

Cod to 2030

**A short review of the UK's cod supply base
and 10 year forward view.**

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Summary

Introduction

This report is a special review focussed on the changing prospects for Atlantic cod supplies to the UK. Special review reports explore changes on the seafood horizon with high impact for the UK seafood industry to identify opportunities and threats. The reviews aim to raise awareness and understanding of longer term trends and impacts amongst industry operators and government. This can then support stakeholders in working together on initiatives to address the changes taking place.

The UK consumer relies on seafood from domestic waters and from around the world. Of key interest to the UK industry are the medium to long term opportunities and threats to the seafood supply base.

In order to help the UK industry to thrive, we reviewed the UK seafood supply portfolio, how it is developing, and the prospects for that supply looking ahead to 2030¹. Having undertaken this initial work, feedback from our processing and importing stakeholders suggested we look at parts of that supply portfolio in more depth. Interest focussed on touchstone species like Atlantic cod, and particularly imported cod supplies, given that the UK and EU are not self-sufficient in cod (having limited cod resources in European waters).

This report is the result of a short exploratory exercise, with key importers, to understand the supply routes to the UK market for Atlantic cod and identify major changes on the horizon. Of particular interest has been identifying trends in key supply chains over the last 10 years, the changes afoot, how this may play out for cod supply to 2030, and the implications for industry.

Recent developments in UK cod supply

The review highlights a range of notable points:

- Tastes and diets are becoming more personalised e.g. veganism, vegetarianism, pescatarianism, and 'flexitarianism'. Many UK consumers are seeking proteins that are easy, simple and versatile, that offer value for money, and that can help personalise meal occasions. Chilled seafood now dominates over frozen and ambient sectors, as chilled natural products - with no additional ingredients - allow more scope for final use, supporting versatility and personalisation.
- Amongst traditional proteins, seafood tends to be priced relatively high and can suffer quickly in the face of price increases although the chilled seafood consumer can often pay more for perceived quality. In the cod market, frozen products are very price oriented, whilst chilled products are influenced by other factors alongside price, such as perceived quality, source country etc.
- The UK (and EU) is not self-sufficient in cod or whitefish. To meet the volumes demanded by the UK market, Atlantic cod supply to the UK is heavily reliant on imports from source countries having major cod fisheries: primarily Iceland, Norway and Russia. Recent years have seen a period of relative abundance, in which the availability of cod

¹ https://www.seafish.org/media/publications/UK_Seafood_Supply_Base_to_2030.pdf

peaked in the Barents sea cod fishery. However, this abundance is now becoming more constrained and, compounded by slow growth in the smaller Icelandic cod stock, this has translated into lower catch levels, particularly in Norwegian and Russian fleets.

- With pressure from the market and constraints in cod fisheries, innovation and investment has triggered important changes in cod supply routes. Cod imports to the UK are overwhelmingly in the form of primary processed products drawn from Iceland, Norway and Russia. Iceland and Russia have seen increased investment in technology to support the efficient supply of premium products for the chilled sector, Norwegian investment has been more conservative. Atlantic cod imports now focus on low volume and premium priced fresh fillets (largely from Iceland) and higher volumes of single frozen fillets (from Iceland and Russia) both of which can support the chilled sector, as well as double frozen fillet blocks (from Norway and Russia via China and Eastern Europe) which can support the frozen sector.

Longer term drivers

More broadly, longer term drivers are putting additional pressure on the competitiveness of supply routes including food security, climate change and automation. Food security will be challenged as wild capture whitefish resources grow slightly but Asian demand grows markedly. Climate change, particularly increased sea temperature, will drive fish to more northerly latitudes. Automation will play a larger role as the cost and availability of technology will improve relative to labour, putting operators with access to high volume supplies in pole position to reshape their supply chains.

Supply of cod towards 2030

Looking ahead:

- The UK is expected to continue as an important market for cod, supported by consumer loyalty for this iconic fish, but faces serious competition from China and elsewhere in Europe as their markets develop.
- Within cod supply routes, continued pressure on the affordability of cod is anticipated with a risk of price barriers and of the species tracking downwards. Recent advances in supply chains are likely to continue with greater pressure for processing near the market.
- Source countries are expected to maximise the value of their cod fisheries. Of the possible future pathways, two paths stand out: source countries could invest and embed their current specialisation targeting chilled and frozen sectors; alternatively, source countries could invest in automation and specialise in high value chilled sector product (Norway, in particular, changing its orientation and investing in these products via automation).
- Automation is likely to play a key role in the shape of future cod supply. Market pressure for shorter supply chains, coupled with investment in automation by larger consolidated businesses handling high volume supplies, could herald a re-shoring of processing to Europe.

Impact and response to longer term developments

Should some of these changes play out, there could be major opportunities and challenges for the UK industry. Appropriate strategies should be explored in responding to these new circumstances – some of which are highlighted by stakeholders. Seafish will continue to maintain close dialogue with industry stakeholders to explore appropriate responses.

1. Introduction

This special review report focusses on the changing prospects for Atlantic cod supplies to the UK. Special review reports explore changes on the seafood horizon with high impact for the UK seafood industry to identify opportunities and threats over the medium to long term. These reviews are intended to raise awareness and understanding of longer term trends and impacts amongst industry operators and government. This can then support stakeholders in working collaboratively on initiatives to address the changes taking place.

The reviews take an holistic perspective, outlining broad trends and pathways, to stimulate thinking and spur action. The reviews are not intended to provide a complete picture, or to engage in precise forecasting or specific predictions.

Having undertaken a previous review of the UK seafood supply base to 2030 (published in 2018)², feedback from our processing and importing stakeholders suggested we look at parts of that supply portfolio in more depth. Interest focussed on the prospects for a number of touchstone species in the UK supply portfolio. Atlantic cod, and particularly imported cod supplies given the limited cod resources in UK or EU waters, was nominated as a key species for further exploration.

