

Atlantic Salmon (*Salmo salar*)

Summary

Salmon, together with other salmonids is the 9th species used in aquaculture by volume [1]. Main producer is Norway accounting for more than 50% share of the production and followed by Chile with a 27% share. Historically production has been affected by disease and parasite outbreaks, and production cost is mainly drove by the cost of feed and varies with production volume and market, while price to the public has been more stable although the price has increased constantly.



Main world exporter is Chile followed by Poland, which is not a producer, but benefits from reexporting salmon products. The main importer is USA, and 6 of the top 10 importers are part of the EU. Almost all salmon production is done in sea cages, and mortality us a big cost for the industry, which together with sea lice treatment reaches a 12% of the revenues.

Contents

Production.....	2
Trade.....	4
Price vs Cost.....	6
Consumption.....	10
Housing Systems	11
Mortality, sea lice and other diseases.....	12
References.....	14

Production

World

- Total global salmon production is nearly 2.5 million tons per annum, which accounts between 288 and 674 million fish [1].
- Norway is the biggest producer and accounts for more than 50% of world salmon production. Followed by Chile accounting for a 27% of the world production [1] (Table 1, Figure 1).

Table 1. Salmon production 2018. Top 10 global production countries.

Country	Production (Tonnes)	Share of global production (%)	Estimated ¹ production by numbers (millions)
Norway	1,282,003	52.63	152 - 355
Chile	661,138	27.14	78 - 183
United Kingdom	166,000	6.81	20 - 46
Canada	123,184	5.06	15 - 34
Faroe Islands	78,900	3.24	9 - 22
Australia	61,227	2.51	7 - 17
Russian Federation	20,566	0.84	2 - 6
United States of America	16,107	0.66	2 - 4
Iceland	13,448	0.55	2 - 4
Ireland	11,984	0.49	1 - 3

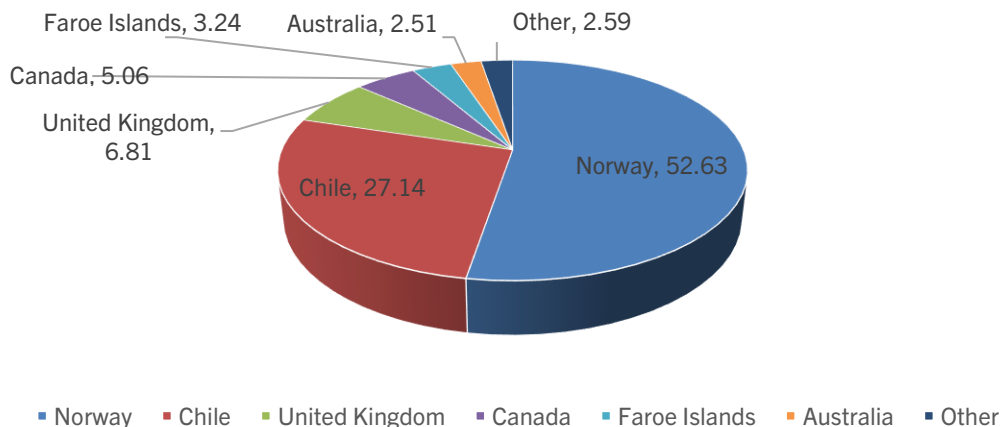


Figure 1. Percentage of global salmon production 2018 in tons. Other includes countries among 10 top countries with less than 1% share.

¹ Fish numbers obtained using a range of estimated mean weight: 3.614 – 8.434 kg: <http://fishcount.org.uk/>

- Global production has increased constantly, most of the increase is due to Norway and Chile increase in production (Figure 2).
- Chile had a sudden drop in production in 2010 (Figure 2) due to ISAV outbreak in 2007 but had health issues before that outbreak.

