures for compensation of employees for the sixty sectors. Value added was also considered, but comparisons with actual data, showed that compensation of employees gave more accurate estimates for man years.

Much effort has been used to obtain the national accounts data necessary for the model calculations. The main data source has been National accounts for the year 2000 from the Eurostat database (Input-Output tables at basic prices). However, some data were older, and the level of detail for these accounts is not sufficient for our analysis, so we needed supplementary data. For some countries the accounts were only available for earlier years, and this data were updated to year 2000 by use of indexes. Some countries do only prepare so-called supply and use tables (at purchaser's prices) and had to be transformed to the standard I-O format at basic prices. Most of the data was available in Euro values, but some had to be transformed from national currencies.

The calculations are carried out on the data available from Eurostat, which means the EU15 less Luxembourg and Greece, and with Poland and Estonia added. To get representative figures for EU25, we have considered different indexes or scaling factors. For the economic effects, the value added figures give a convenient index, which gives a scaling factor of 1,045. For the employment effects an employment index should have been used. Since this was not available, we have used a population index for the scaling of indirect employment effects to EU25, which gives a factor of 1, 112.

The National accounts in Eurostat give a split of imports and exports from inside and outside the EU (Intra-EU and Extra-EU). Some countries (Estonia, Ireland, Sweden) did not supply, in their national accounts, any information about how exports and imports were distributed among their trading partners (i.e. EU and non-EU trading partners). Data for how imports and exports were distributed among non-EU and EU trading partners were therefore collected from the foreign trade statistics for these countries. The source was either Eurostat (in the case of Estonia and Ireland) or the statistical bureau of the country (in the case of Sweden). The data was then aggregated to 22 sectors (mostly industrial produce, but also some agricultural produce). The share of intra-EU trade for these 22 sectors were then compared with the share of intra-EU trade for some countries (Belgium, Denmark, Finland) where data were available from the national accounts. Estonias distribution of trade (between non-EU and EU partners) were similar to those of Denmark (in giving a small distance between the vectors). Thus Estonia "inherited" the distribution of trade between non-EU and EU trade from Denmark. Similarly Ireland inherited the Belgian distribution. In the case of Sweden a simple average of the Danish and Finnish distribution of trade between non-EU and EU trade turned out to give the best fit to the data for the 22 sectors obtained from the foreign trade statistics, thus an average of the the share of intra-

EU trade for Denmark and Finland was used in the case of Sweden. Note that total values were available from the national accounts and that only the split between EU and non-EU trade was obtained through the use of proxy data as described.

In addition to the construction of complete input-output data tables for the selected EU countries, special estimates had to be made to construct data for the fish processing (NACE 15.2) and farming (NACE 05.02) industries. The Eurostat data is specified on 60 industries/commodities, which consists of one fishing industry (catch and farming together) and one common industry for food and beverage products (included fish processing). Due to the limitations on detailed figures on Fish processing, additional data were collected through the various national bureaus of statistics – both through personal communication and through the web pages on internet. Contacts with the national statistical units revealed, however, that many countries did not specify input data for processing of fish products. Therefore, a default distribution of supply and use had to be constructed for sector 15.2. This default vector was based on the average of the vectors for Belgium, Denmark, Netherlands and Sweden (there were not any large differences between the vectors for the different countries, but it was chosen to use an average). The size of the salmon processing part output (sales) of sector 15.2, and the size of the inputs (goods and services) to the salmon processing part of sector 15.2 was then based on survey data, while the vectors were used to distribute the input and output between different sectors in the model.

This resulted in a split of the fish processing industry into 3 sub-categories: a) Processed Norwegian salmon, b) Other processed Atlantic salmon, and c) Other fish processing. For all countries in EU where this was assumed relevant (10 countries), the two salmon processing industries were constructed. The processing of other fish was included in the common industry of food and beverage products. For the salmon farming analysis, a split of the fishing industry in a) Fishing (catch) and b) Fish farming was made for two countries: Ireland and Scotland (UK).