This short review concerns UK Atlantic cod supply to 2030 from international sources. It considers the major industry impacts arising from key changes and long term drivers in the supply of imported cod and close substitutes. The review also sets out major areas for response, for Seafish and the seafood industry - UK whitefish importers in particular.

This review aims to support the UK seafood industry in understanding:

- The major characteristics of the UK cod supply base.
- The new and emerging developments expected to impact on industry supply chains.
- Industry impacts (positive and negative) likely to arise from these developments.
- Action industry (and Seafish) can take in response.

This exercise conducted in 2019 involved a combination of desk research and consultation with industry operators. The review draws upon previous supply reviews conducted in 2010 (*Outlook for supplies of Icelandic cod and haddock to the UK*) and 2018 (*UK seafood supply base to 2030*),

The review has a number of limitations. The focus is on international supplies of cod, given market dependence on imports and the limited resources within UK and EU waters. In addition, the scope of consultation is not exhaustive; due to limited funds a limited number of industry operators were engaged.

This document combines data, opinions and conjecture and is a position paper at the time of press. It is important to bear in mind that evidence today might suggest trends that may turn out to be very different in the longer term.

² https://www.seafish.org/media/publications/UK_Seafood_Supply_Base_to_2030.pdf

2. Cod supply to the UK

Key message:

- UK consumers have a strong preference for whitefish and, within this, cod is an iconic species.
- In supplying this market, Atlantic cod is a key species traded alongside close substitutes such as haddock, Alaska pollock and to a lesser extent pangasius.
- Major processing hubs are NE Scotland (reliant on domestic catch) and Grimsby/Hull (reliant on imported whitefish supply).
- Whitefish supply is dominated by imports, given limited resources available in EU waters.

This section provides a brief overview of whitefish resources as they relate to Atlantic cod, product formats traded, major supply routes and the UK market. Whitefish resources include a range of key production areas, covering fisheries and aquaculture production.

The main whitefish supply routes to support UK markets is shown in figure 2.1.

In summary:

- UK consumers have a strong preference for whitefish, and these products are available in a range of format across retail and food service. Within this, cod is an iconic species.
- Whitefish resources available to UK suppliers include Atlantic cod (North Atlantic and Barents sea) but also close substitutes such as haddock (North Atlantic and Barents sea), Alaska pollock (North Pacific), and pangasius (SE Asia).
- A range of product formats are produced and traded. Notable UK whitefish processing hubs are the North East of Scotland (oriented to fresh products drawing on whitefish landings from EU waters) and Grimsby/Hull (oriented to fresh and frozen product drawing on imported whitefish).
- Whitefish supply is dominated by imports, with vessel landings a relatively small proportion. This balance reflects the limited resource in EU waters and dependence on overseas supplies.

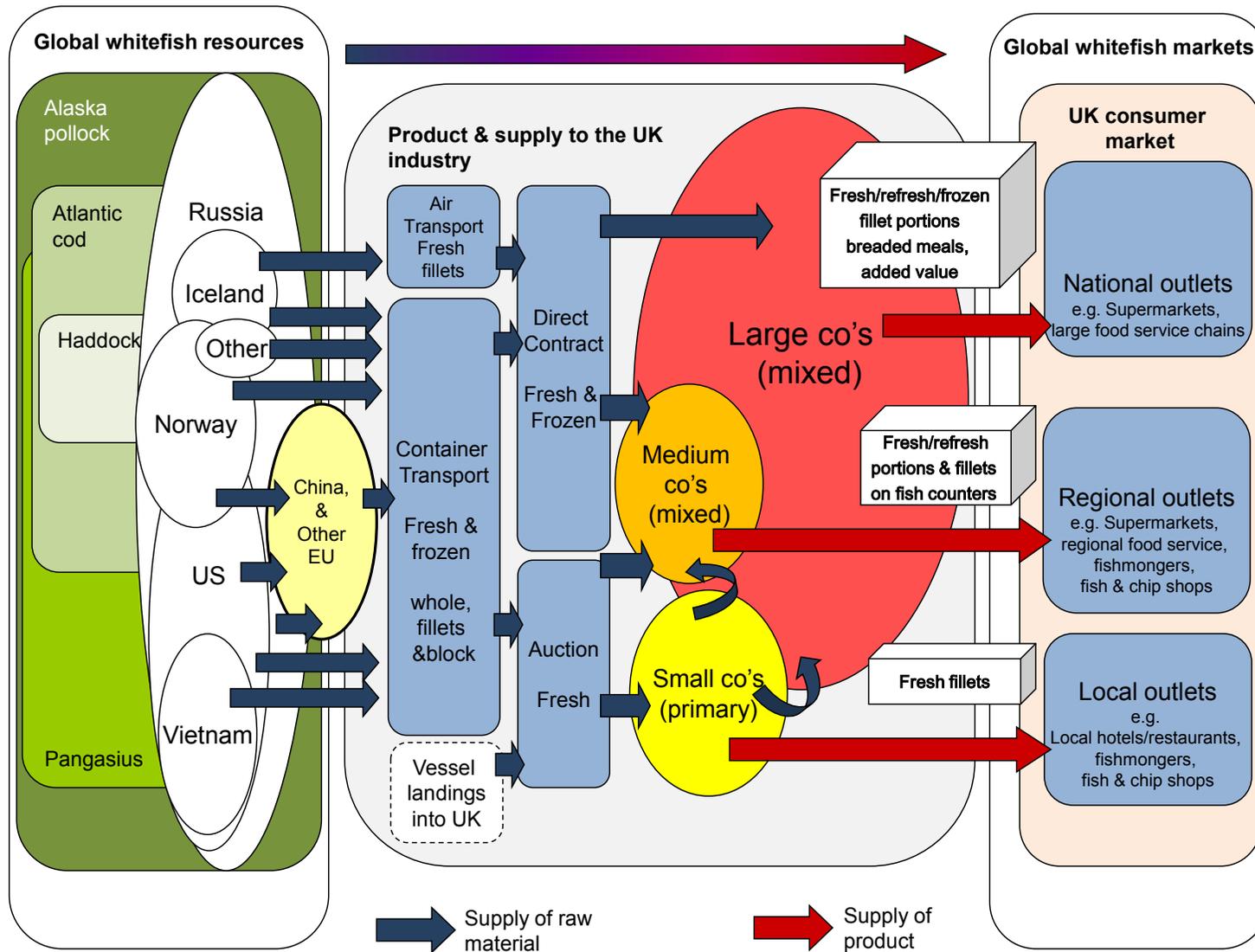


Figure 2.1 Major import supply routes that support UK whitefish for the UK consumer market