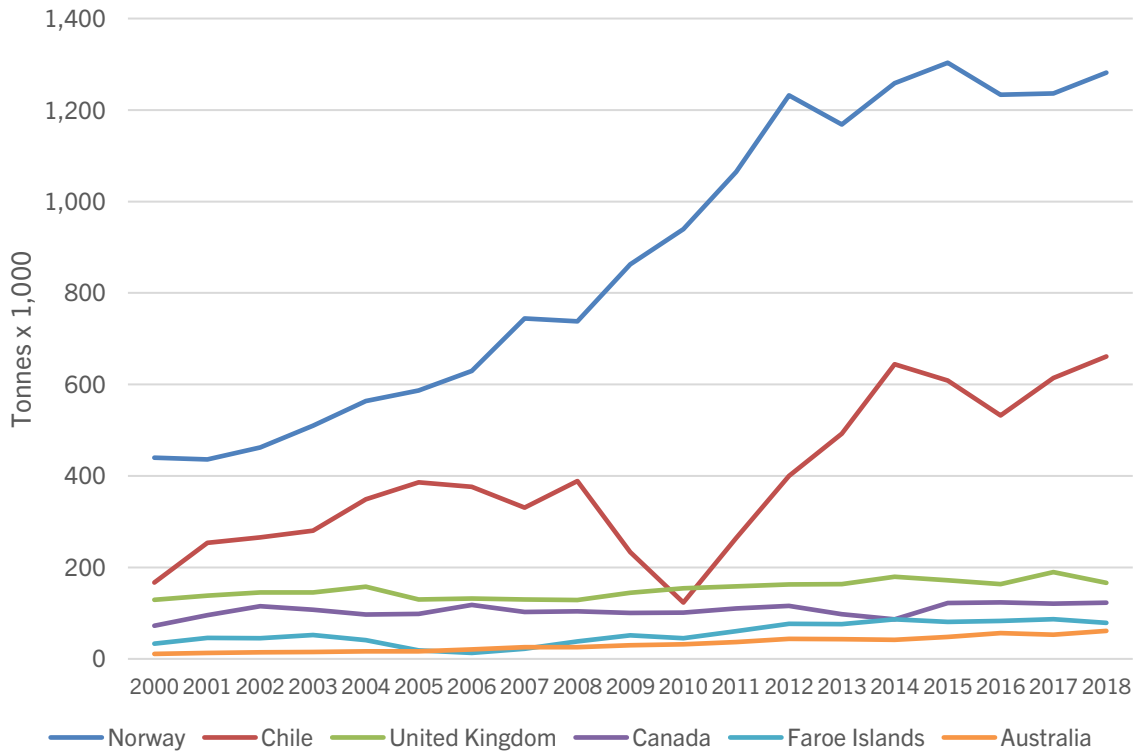


Figure 2. Production of salmon (tonnes) 2000-2018 of the six top producer countries on 2018.

- MOWI is the biggest producer worldwide by volume followed by Cermaq (Table 2).
 - Among the 5 main global producers, only Cooke is not based in Norway.

Table 2. Top 5 global salmon producers' annual revenue, volume, and head-quarters location. Ordered by production volume.

Rank	1	2	3	4	5
Producer	MOWI	Cermaq	SalMar	Leroy	Cooke
Annual revenue	US\$4.1 billion	£821 million	-	£1.6 billion	US\$2.4 billion
Volume (Tn)	436,000	157,800	166,000	138,000	80,000
HQ	Norway	Norway	Norway	Norway	Canada

EU

- In 2018, EU27 produced 13,314 Tn which accounts between 1.58 and 3.7 million fish [2].
- EU27 2018 production comes from three countries: Ireland (90%), Denmark (7.74%) and France (2.25%) [2].

UK

- In 2018, UK production was 166,000 Tn (22 – 46 million fish) [2].
- Production increased overtime, mostly since 2008, but increase hasn't been as steep as in Norway or Chile (Figure 2).
- Top Scottish producer is MOWI with a volume of 50,000 Tn followed by Cooke (Table 3).
 - None of the top 5 UK (Scotland) producers their parent companies are not in UK.

Table 3. Top 5 UK salmon producers' production, revenue, buyers, and market share.

Rank	1	2	3	4	5
Producer	MOWI	Cooke	The Scottish Salmon Company	Scottish Sea Farms	Grieg Seafood
Annual revenue	-	£161 million	£180 million	£183 million	£62 million
Volume (Tn)	50,000	~ 22,500	20% of Scottish production	30,000	11,924
HQ	Norway	Canada	Faroe	Norway	Norway

Trade

World

- Largest exporters in the world are Norway with 1,020,369 Tn (US\$8,3 billion) and Sweden with 493,210 Tn (US\$3,9 billion) (Table 4) [2].
- Largest importer in the world is Sweden with 531,002 Tn (US\$4,2 billion), and followed by USA with 383,911 Tn (US\$4,3 billion) and Denmark with 184,555 Tn (US\$1,5 billion) (Table 4) [2].
- Norway dominates Asian market and has a big share of it, which deter other actors to export to Asia [3].
 - Norwegian salmon market share per country: China 25%², Hong Kong 94%, Japan 86%, Singapore 92.7%, South Korea 99.1%, Taiwan 79.6%, Vietnam 88.7%.

EU

- EU 27 exports 1,012,219 Tn, from which Sweden is the main exporter with 493,210 Tn followed by Denmark with 166,133 Tn (Table 4) [2].
 - Exports account for a value of US\$9.5 billion. Sweden exports value is of US\$3.95 billion and Denmark US\$1.5 billion (Table 4) [2].
- EU27 imports account for 1,397,586 Tn. Main importer from EU27 is Sweden with 531,000 Tn followed by Denmark with 184,555 Tn (Table 4) [2].
 - EU27 imports value is US\$12.7 billion. Main importers by value are Sweden (US\$4.2 billion) and Germany (US\$1.8 billion) (Table 4) [2].
- Note that from the ten top importers, 6 are from the UE (Table 4).