The construction of the salmon processing industries were carried out in 3 stages:

1. Aggregate data on input and output for processed Norwegian and non-Norwegian salmon were registered/calculated for each country, split on a) domestic, b) intra-EU and c) extra-EU deliveries.
2. Representative input-output data for the fish processing industry were collected to construct a general data set for the fish processing industry. This data was delivered from 4 (5) EU countries (Denmark, Sweden, Belgium, Netherlands and Estonia).
3. Necessary input-output data were constructed for each country by combining data from 1 and 2.

The construction of the salmon farming industry were carried out in a similar manner:

1. Aggregate data on input and output for fish farming in Ireland and Scotland were registered/calculated and split on a) domestic, b) intra-EU and c) extra-EU deliveries.
2. Representative input-output structure data for the fish farming industry are not available from any EU national account. As a substitute, data from the fish farming industry in Norway were used to construct input and output structure coefficients.
3. Necessary input-output data were constructed for the two countries by combining data from 1 and 2.

By using price and volume indexes, the 2003 data for the salmon processing data were harmonized with the national accounts data for 2000. Thus, the demand figures for calculating the salmon processing industry keeps 2003 level, while the input-output structure for calculating the indirect effects are based on 2000 data.

Figure 10 Commodity flows in the database and multi-national input-output model

Commodity flows in EU	Intermediates				Private consumption				Other final demand				Exports (to EU)	Exports (to non-EU)	SUM
	Country 1	...	...	Country 15	Country 1	...	...	Country 15	Country 1	...	...	Country 15			
Country 1	Domestically produced intermediates $H^d$				Private consumption of domestic goods $cp^d$				Other final demand of domestically produced goods $Z^d$				Exports to the EU of domestically produced goods $E^{EU}$	Exports to non EU countries of (domest. prod. goods) $E^{Non-EU}$	SUM= Value of production $x$
...		...				...				...			...	...	...
...			...				...				...		...	...	...
Country 15				Domestically produced intermediates $H^d$				Private consumption of (domestic. prod. goods) $cp^d$				Other final demand (domestic. prod. goods) $Z^d$	Exports to the EU (domestic. prod. goods) $E^{EU}$	Exports to non-EU countries $E^{Non-EU}$	SUM= Value of production $x$
Intra EU Imports	Intermediates imported from the EU $H^{EU}$	...	...	Intermediates imported from the EU $H^{EU}$	Private consumption of imports from the EU $cp^{EU}$	...	...	Private consumption of imports from the EU $cp^{EU}$	Other final demand of imports from the EU $Z^{EU}$	...	...	Other final demand of imports from the EU $Z^{EU}$	(Sum Imports = Sum exports in the EU ( $M^{EU}=E^{EU}$ ))	---	Sum = Imports between EU-countries $m^{EU}$
Extra EU Imports	Intermediates imported from outside the EU $H^{EU}$	...	...	Intermediates imported from outside the EU $H^{EU}$	Private consumption of imports (from outside EU) $cp^{non-EU}$	...	...	Private consumption of imports from outside the EU $cp^{non-EU}$	Other final demand of imports from outside the EU $Z^{non-EU}$	...	...	Other final demand of imports from outside the EU $Z^{non-EU}$	---	---	Sum = Imports from non-EU countries $m^{non-EU}$
	SUM= Intermediates $H$	...	...	SUM= Intermediates $H$	SUM= Private consumption $cp$	...	...	SUM= Private consumption $cp$	SUM= Other final demand $Z$	...	...	SUM= Other final demand $Z$	Sum= Intra-EU exports $e^{EU}$	Sum= Exports to non-EU countries $e^{Non-EU}$	SUM Supply (make) in EU = SUM Demand (use) in EU
Value added = Gross product	Gross product $r$	...	...	Gross product $r$	---	---	---	---	---	---	---	---	---	---	SUM Gross product in EU $x$
Production	SUM= Value of production $x$	...	...	SUM= Value of production $x$											SUM= Value of production EU $x$

## 11.2 Data from Kontali Analyse

Kontali Analyse AS, Norway has provided estimates of supply and demand of farmed Atlantic Salmon to the EU25. Here we present parts of their provisions to the project.