2.1 UK consumer market

Key messages:

- The UK consumer seeks proteins that are easy, simple and versatile and offer value for money. Cost health and environmental factors are important in buying food.
- In seafood, there is a complex interaction between chilled and frozen product markets with each being driven by different underlying preferences. Frozen products are very price oriented, whilst chilled products are influenced by other factors alongside price, such as quality, source country etc.
- Amongst traditional proteins, seafood tends to be priced relatively high and can suffer quickly in the face of price increases although the chilled seafood consumer can often pay more for perceived quality and value for money.
- In UK retail chilled seafood dominates over frozen and ambient sectors. In UK food service fish and chip shops and pubs are the dominant channels for out of home consumption of cod and haddock.

UK consumer preferences highlight a range of factors that influence the food purchasing decision. These include:

- Cost, health, and environmental factors.
- Taste and different diets: veganism, vegetarianism, pescatarianism, flexitarianism (primarily but not strictly vegetarian).
- Choice and personalisation to support consumer experimentation.
- Many UK consumers are seeking proteins that are easy, simple and versatile, that offer value for money and that can play into personalisation.

In seafood, there is a complex interaction between chilled and frozen product markets with each being driven by different underlying preferences. Frozen products are very price oriented, whilst chilled products are influenced by other factors alongside price, such as quality, source country etc.

Amongst traditional proteins, seafood prices are relatively high on average. Seafood can be price sensitive, reacting badly to price increases and often the first to suffer in comparison to other proteins. Consumers buying chilled seafood products are often prepared to pay more if products are perceived to be higher quality and value for money.

UK retail is a relatively concentrated sector, with several major retailers having an important influence on food sales and supply chain practice. Retailers pursue strategies that reflect their target consumers and that differentiate themselves in the market. As an illustration, retailer sourcing strategies in the chilled whitefish sector range from those who specify, and those who are flexible on, catch method and source country.

- In volume and value, the chilled seafood sector dominates over frozen and ambient sectors³.
- Within the chilled sector, the largest segment is chilled natural. Chilled natural products - with no additional ingredients - allow more scope for final use, supporting versatility and personalisation. By share of chilled sector value, the top whitefish species are cod

³ In the 52 weeks to June 2019, of £3.81bn total seafood sales, chilled represented 62%, frozen 24%, and ambient 14%. Of 392,356 tonnes (product weight) total sales volume, chilled represented 46%, frozen 33%, and ambient 21%.

(11%), and haddock (8%). Salmon, being an important substitute for whitefish, is also influential (with 45% share of value).

- The frozen natural and fingers segments account for 50% of total sales value. By share of value, the top species relevant to the frozen whitefish sector are: cod (30%), pollock (16%), haddock (8%). As a substitute for whitefish, salmon is also an influential species (7% of value).

Compared to chilled, the response to price change in the frozen sector can be slower yet more substantial, such that prolonged frozen trends can act as a barometer for movement in chilled. With price already low, price changes in frozen can involve quite substantial product change (species, product size etc) whilst price change in chilled can be addressed by rapid volume change due to lower stockholding.

In retail, chilled seafood appeals to an older, more affluent, consumer group. Certain consumer groups respond to particular product formats. The cod consumer, in contrast to the overall seafood consumer, is older, less affluent and from larger households with older children. Consumers buying chilled cod are slightly older so more locked into preferences and price has less of an impact. In the face of price increases, the older consumer is more likely to switch retailer (e.g. to Aldi/Lidl) and stick with the same product.

In contrast with retail, UK food service has been and remains a relatively fragmented sector, with some concentration in particular food service channels. The latter include non-profit channels (i.e. public body catering), and large corporate in hotels, pubs and restaurants channels.

For overall seafood servings purchased for out of home consumption, the largest channel is *Quick Service Restaurants (QSR) - excluding fish and chip shops*. This is followed by the *full service restaurant* channel, and the *fish and chip shop* channel in third place.

With fish and chips so iconic in the UK, the *fish and chip shop sector* is responsible for the largest share of cod and haddock consumption, but it is notably fragmented. There are estimated to be over 11,000 fish and chip shop outlets in the UK.

By share of total out of home consumption, the major food service channels for:

- cod are *fish and chip shops* (44%), pubs (21%) and *full service restaurants* (11%), and
- haddock are *fish and chip shops* (35%), pubs (18%) and *full service restaurants* (13%).

In comparison with other proteins, buying seafood out of home is an expensive choice. Average seafood spend is ranked third behind lamb and beef/veal, with cod being the most popular species.

In food service, seafood appeals to an older, more affluent consumer group. Certain consumer groups respond to specific channels at particular times. For those eating out of home, the cod consumer contrasts with the overall food consumer, being older and less affluent. The exception is in the pub channel, where the cod consumer is more affluent. Friday continues to be an important eating occasion for cod and haddock (reflecting a long standing tradition of eating fish on a Friday).

2.2 Resources

Key message:

- With limited cod resources in EU waters, cod is overwhelmingly sourced from important fisheries in the North Atlantic, with Iceland, Norway and Russia as key source countries. There are close substitutes in whitefish, the largest of which by volume of resource are Alaska pollock, pangasius and haddock.