² China restricts imports from Norway. This increased smuggling from Vietnam, making Vietnam demand Chinese demand.

Table 4. Worldwide exports and imports in 2018, by volume and by value.

Exports					
Country	Quantity (Tonnes)	Share(%)	Country	Value (USD x 1000)	Share (%)
World	2,743,292		World	25,330,784	
Norway	1,020,369	37.20	Norway	8,307,945	32.80
Sweden	493,210	17.98	Sweden	3,957,345	15.62
Chile	349,914	12.76	Chile	3,947,061	15.58
Denmark	166,133	6.06	Denmark	1,547,264	6.11
Poland	104,177	3.80	Poland	1,488,121	5.87
China	93,369	3.40	UK	844,109	3.33
Canada	92,459	3.37	Canada	812,732	3.21
UK	89,325	3.26	China	659,230	2.60
Faroe Islands	58,386	2.13	Germany	650,004	2.57
Germany	48,991	1.79	Faroe Islands	514,982	2.03
Imports					
Country	Quantity (Tonnes)	Share(%)	Country	Value (USD x 1000)	Share(%)
World	2,539,049		World	24,807,550	
Sweden	531,002	20.91	USA	4,356,632	17.56
USA	383,911	15.12	Sweden	4,208,772	16.97
Denmark	184,555	7.27	Germany	1,825,469	7.36
France	167,295	6.59	France	1,525,892	6.15
Poland	163,373	6.43	Denmark	1,503,396	6.06
Germany	157,162	6.19	Poland	1,243,214	5.01
UK	83,912	3.30	Italy	830,468	3.35
Brazil	81,573	3.21	Japan	827,238	3.33
Italy	78,373	3.09	UK	756,258	3.05
Japan	73,367	2.89	China	754,045	3.04

UK

- UK exports for a total of 89,325 Tn. Exports have a value of US\$844 million (Table 4)[2].
- UK imports for a total of 83,912 Tn which accounts for a value of US\$756 million (Table 4) [2].
- Worldwide, UK is the 6th importer by volume, and 8th by value (Table 4).
- France has been increasingly substituting Norwegian salmon for Scottish salmon since 2016-2017 [4].

Price vs Cost

Cost

- Production cost has constantly increased since 2003 (Figure 3).
- Production cost has grown more similar among countries over time. Scotland is an exception and has the current higher production cost (Figure 3).

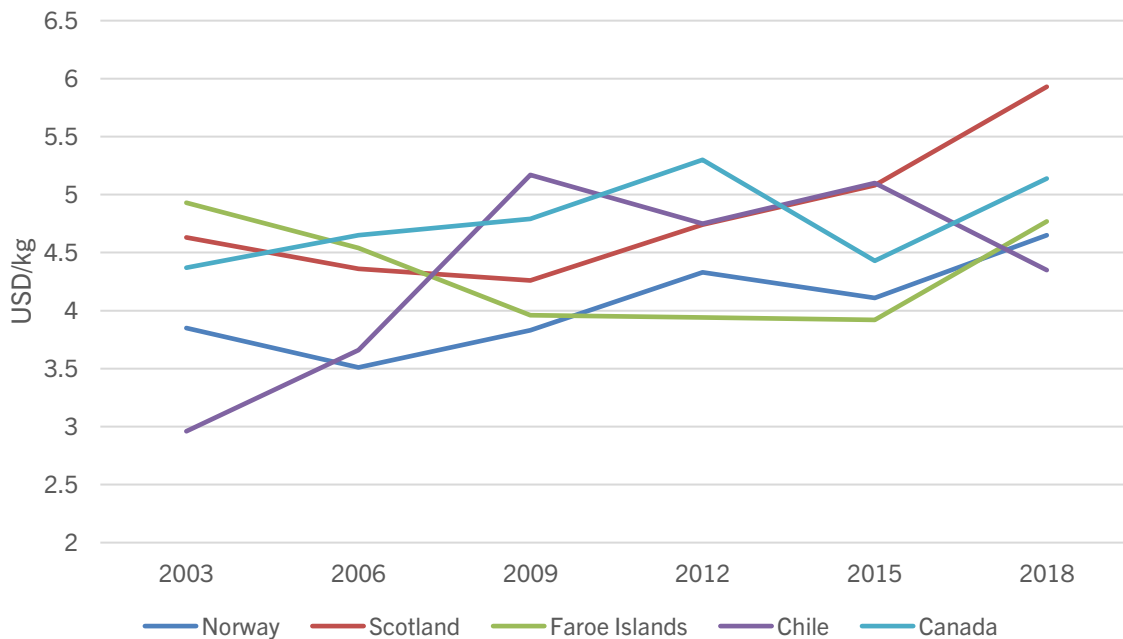


Figure 3. Cost of production (USD/kg) for the 5 main producer countries [5].