Kontali list of Sources; Statistics Norway, Servicio Nacional de Aduanas, Statistics Canada, BTS, Forvus, Statistics Denmark, Statistical Bureau of the Faeroe Islands, Ireland Central Statistics Office, US Bureau of Census, De Nederlandsche Bank, Ofimer, EUROSTAT

### GERMANY - 2003

Farmed Atlantic Salmon

Country Processing Estimate

Based on Trade Statistics and Kontali Analyse Databases and Simulation models

In tonnes wfe

	SUPPLY TO GERMANY										GERMAN PRODUCT TRANSFORMATION			EXPORT FROM GERMANY		
	Norway	UK	Faeroe Island	Denmark	Poland	Ireland	Iceland	Chile	Canada / USA	Total export to Germany	Input	Norwegian Share (%)	Output	EU	Other Markets	Total export from Germany
Fresh whole salmon	24.374	5.995	913	11.563	0	1.512	323	0	3	44.682	-28.000	90		7.000	0	7.000
Frozen whole salmon	768	2	0	1.373	0	10	3	0	0	2.155	-1.000	100				0
Fresh salmon fillets	2.788	390	0	5.689	0	162	15	0	0	9.045			3.000	500		500
Frozen salmon fillets	9.565	259	2.112	9.416	100	0	17	3.406	0	24.875	-2.000	10	4.000	3.000		3.000
Smoked Salmon	184	472	0	10.095	6.000	63	2	8	32	16.856			20.000	9.000	700	9.700
Other Prepared / Value Added Products	286	162	54	4.143	300	0	29	3.828	0	8.803	-1.000	80	5.000	2.000	300	2.300
<b>Total</b>	<b>37.965</b>	<b>7.280</b>	<b>3.079</b>	<b>42.280</b>	<b>6.400</b>	<b>1.746</b>	<b>389</b>	<b>7242</b>	<b>34</b>	<b>106.415</b>	<b>-32.000</b>	<b>85</b>	<b>32.000</b>	<b>21.500</b>	<b>1.000</b>	<b>22.500</b>

## DENMARK - 2003

Farmed Atlantic Salmon

Country Processing Estimate

Based on Trade Statistics and Kontali Analyse Databases and Simulation models

In tonnes wfe

	SUPPLY TO DENMARK								DANISH PRODUCT TRANSFORMATION			EXPORT FROM DENMARK									
	Norway	UK	Faeroe Island	Ireland	Iceland	Chile	Canada/ USA	Total export to Denmark	Input	Estimated Norwegian Share (%)	Output	USA	Japan	Germany	France	Italy	Spain	Belgium	Other EU	Other Markets	Total from Denmark
Fresh whole salmon	77.954	911	23.803	135	222		1	103.026	-67.000	80		0	46	11.563	9.884	5.714	10.788	4.824	6.974	238	50.032
Frozen whole salmon	796	3	847	0	0	0	0	1.647			2.500	0	87	117	188	71	167	14	1.985	1.099	3.727
Fresh salmon fillets	1.965	1.023	1	158	8		0	3.155			13.000	1.525	25	5.689	1.056	1.183	128	341	2.296	150	12.392
Frozen salmon fillets	2.217	15	1.793		9	255	0	4.289			15.000	0	40	9.416	2.347	311	66	241	2.607	567	15.595
Smoked Salmon	303	5	2		4		0	314			26.000	81	7	10.095	291	5.704	214	802	1.566	1.268	20.028
Other Prepared / Value Added Products	40	0	133		7	122	0	302			10.500	35	0	4.143	899	734	56	57	1.146	153	7.223
<b>Total</b>	<b>83.275</b>	<b>1.958</b>	<b>26.579</b>	<b>293</b>	<b>250</b>	<b>377</b>	<b>0</b>	<b>112.733</b>	<b>-67.000</b>	<b>80</b>	<b>67.000</b>	<b>1.641</b>	<b>206</b>	<b>41.024</b>	<b>14.666</b>	<b>13.716</b>	<b>11.419</b>	<b>6.280</b>	<b>16.573</b>	<b>3.475</b>	<b>108.998</b>