Of the whitefish resource, Atlantic cod is of central importance to the UK. Other relevant whitefish resources include several key species: Alaska pollock, haddock, and pangasius. Pacific cod is also a relevant substitute but is not covered in this review of resources.

Within whitefish, the largest resource by volume is Alaska pollock, followed by pangasius, Atlantic cod and then haddock. See table 2.1. Over the last 20 years, average annual catches of:

- Atlantic cod has been 1m tonnes, centred on the North Atlantic fisheries (*Barents Sea, Icelandic Waters, North Sea, Baltic Sea and Greenland*).
- Haddock has been 0.3m tonnes, also centred on fisheries in the North Atlantic (*Barents Sea, Icelandic Waters, and North Sea*).
- Alaska pollock has been around 2.9m tonnes, centred on North Pacific fisheries (*Sea of Okhotsk, East and West Bering Sea, Aleutian Islands, Japanese Pacific Coast and Navarinsky*).

Over 20 years, annual cod and haddock catch in European waters has been relatively small (North sea cod falling from ~100k to 50k tonnes and haddock from ~120k to 40k tonnes), while *SE Asia* production of pangasius, a major species of farmed whitefish, increased from ~40k to 2.8m tonnes.

	2017	2018	2019
Alaska pollock catch* (000t)			
Russia	1,710	1,700	1,700
USA/Canada	1,547	1,543	1,450
Other (Japan, S. Korea, China, others)	213	210	210
TOTAL	3,470	3,453	3,360
Pangasius production** (000t)			
Vietnam	1,238	1,302	1,295
Bangladesh	554	647	750
India	550	600	625
Indonesia	100	125	150
TOTAL	2,442	2,673	2,820
Atlantic cod catch* (000t)			
Norway	417	361	326
Russia	400	341	307
Iceland	253	280	285
Other (EU, Faroes, Greenland, Canada, US)	245	228	221
TOTAL	1,315	1,210	1,139
Haddock catch* (000t)			
Norway	115	99	92
Russia	107	90	81
Other (Iceland, EU, US, Canada)	117	126	139
TOTAL	339	315	312

*Source: Groundfish Forum 2018. **Source: Professor Ragnar Tveteras, GAA Conference, Dublin 2017

2.3 Product formats and trade

Key message:

- Fresh (never frozen) products and, increasingly, refreshed (single frozen) products are suited to the chilled sector; single frozen and double frozen products are suited to the frozen sector.
- The main product formats traded are fresh (whole or fillet), frozen (whole headed and gutted, fillet block or individually quick frozen (IQF) fillets), and salted. EU suppliers specialise in supplying fresh whole and fillets, Iceland specialise in supplying fresh and frozen fillets, Norway in fresh and frozen whole fish, and Russia in frozen whole and fillets.

A range of product formats have been developed to meet the preferences of the chilled and frozen market sectors:

- Chilled: fresh (never frozen) products and, increasingly, refreshed (single frozen) products.
- Frozen: single frozen and double frozen products.

Whitefish product formats are also the result of the location and availability of whitefish resources in relation to markets, and the supply chains required to deliver. Several main whitefish product formats are traded. Table 2.2 provides a brief description of fresh, frozen and salted product formats:

- Fresh (never frozen) products, either in whole fish or fillet/loins, can meet the needs of premium chilled market sector. These products can be delivered by short supply chains constrained by availability i.e. where these align with time constraints (e.g. fishing seasons) and distance constraints (e.g. resources are relatively near to markets).
- In contrast, frozen products, either in whole fish or fillet/block, can meet the needs of a broader market base. These products can be delivered by long supply chains that can extend availability beyond specific time periods (fishing seasons) and distance (nearby resources). Products can be in 'single-frozen' formats, or 'double-frozen' where product supply chains extend globally with production stages in different countries.
- Other formats include salted, dried, or similarly prepared products. These products can also be delivered by long supply chains to extend availability.

Product format	Description
<ul style="list-style-type: none"> • Fresh (never frozen) product: <ul style="list-style-type: none"> ○ Whole (H&G) fish ○ Fillets or specially cut portions e.g. cod loins 	<p><i>Serving short supply chains, by distance or time to final markets</i></p> <p><i>Primarily transported in containers to auction markets and direct to processors</i></p> <p><i>Either transported by air or container vessels directly to retail or food service customers, occasionally with a short stop for repacking in the UK.</i></p>
<ul style="list-style-type: none"> • Frozen product: <ul style="list-style-type: none"> ○ Whole (H&G) ○ Fillets 	<p><i>Serving long supply chains, by distance or time to final markets</i></p> <p><i>Primarily transported in containers to primary processors often in low cost locations e.g. China & SE Asia and Eastern Europe.</i></p> <p><i>Includes frozen at sea products, primarily fillets that go directly to retail or food service as single frozen product. Also includes frozen fillet blocks that are then used for further processing in the UK (breaded, battered, ready meals etc) before final sale as double frozen products.</i></p>
<ul style="list-style-type: none"> • Salted, dried or otherwise prepared product. 	<p><i>Serving long supply chains, by distance or time to final markets. Many of these are made from by-products.</i></p>

Short and long supply chain facilitate to the delivery of specific product formats. Fresh products are delivered through short supply chains where time and distance have a critical

role. Single frozen products involve slightly longer chains where time and distance are less problematic. Double frozen products involve much longer, extended, supply chains where time and distance are less critical.