- The main cost for salmon production is the cost of feed which amounts for an average of 47% of the total cost of production in 2018 (Figure 4).
- Cost distribution has kept constant over time but recently share of feed cost over total cost production has decreased for Norway, Scotland and Canada, but mostly in Scotland, while Miscellaneous cost has increased (Figure 5).
 - Miscellaneous probably includes the cost of treatments and vaccination.
- Cost of feed has increased the cost of production constantly. Percentage of the cost has been maintained fairly constant but depending on the country, the raw cost changes significantly over time (Figure 6).
- Scotland has the higher production cost and historically has been the producer with higher feed cost. Differently to the rest the increase has been quite constant and relatively stable (Figure 6).

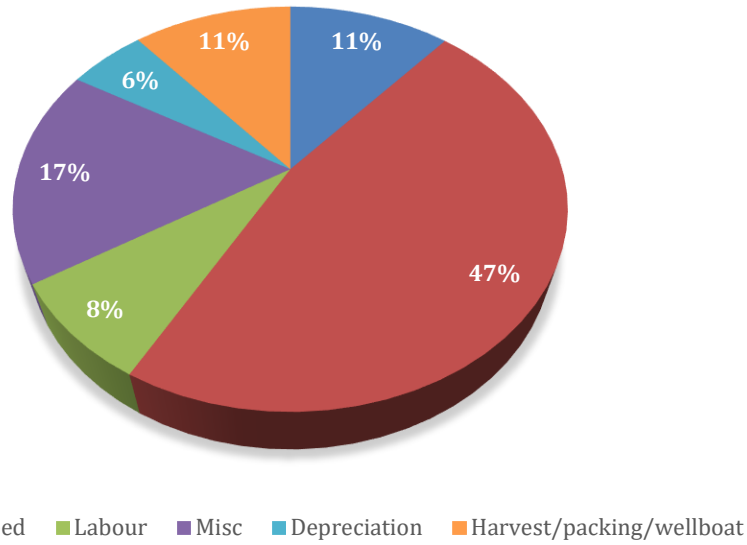


Figure 4. Average cost distribution from the 5 main producer countries [5].