## FRANCE - 2003

Farmed Atlantic Salmon

Country Processing Estimate

Based on Trade Statistics and Kontali Analyse Databases and Simulation models

In tonnes wfe

	SUPPLY TO FRANCE									FRENCH PRODUCT TRANSFORMATION			EXPORT FROM FRANCE		
	Norway	UK	Denmark	Faeroe Island	Ireland	Iceland	Chile	Canada / USA	Total to France	Input	Norwegian Share (%)	Output	EU	Other Markets	Total export from France
Fresh whole salmon	60.338	26.244	9.884	1.586	8.274	400	0	2	106.729	-68.000	70		3.000		3.000
Frozen whole salmon	648	31	224	15			248	0	1.166						0
Fresh salmon fillets	9.185	4.607	1.056	16	149	0	0	0	15.013	-5.000	80	6.000			0
Frozen salmon fillets	3.712	431	2.347	1.944	0	246	4.219	0	12.901	-2.000	10	7.000			0
Smoked Salmon	29	2.673	583	0	94	0	82	0	3.461			48.000	6.000	1.000	7.000
Other Prepared / Value Added Products	347	91	928	108	0	2	2.607	0	4.082	-1.000	0	15.000	1.000		1.000
<b>Total</b>	<b>74.259</b>	<b>34.078</b>	<b>15.022</b>	<b>3.669</b>	<b>8.518</b>	<b>648</b>	<b>7.156</b>	<b>2</b>	<b>143.352</b>	<b>-76.000</b>	<b>68 %</b>	<b>76.000</b>	<b>10.000</b>	<b>1.000</b>	<b>11.000</b>



**UK - 2003**

**Farmed Atlantic Salmon**

**Country Processing Estimate**

Based on Trade Statistics and Kontali Analyse Databases and Simulation models

In tonnes wfe

	SUPPLY TO UK								UK PROCESSING AND PRODUCT TRANSFORMATION			EXPORT FROM UK										
	Norway	Faeroe Island	Denmark	Ireland	Iceland	Chile	Canada / USA	Supply from Domestic Prod.	Total to UK	Input	Norwegian Share (%)	Output	USA	Japan	France	Germany	Ireland	Spain	Belgium	Other EU	Other Markets	Total export from UK
Fresh whole salmon	13.572	1.128	1.056	780	13	0	0	162.000	178.550	-85.000	10	700	14.714	3.083	26.244	5.995	3.534	5.685	915	2.486	2.674	65.330
Frozen whole salmon	1.584	4	3	0	0	49	0	1.640	1.640				586	26	31	2	8	0	0	66	20	740
Fresh salmon fillets	994	0	53	11	0	0	0	1.057	1.057			23.300	34	0	4.607	390	549	408	2.045	1.426	5	9.464
Frozen salmon fillets	1.041	394	197	3	18	145	0	1.797	1.797			13.000	376	0	431	259	160	1	362	850	68	2.506
Smoked Salmon	14	24	284	194	0	0	0	516	516			30.000	656	19	2.673	472	72	117	1.153	1.742	224	7.128
Other Prepared / Value Added Products	142	36	716	0	0	458	0	1.352	1.352			18.000	47	1	91	162	842	37	7	96	219	1.503
<b>Total</b>	<b>17.347</b>	<b>1.586</b>	<b>2.309</b>	<b>989</b>	<b>31</b>	<b>652</b>	<b>0</b>	<b>162.000</b>	<b>184.913</b>	<b>-85.000</b>	<b>10</b>	<b>85.000</b>	<b>16.412</b>	<b>3.129</b>	<b>34.078</b>	<b>7.280</b>	<b>5.166</b>	<b>6.248</b>	<b>4.481</b>	<b>6.666</b>	<b>3.211</b>	<b>86.671</b>