The geographical location of the main whitefish resources, their proximity to final markets and population densities, and the presence of large seafood businesses, drives specialisation in source countries. As of 2018, in the context of global whitefish supply:

- The volume of whitefish available in European waters is relatively limited. However, being very close to final markets, UK/EU suppliers of this material *specialise in providing primary processed fresh products* e.g. whole, fillets. UK and continental suppliers also provide consumer-ready value added products to the UK market.
- Iceland *specialises in providing processed - particularly fresh - products*, providing primary processed fish e.g. frozen and fresh fillets, dried. Fishing is a large part of the Icelandic economy, fishing grounds are relatively close to onshore markets, and Icelandic supply is relatively consistent through year. Iceland is geographically well placed to serve both North America and the European mainland.
- Norway *specialises in raw material supply*, providing whole fish with limited processing e.g. frozen and fresh, salted. Seafood (particularly salmon and cod) is a large part of the Norwegian economy but oil & gas is also a large sector. Labour costs in Norway are extremely high and this makes processing elsewhere an attractive option. Fishing grounds are relatively distant from final markets, and supply is very inconsistent through the year with a short catching season (high volume in February – April period).
- Russia *specialises in providing frozen processed products and raw material supply*, providing whole/H&G and fillets. Fishing grounds are relatively distant from final markets, and supply is relatively consistent through the year.
- The US *specialises in frozen processed fish*, providing primary processed fish e.g. frozen fillets/block and surimi. Fishing grounds are relatively distant from final markets.

2.4 Main supply routes

Key message:

- UK imports of whitefish species overwhelmingly focus on primary processed products. Atlantic cod imports focus on low volume and premium priced fresh fillets (largely from Iceland) and higher volumes of frozen fillet: single frozen fillets (from Iceland and Russia) and double frozen fillet blocks (from Norway and Russia via China and Eastern Europe).

In securing whitefish supplies, the UK industry draws on overseas and domestic sources. Supply routes are therefore domestic and international, with the focus here on international routes.

Whitefish is an important part of the overall UK seafood supply base. Of the whitefish species focussed on here, the UK seafood industry imported over 440k tonnes worth more than £700m in 2018.

When these species are imported, the UK is overwhelmingly focussed on primary processed products. Fillets dominate the volume of imported cod (80%), haddock (58%), Alaska pollock (100%) and pangasius (92%).

Atlantic cod is by far the largest component of the UK's imported whitefish species. In volume terms, Atlantic cod accounts for 244k tonnes (55%), followed by haddock (21%), Alaska pollock (17%) and a relatively small amount of pangasius (6%).

Table 2.3 shows the major source countries supplying the UK with Atlantic cod in 2018. Iceland is a significant supplier of high value cod products, whilst China and the EU also play a major supply role.

Source country	Value (£m)	Volume (live weight tonnes)	Average price (£/tonne)
Iceland	160	68,085	£2,350
Norway*	43	22,386	£1,926
Russia	35	20,056	£1,769
Faroe	30	15,674	£1,936
China	94	44,904	£2,095
EU (excl. UK)	82	42,367	£1,937
<i>Rep of Ireland</i>	2	994	£2,137
<i>Poland, Lithuania, Latvia, Czech Rep, Romania</i>	20	8,923	£2,258
<i>Germany, Denmark</i>	60	32,450	£1,842
Other	19	30,296	£620
TOTAL	464	243,768	£1,903

Source: British Trade Statistics. *plus trade via Sweden

When cod is imported, the focus is on premium priced fresh fillets and more reasonably priced frozen fillets. The dominant product format for cod is frozen fillets at 194k tonnes, worth £336m. This represents 80% of total cod import volume, at an average price of £1,730/tonne liveweight. Fresh fillets account for 9% of cod volume, at an average price of £2,980/tonne liveweight. Fresh and frozen headed and gutted formats are a relatively small share, each format accounting for 4% of imported cod, whilst salted cod represents 3%.

With a preference for cod fillets, the UK relies on a small number of supplier countries. For fresh fillets, Iceland dominates with around 80% of import volume at an average price of

£3,090/tonne liveweight. In terms of frozen fillet volume, the most significant source countries are China (30%), other EU (20%), Iceland (23%), Russia (10%), and Norway (7%) with an average price ranging from £1,300 -£2,090/tonne liveweight.

The small number of supplier countries specialise in specific cod product formats. Based on value, double frozen fillets tend to dominate cod imports utilising lower value fillets (block/low value IQF) sourced from China and other EU countries. Similarly, single frozen fillets are sourced from Iceland as well as Russia and Norway, providing high value IQF fillets. Iceland specialises in high value fresh fillets.

Specific countries therefore play distinct roles in the supply chains that deliver cod imports into the UK. Iceland, Russia and Norway play an important role in short chains supplying fresh and single frozen products in line with available supply. Using material from these countries, China and other EU countries provide low cost processing in long supply chains delivering double frozen product, extending availability.

3. Longer term drivers affecting whitefish supplies

This section provides a brief review of the longer term drivers and developments affecting whitefish supply over the long term. Important changes afoot at the global level include food security, automation and climate change.

3.1 Food security

Key message:

- World Bank projections to 2030 suggest:
 - the consumption of capture whitefish will increase slightly with increases in Asia (China) and decreases in Europe (the net result of a decrease in western, and an increase in eastern, European countries).
 - the consumption of farmed whitefish will increase markedly, mostly in Asia (driven by China) with little change in Europe.
 - the volume of capture whitefish will remain static, whilst the volume of farmed pangasius will increase markedly.
- For European food security, production will not be sufficient to meet consumption; the UK and EU will still rely on imported material to meet consumer demand for whitefish.

Projected consumption is closely tied to the longer term changes in the economic development of specific countries. The World Bank has projected seafood consumption and production to 2030. Based on analytical models, these projections may contain flawed assumptions and suffer from inaccuracies. However, they may be useful in terms of broad trends expected over the next 10 years.

Consumption projections focus on expected volumes of demersal fish (which we assume here to be capture whitefish), and freshwater and diadromous fish (which we assume here to be farmed whitefish). According to the World Bank:

- the consumption of capture whitefish to 2030 is projected to increase marginally, but:
 - increase considerably in countries of the Middle East and North Africa region, particularly in Turkey.
 - increase amongst countries in the East Asia region. This is driven particularly China which will offset an expected decline in Japan.
 - with a small decrease in the countries of Europe. This is expected to be the net result of decreasing consumption in western European countries (exception of UK and RoI) and an increase amongst eastern European countries.
- the consumption of farmed whitefish to 2030 is projected to increase markedly, with:
 - a major increase in countries of East Asia, driven by China, offsetting decline in Japan.
 - a major increase amongst countries of the South Asia region. This is driven particularly by India.
 - a major increase in South East Asia, particularly Indonesia, Myanmar, and Vietnam.