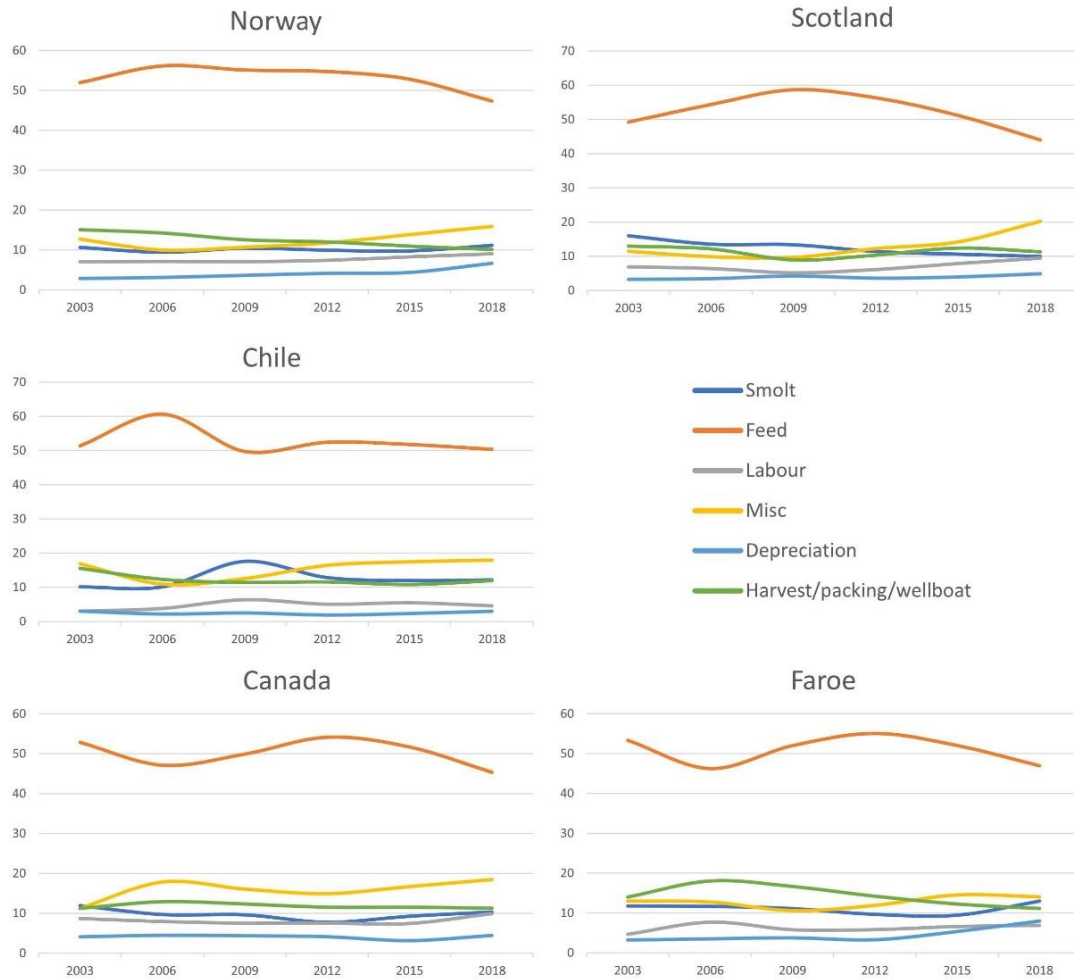


Figure 5. Salmon cost distribution (%) between the 6 main categories of the 5 main producer countries from 2003 to 2018.

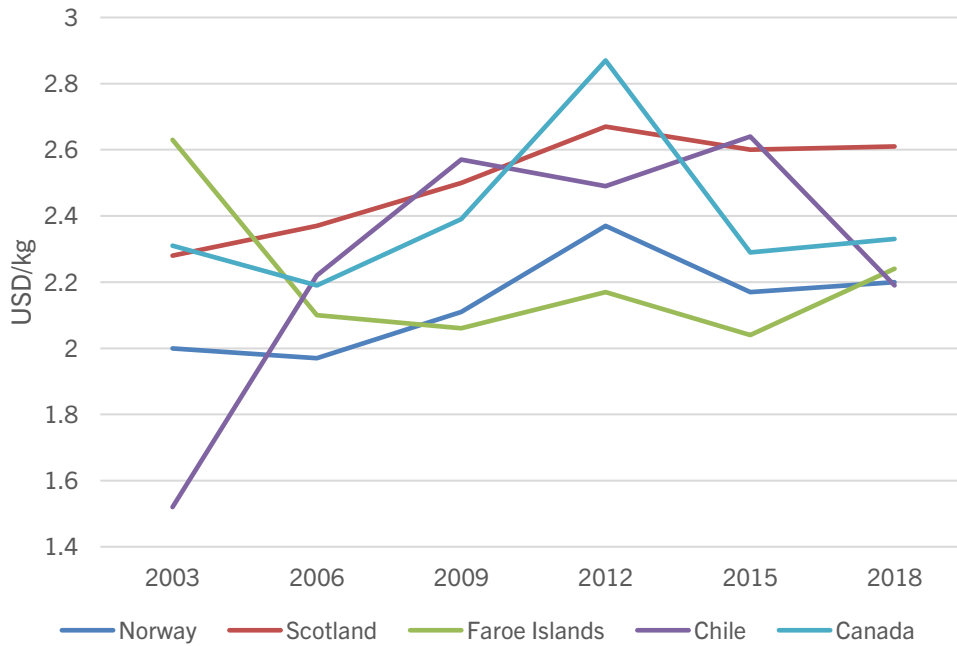


Figure 6. Cost of feed (USD/kg) over time in the main five producer countries.

Price

- Constant upward trend of salmon prices (Figure 7).
 - Since January 2006 until early March 2021 the price of Norwegian salmon has increased 90%.
 - Detail price is more stable than origin price or wholesale price. Difference between detail price and wholesale has been increasing (Figure 7).
- Buildup of harvestable biomass reduce prices. See in Figure 2 2012, 2016 and 2018 as examples of increasing production coinciding with lower prices at the same period, see Figure 7.
 - Russian embargo to European goods also affected, see 2017 decrease (Figure 7) [4].
- Scottish salmon price is closely related with Norwegian price. In Europe, many times paid at a premium due to perceived sustainability and quality [6].