## POLAND - 2003

Farmed Atlantic Salmon

Country Processing Estimate

Based on Trade Statistics and Kontali Analyse Databases and Simulation models

In tonnes wfe

	SUPPLY TO POLAND							POLISH PRODUCT TRANSFORMATION			EXPORT FROM POLAND			
	Norway	UK	Faeroe Island	Denmark	Ireland	Chile	Total export to Poland	Input	Norwegian Share (%)	Output	Germany	Japan	Other Markets	Total export from Poland
Fresh whole salmon	20.182	0	0	2	0	0	<b>20.184</b>	-17.000	100		0	0	100	<b>100</b>
Frozen whole salmon	476	0	0	27	0	0	<b>503</b>				0	0	50	<b>50</b>
Fresh salmon fillets	1.376	0	0	6	0	0	<b>1.382</b>	-1.000	100	1.800	0	0	0	<b>0</b>
Frozen salmon fillets	424	0	0	62	0	40	<b>526</b>			3.800	100	1.200	1.000	<b>2.300</b>
Smoked Salmon	15	0	0	3	0	0	<b>18</b>			9.000	6.000	0	200	<b>6.200</b>
Other Prepared / Value Added Products	6	0	0	1	0	0	<b>7</b>			3.400	300	0	200	<b>500</b>
<b>Total</b>	<b>22.479</b>	<b>0</b>	<b>0</b>	<b>100</b>	<b>0</b>	<b>40</b>	<b>22.619</b>	<b>-18.000</b>	<b>100</b>	<b>18.000</b>	<b>6.400</b>	<b>1.200</b>	<b>1.550</b>	<b>9.150</b>

### EU - 2003 (EU-25)

Farmed Atlantic Salmon

Salmon Processing Overview / EU Consumption Estimate

Based on Trade Statistics, Kontali Analyse Databases, KA Simulation models and Cross Checking / Feedback from Industry Contacts

In tonnes wfe

	SUPPLY TO THE EU (25)								EU PROCESSING AND PRODUCT TRANSFORMATION			SUPPLY FROM THE EU (25)					ESTIMATED NET CONSUMPTION EU (25)
	Export to the EU						Supply from Domestic Production		Total Supply to the EU (25)	See next page for details			Estimated Export / Re-export from the EU (25)				
	Norway	Faeroe Island	Iceland	Chile	Canada / USA	Other	Supply from UK	Supply from Ireland		Input	Norwegian Share (%)	Output	USA	Japan	Other Markets	Total Export from the EU (25)	
Fresh whole salmon	295.895	33.538	1.154	0	349		162.300	18.400	511.637	-355.000	64 %	0	14.710	3.130	3.810	21.650	135.000
Frozen whole salmon	11.318	988	29	777	184				13.297	-1.000	60 %	3.200	610	110	1.230	1.950	13.500
Fresh salmon fillets	26.726	16	125	0	8				26.876	-6.000	83 %	57.600	1.560	30	150	1.740	76.700
Frozen salmon fillets	23.423	6.918	346	12.418	3				43.108	-4.000	10 %	52.300	1.380	1.240	940	3.560	87.800
Smoked Salmon	1.724	25	9	90	52				1.901	0		178.000	750	230	4.020	5.000	174.900
Other Prepared / Value Added Products	1.051	376	43	10.553	3				12.026	-2.000	40 %	76.900	80	200	970	1.250	85.700
<b>Total</b>	<b>360.139</b>	<b>41.863</b>	<b>1.707</b>	<b>23.838</b>	<b>598</b>		<b>162.300</b>	<b>18.400</b>	<b>608.844</b>	<b>-368.000</b>	<b>63,8 %</b>	<b>368.000</b>	<b>19.090</b>	<b>4.940</b>	<b>11.130</b>	<b>35.160</b>	<b>573.600</b>