- very little change in consumption is expected in the countries of Europe. This is expected to be the net result of decreasing consumption in western European countries (exception of UK and RoI) and an increase amongst eastern European countries.

China is expected to have a major influence on overall food security, both in terms of overall population level and in terms of ability to pay. It is estimated that by 2025, China will have more than 220 cities with populations over one million and eight megacities with over 10 million⁴. For McKinsey, the upper middle class will be main driver of consumer spending. This group, earning the equivalent of between (\$16-34k), and able and willing to pay a premium for quality, is expected to account for 54% of urban households by 2022 (from 14% in 2012)⁵.

Production projections focus on expected volumes of demersal fish (which we assume here to be capture whitefish), and pangasius. According to the World Bank:

- The production volume of capture whitefish to 2030 is projected to remain static. This stable volume is broadly reflected across all regions.
- The production volume of pangasius to 2030 is projected to increase markedly:
 - A major increase in South East Asia, particularly Vietnam and Indonesia.
 - A large increase in East Asia, driven by China.

For European food security, whitefish production will not be sufficient to meet consumption; the UK and EU will still rely on imported material to meet consumer demand for whitefish. The UK Seafood Industry Alliance notes that for many years, inside or outside the Common Fisheries Policy, the UK has never been self-sufficient in fish. The UK imports *'nearly three and a half times the total volume of cod landed by EU registered vessels from all EU waters'* annually such that *'even on the most optimistic assumptions about stock recovery or future UK quota shares, there will still be a substantial shortfall in terms of current market needs'*. With climate change expected to contribute to a shift in the distribution of whitefish towards higher latitudes (see below), the security of overseas supply will become even more important.

3.2 Automation

Key messages:

- The 4th industrial revolution, driven by digital technologies, is expected to reinvent food chains allowing machines to responsively manage production, storage, transportation and manufacture of products with limited human guidance.
- The availability and cost of technology is likely to improve whilst cost and availability of labour is likely to be more challenging. Those operators with access to high volume and stable supplies are likely to be in pole position to reshape their supply chains.

Longer term drivers suggest a number of changes over the next 10 years that could change the labour/automation profile across industry:

- The cost and availability of labour is likely to be more challenging: ageing populations and shrinking workforces tightening labour markets; changing migration conditions

⁴ Worldwide urban population growth. EU Foresight. https://ec.europa.eu/knowledge4policy/foresight/topic/continuing-urbanisation/worldwide-urban-population-growth_en (accessed November 2019).

⁵ Mapping China's middle class, McKinsey Quarterly. June 2013.

slowing a supply of labour ready to fulfil low wage job roles; and ongoing perceptions of the seafood industry as unattractive.

- The availability and cost of technology is likely to improve. With new digital technologies, and the so-called 4th industrial revolution, automation will be transformed, potentially able to support non-routine tasks and deliver *efficient* but also *flexible* production.
- Automation is due to impact considerably on job roles within the next 10-20 years, making some roles obsolete. New roles may emerge focussed on complex problem solving, creativity and social relationships.

In food, it is anticipated that automation could reinvent supply chains whilst addressing a number of challenges facing the food industry. Automation could support co-ordination on a single platform across an ecosystem of different actors in food delivery. This would enable intelligent food production and consumption systems: machines connected through the internet to manage production, storage and transportation, manufacture products and adapt to new processes, in response to - and in anticipation of - market and sales, with limited human guidance.

The digital transformation from a linear supply chain to an 'autonomous ecosystem of firms' will evolve, following a maturity pathway. In seafood, initial steps in this pathway include: the proliferation of sensors that monitor environmental signals; blockchain technology that could improve transparency and traceability; automatic identification systems (AIS) that could help reduce illegal, unreported and unregulated (IUU) fishing.

The successful deployment of automation depends on having fertile investment conditions; the ability to activate longer term investments and secure their returns. In seafood, such conditions often depend on there being available volume and security of supply, alongside security of markets. These returns must be more advantageous than off-shoring production to locations with lower labour cost and then importing finished product back for distribution. Given the scale of whitefish resource volume, and the ability to leverage investment, major source countries are well placed to deploy automation and reinvent seafood chains. Nordic countries, in particular, are well placed to invest in technology and harness the benefits of the 4th industrial revolution⁶.

3.3 Climate change

Key message:

- Climate change - particularly increased sea temperature - is expected to affect fish distribution, fish migration and the recruitment and productivity of fisheries. In the longer term a shift in the distribution of whitefish towards higher latitudes is expected. Projections suggest reduced potential catch in temperate fisheries (including Iceland and Europe) with increased catch in higher latitude fisheries (including Norway, Russia and the US).

Climate change will affect seafood production systems in terms of: sea level rise; increased storminess and waves; temperature change; ocean acidification; changes in rainfall and run-off. Impacts on aquaculture production will vary by location, and in the short term are expected to include loss of production, disease/algae/parasites, and decreased productivity.

⁶ Thorsteinsson, H.F. (2019) *Industry 4.0 and the Seafood Sector*. UK Seafood Summit, 2019.

Longer term impacts include limited access to resources (e.g. wild seed, freshwater, feeds from marine and terrestrial sources) and decreased productivity⁷.

Whitefish capture production is particularly exposed to:

- Sea temperature change. In general, this can affect fishery resources, specifically the growth rate and distribution of species, changes in year class strength, and affect migration patterns.
- Increased storminess and waves. In general, this can affect offshore fishing operations in terms of working conditions, gear deployment and damage to the fleet.