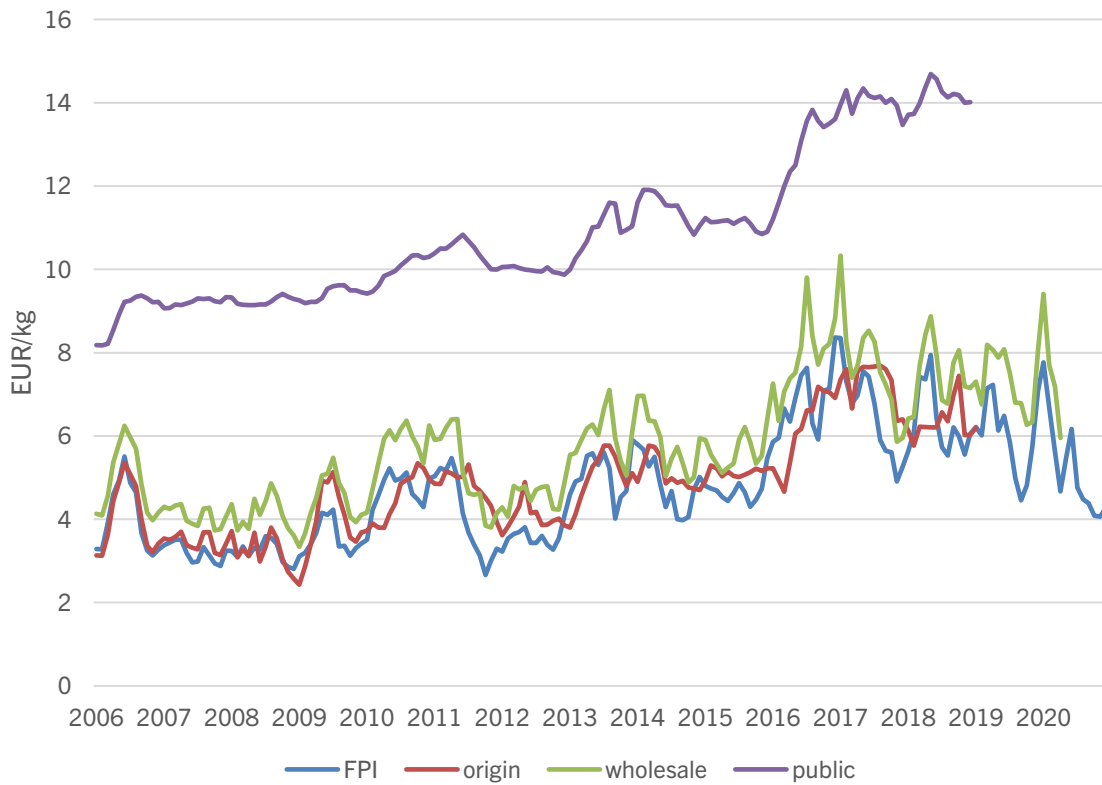


Figure 7. Timeline of salmon price from FPI (Norwegian salmon) [7] and prices from network of wholesale markets in Spain including Mercamadrid by three categories: at origin, wholesale and detail [8] from 2006 to 2020.

- Norway dominates Asian market and exercise market power due to the high market share. It creates higher prices, and considered discriminatory practices [3].
- Norway has redirected products to European market due to COVID, and the price is expected to decrease [9].

Consumption

World

- Europe is the highest consumer of salmon with an estimated consumption for 2017 of 1,058,000 Tn (Figure 8). It is expected to increase as seafood consumption continuously increases [10].

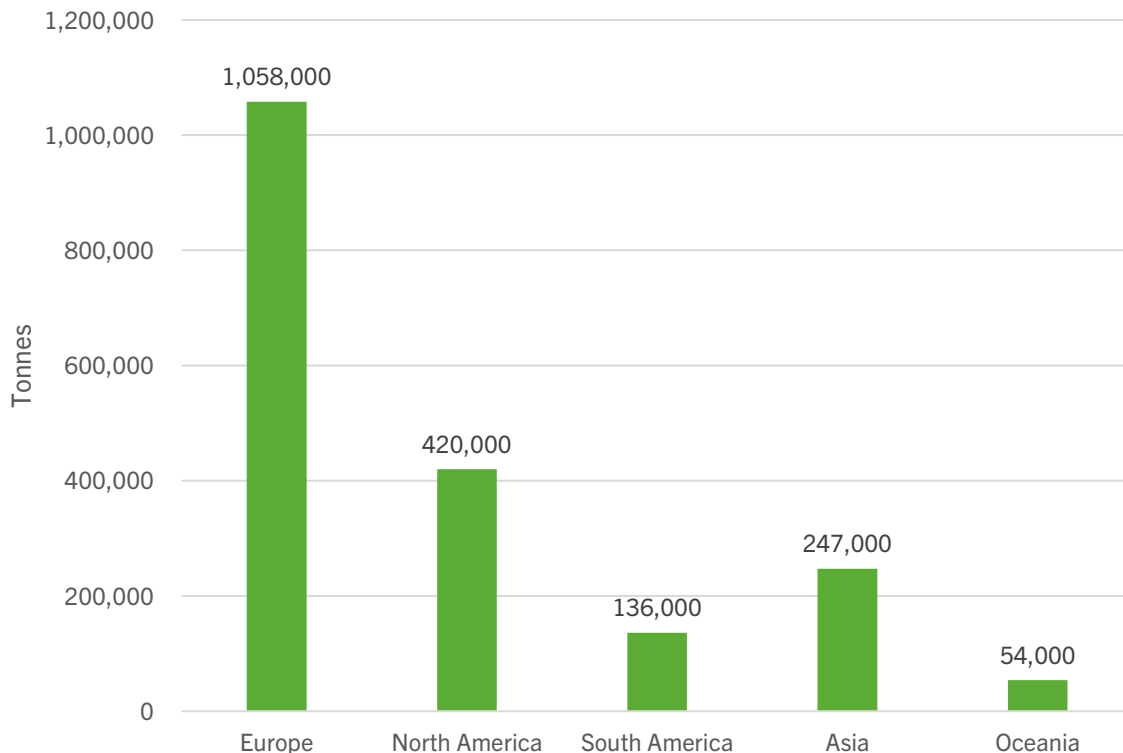


Figure 8. Estimated consumption of salmon per continent in 2017 [10].