## EU - 2003 (EU-25) Calculation of Norwegian share of input to the EU Processing industry

Farmed Atlantic Salmon

Salmon Processing Overview

Based on Trade Statistics, Kontali Analyse Databases, KA Simulation models and Cross Checking / Feedback from Industry Contacts

In tonnes wfe

	Input volume										EU-Total
	France	Denmark	Germany	Poland	UK	Spain	Italy	Nether-lands	Belgium	Other	
Fresh whole salmon	-68.000	-67.000	-28.000	-17.000	-85.000	-18.000	-9.000	-19.000	-18.000	-25.000	<b>-354.000</b>
Frozen whole salmon	0	0	-1.000	0	0	0	0	0	0	-1.000	<b>-2.000</b>
Fresh salmon fillets	-5.000	0	0	-1.000	0	0	0	0	0	0	<b>-6.000</b>
Frozen salmon fillets	-2.000	0	-2.000	0	0	0	0	0	0	0	<b>-4.000</b>
Smoked Salmon	0	0	0	0	0	0	0	0	0	0	<b>0</b>
Other Prepared / VAP	-1.000	0	-1.000	0	0	0	0	0	0	0	<b>-2.000</b>
<b>Total</b>	<b>-76.000</b>	<b>-67.000</b>	<b>-32.000</b>	<b>-18.000</b>	<b>-85.000</b>	<b>-18.000</b>	<b>-9.000</b>	<b>-19.000</b>	<b>-18.000</b>	<b>-26.000</b>	<b>-368.000</b>

	Norwegian Share										Norwegian Share All EU	Norwegian Quantity										
	France	Denmark	Germany	Poland	UK	Spain	Italy	Nether-lands	Belgium	Other		France	Denmark	Germany	Poland	UK	Spain	Italy	Nether-lands	Belgium	Other	Total
Fresh whole salmon	70	80	90	100	10	70	85	80	85	80	<b>63 %</b>	-47.600	-53.600	-25.200	-17.000	-8.500	-12.600	-7.650	-15.200	-15.300	-20.000	<b>-222.650</b>
Frozen whole salmon	0	0	100	0	0	0	0	0	0	20	<b>60 %</b>	0	0	-1.000	0	0	0	0	0	0	-200	<b>-1.200</b>
Fresh salmon fillets	80	0	0	100	0	0	0	90	0	0	<b>83 %</b>	-4.000	0	0	-1.000	0	0	0	0	0	0	<b>-5.000</b>
Frozen salmon fillets	10	0	10	0	0	0	0	10	0	0	<b>10 %</b>	-200	0	-200	0	0	0	0	0	0	0	<b>-400</b>
Smoked Salmon	0	0	0	0	0	0	0	0	0	0		0	0	0	0	0	0	0	0	0	0	<b>0</b>
Other Prepared / VAP	0	0	80	0	0	0	0	0	0	0	<b>40 %</b>	0	0	-800	0	0	0	0	0	0	0	<b>-800</b>
<b>Total</b>	<b>68 %</b>	<b>80 %</b>	<b>85 %</b>	<b>100 %</b>	<b>10 %</b>	<b>70 %</b>	<b>85 %</b>	<b>80 %</b>	<b>85 %</b>	<b>78 %</b>	<b>62,5 %</b>	<b>-51.800</b>	<b>-53.600</b>	<b>-27.200</b>	<b>-18.000</b>	<b>-8.500</b>	<b>-12.600</b>	<b>-7.650</b>	<b>-15.200</b>	<b>-15.300</b>	<b>-20.200</b>	<b>-230.050</b>

**Trondheim**

Address: NO-7465 Trondheim, Norway

Phone: +47 73 59 30 00

Fax: +47 73 59 33 50

**Oslo**

Address: P.O. Box 124, Blindern, NO-0314 Oslo, Norway

Phone: +47 22 06 73 00

Fax: +47 22 06 73 50