Temperature change in recent years is understood to have played a role in the status of whitefish fisheries. In the:

- North Atlantic, warmer temperatures have influenced recruitment and productivity of Atlantic cod e.g. associated with poor recruitment in the North Sea, but with good recruitment in the Barents sea and off the Labrador coast.
- North East Pacific, abnormally warm conditions affected the distribution of Alaska pollock.

According to the FAO climate change will affect catch potential of all species, with:

- total maximum catch potential in the worlds EEZ's projected to decrease by 2050 compared to catch in 2000. This will be a decrease of 2.8% in a low emission scenario and 7% in a high emissions scenario.
- projected changes in catch potential varying by EEZ. The most substantial reductions are in tropical areas, temperate latitudes are expected to decrease substantially, whilst higher latitudes are often expected to increase.
- projections suggesting that over the longer term there will be gradual shift in distribution of whitefish species to higher latitudes (see figure 3.1).

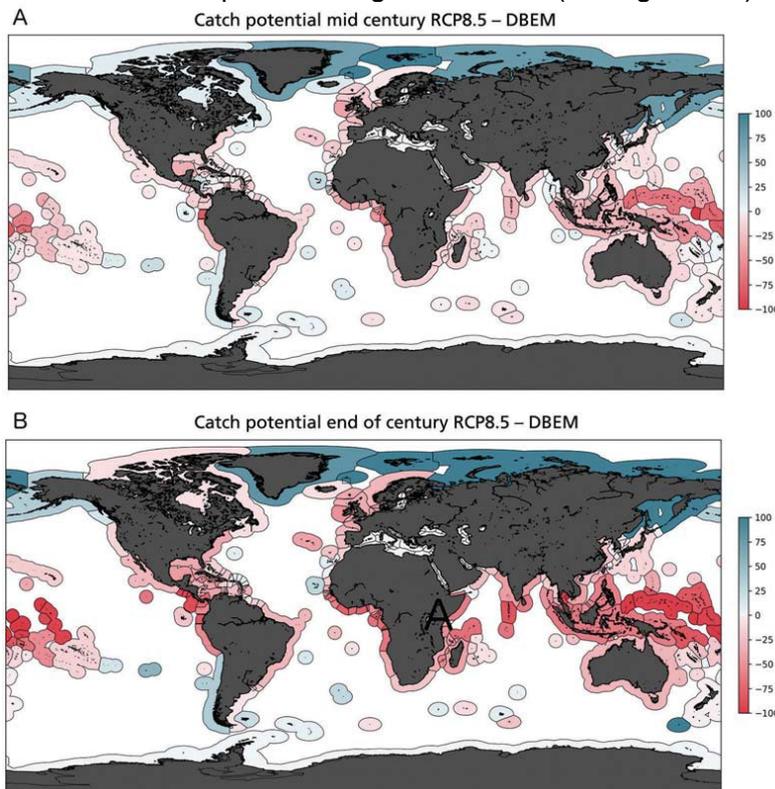


Figure 3.1. Projected changes in maximum catch potential (%) under high emission scenario by 2050 (A: 2046 to 2055) and 2095 (B: 2091 to 2100) (from Cheung et al. 2018).

⁷ FAO (2018) *Impacts of climate change on fisheries and aquaculture; synthesis of current knowledge, adaptation and mitigation options*. FAO Fisheries and Aquaculture Technical paper 627.

4. Cod supply to the UK – recent and anticipated developments

This section provides an industry perspective on cod supply alongside the supply of close substitutes. It sets out consultees views on how supply has changed over the last ten years and how this may play out over the next few years to 2030. Changes in cod supply are described in terms of availability, affordability, preferences, environmental constraints, and innovation (see Appendix 1) across the UK market, major supply regions, and species and chain. Where appropriate, stakeholder views are supplemented with a review of production, UK trade, retail and food service data.

4.1 UK access to cod supply and how this has changed in the last 10 years

4.1.1 UK consumer market

Key messages:

- UK consumer preferences continue to evolve, becoming more complex, open to products that are versatile and can support personalisation – including non-meat protein products.
- Retailers have shifted towards carrying less stock, with a requirement for responsive supply chains.
- Buyer preferences have accepted the merits of refreshed (single frozen) in place of fresh products.
- The chilled sector has shown growth, particularly chilled natural products - with no additional ingredients – these products allow more scope for final use, supporting versatility and personalisation.

Whitefish supply has been challenged in the UK market by shifting preferences and affordability.

Preferences

Cod is iconic in the UK and plays an important role in other markets. Cod is similarly iconic in Portugal and South America e.g. salted cod, whilst being an important substitute for key species in France (e.g. as a substitute for salmon) or Spain (e.g. a substitute for hake). In the US, consumers have long had an appetite for cod due to its historic availability on the Grand Banks.

UK consumer preferences continue to evolve and become more complex. Cost, health, environmental concerns have long been important and are now becoming established factors in food purchasing. More recent changes relate to the broadening of different diets (veganism, vegetarianism, pescatarianism, flexitarianism, etc) and the related growth of personalisation. This broadening of interests, personalisation, and value for money, reflects a growing interest in experimentation rather than wholesale changes towards new fixed preferences, where consumers 'dip their toes into something new'. A parallel, and reinforcing development, has been a broadening of the protein envelope. There has been protein innovation, with non-meat protein expanding food choices.

Elsewhere, consumer habits are also changing.

- In Europe, smaller families, more convenience, more frequent trips to retailers (three times per week rather than once a week) imply a greater interest in chilled product.
- Meanwhile, China has moved further towards western consumption patterns. Food has moved into brand based packaging, reflecting an interest in higher standards and recognised product integrity.

In this context, UK seafood consumption has continued to track downwards since ~2005. Between 2015 and 2017 the number of seafood portions per person per week fell by 5.4% and continued to fall in 2019.

In UK retail, and increasingly in food service, there is demand for consistent product quality, availability with increased demands for sustainability and responsibility. The latter has led to demands for transparency and growth of sourcing information and knowledge.