EU

- 2018 total consumption of fresh salmon in EU was 135,000 Tn [11].
- Is the third most consumed species after tuna and cod [11].
- Biggest consumer of fresh salmon in EU is Spain with an estimate consume of near 48,000 Tn, reaching a value of €500 million (Table 5) [11]. Cost per kg for Spain is around 8€ less than France, second biggest consumer.
- Higher cost per kg is in Netherlands achieving 23.29 €/kg. In comparison, Portugal pays the least per kg, 9.08 €/kg.
- Ireland and Spain lead the consumption per capita with 1.17 and 1.02 kg per person, twice or even thrice times other countries on the top 10 consumers.

UK

- Consumption of salmon in UK is estimated at 28,500 Tn with a value of €452 million in 2018 [11].
- Consumption per capita was 0.42 kg, and each person expended 6.79 € in salmon in 2018. The cost per kg was of 15.83 €/kg.

Table 5. Estimate consumption of fresh salmon in the EU in 2018 [11].

Country	Tonnes	Value (x 1000 €)	Cost per kg (€)	Per capita (Kg)	Expense per person (€)
Spain	47,747	500,773	10.49	1.02	10.70
France	22,641	413,956	18.28	0.34	6.17
Italy	16,855	246,151	14.60	0.28	4.07
Germany	13,232	243,893	18.43	0.16	2.94
Poland	8,100	92,334	11.40	0.21	2.43
Netherlands	7,873	183,360	23.29	0.46	10.64
Ireland	5,692	100,727	17.70	1.17	20.69
Sweden	4,888	59,411	12.15	0.48	5.84
Denmark	4,024	89,181	22.16	0.69	15.39
Portugal	4,018	36,491	9.08	0.39	3.55

Housing Systems

World

- It seems clear that most salmon are produced in cages and there are projects to develop salmon aquaculture in recirculation aquaculture systems (RAS) inland, but we do not have current global figures of production by rearing system.
- Norway produces all the salmon in sea cage systems [12].

EU

- In 2018, EU27 produced 12,476 Tn of salmon in cages, while 1,021 Tn came from production in RAS systems [12].
 - Cage production: Ireland produced 11,984 Tn, and the rest (492 Tn) were produced by Poland.
 - RAS system production: all from Denmark: 1.201 Tn

UK

- All production from UK is done using sea cages [12].

Mortality, sea lice and other diseases

Mortality

- Cause of mortality for 65% of cases is unknown or not disclosed³. The remaining 35% is sea lice, other diseases and algal blooms (Figure 9) [13].
 - Main causes of deaths reported are diseases, sea lice and delousing treatments and algal blooms, although specific incidence is not available [14].

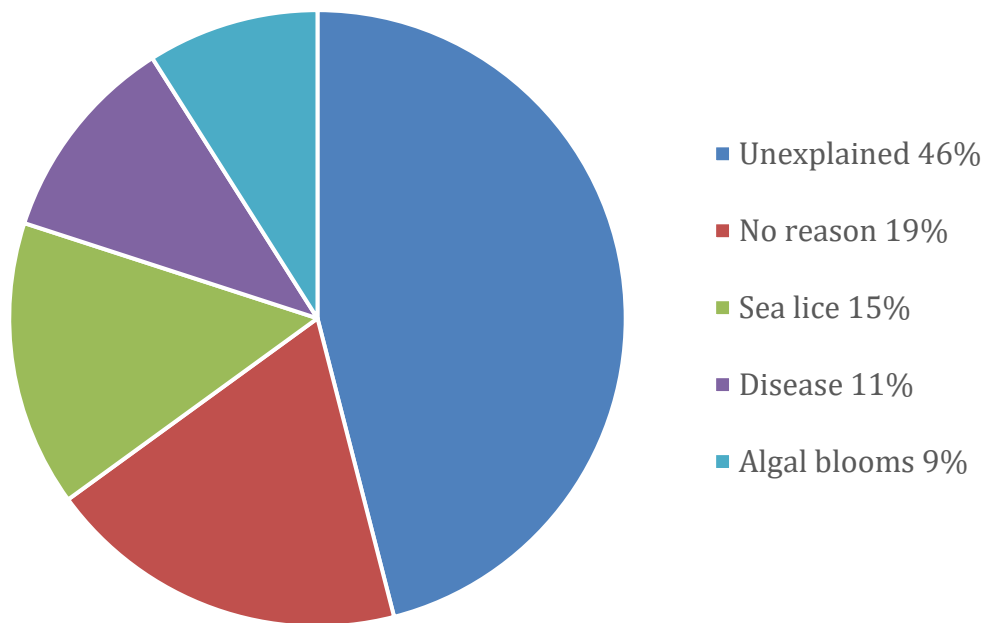


Figure 9. Percentage of causes of mortality³ [13].

- Mortality data is only available for Norway and Scotland (Table 6) [13].
 - In 2013, Scottish Government stopped publishing aggregated figures due to industry pressure. Mortality data is published voluntarily from producers weekly: weekly mortality and accumulated mortality for completed cycle [13].

Table 6. Percentage of tonnes lost from mortalities in Norway and Scotland 2013-2019 [13].

% Tons lost	2013	2014	2015	2016	2017	2018	2019
Norway	11	12	14	15	15	13	15
Scotland	6.4	9	10.8	13.6	13.4	10.6	13.5

- Mortality cost between 2013 and 2019 is calculated to be close to US\$2.4 billion for Norwegian and close to US\$1 billion for Scottish producers [13].
- In Scotland, 86% of mortalities are related to diseases and their treatments [14].

³ **Unexplained mortalities:** The cause of death has not been established.

No reason mortalities: The cause of death is could be known or not, but it has not been stated in the report.

Sea lice

- Globally, the estimated cost of combatting sea lice is 6% of the revenues. Together with mortalities they reach to a 12% which translates to USD\$ 7.1 billion from 2013 to 2019 (Table 7) [13].
- The effect of sea lice and their treatments accounts for 15% of mortalities [13].

Table 7. Cost of sea lice control across countries from 2013 to 2019, in millions of USD.

Country	2013	2014	2015	2016	2017	2018	2019
Norway	240	265	280	469	271	295	319
Scotland	57	66	62	60	75	62	78
Chile	176	232	222	199	247	263	304
Canada	12	11	16	17	17	17	17

References

- [1] FAO Fisheries and Aquaculture Department, "Top 10 species groups in global aquaculture 2018," 2020. [Online]. Available: <http://www.fao.org/3/ca9383en/ca9383en.pdf>.
- [2] FAO, "Fishery and Aquaculture Statistics.1976-2019," 2021. www.fao.org/fishery/statistics/software/fishstatj/en (accessed Jun. 01, 2021).
- [3] Bong-Tae Kim, "Pricing Behavior for Sustainably Farmed Fish in International Trade: The Case of Norwegian Atlantic Salmon (*Salmo salar*)," *Sustainability*, vol. 10, no. 12. 2018, doi: 10.3390/su10124814.
- [4] GLOBEFISH-FAO, "Global salmon prices come down as farmed harvests flood the market," *Market Reports*, 2018. <http://www.fao.org/in-action/globefish/market-reports/resource-detail/en/c/1110416/> (accessed Mar. 18, 2021).
- [5] Audun Iversen, Frank Asche, Øystein Hermansen, and Ragnar Nystøyl, "Production cost and competitiveness in major salmon farming countries 2003–2018," *Aquaculture*, vol. 522, p. 735089, 2020, doi: <https://doi.org/10.1016/j.aquaculture.2020.735089>.
- [6] GLOBEFISH-FAO, "European Price Report - January 2021," 2021. [Online]. Available: https://issuu.com/globefish/docs/globefish_-_european_price_report_-_jan_2021_.
- [7] Fish Pool ASA, "Fish Pool ASA." <https://fishpool.eu/> (accessed Mar. 17, 2021).
- [8] Pesca y Alimentación Ministerio de Agricultura, "Observatorio de la Cadena Alimentaria." <https://www.mapa.gob.es/es/alimentacion/servicios/observatorio-de-precios-de-los-alimentos/default2.aspx> (accessed Mar. 22, 2021).
- [9] GLOBEFISH-FAO, "European Price Report - February 2021," 2021. [Online]. Available: <http://www.fao.org/in-action/globefish/publications/details-publication/en/c/1301056/>.
- [10] Felipe Irrarázaval and Beatriz Bustos-Gallardo, "Global Salmon Networks: Unpacking Ecological Contradictions at the Production Stage," *Econ. Geogr.*, vol. 95, no. 2, pp. 159–178, Mar. 2019, doi: 10.1080/00130095.2018.1506700.
- [11] European Commission, "European Market Observatory for Fisheries and Aquaculture Products," 2021. <https://www.eumofa.eu/> (accessed Mar. 02, 2021).
- [12] EuroStat, "Production from aquaculture excluding hatcheries and nurseries (from 2008 onwards)." 2021, doi: Online code: FISH_AQ2A.
- [13] Just Economics, "Dead Loss: The high cost of poor farming practices and mortalities on salmon farms," 2021. [Online]. Available: <https://www.justeconomics.co.uk/health-and-well-being/dead-loss>.
- [14] Scottish Government, "Fish Health Inspectorate: mortality information," 2021. <https://www.gov.scot/publications/fish-health-inspectorate-mortality-information/> (accessed Mar. 15, 2021).