Reflecting growing interest in sustainability and responsible practice, retailer sourcing policies have meant supply to some parts of the UK market is constrained. In some cases, these constraints have meant sourcing from individual countries, or to those supply chains using particular fishing gear (line or trawl caught) or that avoid controversial practices (e.g. Whaling, IUU fishing or exploiting labour).

In the face of tougher market conditions, buying preferences of UK outlets have shifted to adjust. Adjustment includes using alternative product formats - refreshed (single frozen) rather than fresh (never frozen), species (greater use of Alaska pollock) and supply base (changing source country).

Affordability

Over the last 10 years affordability has been challenged in both UK retail and food service.

The UK retail footprint continues to evolve as outlets move from high volume supermarkets, to include low volume metro outlets, and online sales. This has implications for stockholding and responsiveness in supply chains. For UK retail sales:

- The total chilled seafood sector has shown consistent long term growth in volume (9%) and value (37%). However this has stalled in recent years with volume slowing. Within this sector:
 - The chilled natural segment has shown continued volume and value growth. Those segments showing relative decline include prepared and meal products.
 - Both salmon and cod have maintained full growth (volume and value over the long term) whereas haddock has recently suffered volume decline.
- The total frozen seafood sector has seen declining volume (-26.5%) and value (-2.4%). Within this:

- There were no frozen segments that showed full growth; natural and fingers showed inflationary increase in value and lost the least volume whilst meals, prepared and sauce saw substantial decline in volume.
- Cod has seen value growth but volume decline, whilst pollock, salmon and pangasius have seen full growth. Haddock has been in full decline, resulting from modest price increase.

In UK food service, growth over the long term (since 2007) has been in lower price and convenient formats; seafood burgers, seafood sandwiches and fried fish.

Growth across food service channels is mixed. Those channels in:

- growth are quick service restaurants (excluding fish and chip shops), full service restaurants, pubs, and travel and leisure.
- decline are fish and chip shops, workplace & education.

For some importers, 'the UK is the largest cod market but it no longer pays the highest prices', despite the loyalty of UK consumers and 'this is becoming critical now'. The UK pays the highest prices for frozen at sea fillets, driven by the fish and chip shop sector, but this is also under pressure due to the increasing cost of raw material.

Greater affluence has also played a role in buying more chilled product, particularly for consumers in emerging economies.

The growth in the chilled sector is reflected in European markets:

- Chilled cod has seen growth although this is variable between countries. In Western European markets growth in this sector is from a mature base, particularly the UK and France. The Benelux countries show significant growth where refreshed (single frozen) product has taken hold. In Eastern Europe, the chilled sector shows significant growth but from a small base.
- Frozen cod has shown growth in Eastern Europe.

The US has also been a growing market for Icelandic fresh fillets in the last 10 years.

Farmed whitefish plays an important role in Asia. For example, pangasius can meet Chinese need for high volume whitefish very quickly. In recent years Chinese demand for pangasius pushed up prices, and this affected prices on the global market. However, there are also early signs of the emergence of China's demand for capture whitefish, where Icelandic material is already being sent to Hong Kong for consumption. The Norwegian Seafood Council estimates Chinese consumption of cod has increased 500% between 2014 and 2019 albeit from a small base (from 1,000t to 5,000t)⁸. However, serving this market may be limited by resources; some operators only have enough fish to serve current customers.

⁸ <https://www.undercurrentnews.com/2019/11/27/chinese-consumption-of-norwegian-cod-up-500-with-more-to-come/>

4.1.2 Major supply regions

Key messages:

- Environmental constraints have changed for cod. The last ten years saw a period of relative abundance, in which availability peaked in the Barents sea. However, this abundance is now becoming more constrained with a lower cod stock in the Barents sea compounded by slow growth in the smaller Icelandic cod stock. In these responsibly managed fisheries this translates into lower catch levels, particularly in Norwegian and Russian fleets.
- Environmental constraints have tightened for haddock in recent years, with the Barents sea haddock stock now at a low point in its cycle. This has translated into lower catch levels and reduced availability of local whitefish substitutes for cod. Fewer constraints on Alaska pollock and pangasius have ensured continued availability of cod substitutes from further afield.

The supply of whitefish from international sources has been primarily driven by availability, preferences and environmental constraints.

Atlantic cod is a major wild whitefish resource over five stocks, with spawning stock biomass (SSB) and catch both increasing in the largest part of this resource over the last 10 years i.e. Barents sea (Norway/Russia) and Icelandic waters (Iceland). Average catch over the last 20 years has been 661k tonnes for the former, 116k tonnes for the latter. However, there have been reductions in both SSB and catch in the other stocks, with gradual reductions seen in the Barents sea catch since 2014. As of 2019 the Barents sea stock remains at a high level, whilst Icelandic stock is still growing.

Haddock is an important wild whitefish resource over three stocks, with SSB and catch reduction in the largest of these - the Barents sea (Norway/Russia) - in the last 10 years. Average catch over the last 20 years in the Barents sea has been 170k tonnes, in the North sea 86k tonnes and in Iceland 59k tonnes. Over the last 10 years, SSB and catch in the Barents sea increased initially but dropped considerably in 2013. SSB and catch for North sea and Icelandic waters has fluctuated consistently around a low level. As of 2019, the largest haddock resource - Barents sea - is at a low point in its cycle. The smaller Icelandic stock appears to be in reasonable condition.

Alaska pollock is the largest wild whitefish resource and, although SSB has fluctuated, catches have remained stable over the last ten years. The largest part of this resource (80%) is the Sea of Okhotsk (Russia) and East Bering Sea (US). The largest catches are in the East Bering Sea (US) followed by the Sea of Okhotsk (Russia); average catch over last 20 years has been 1.2m tonnes for the former, 0.9m tonnes for the latter.

Pangasius production is in excess of 2.8m tonnes. Vietnam remains the centre of this production, with pangasius raised in ponds, and the majority of production coming from larger, integrated farms. Over the last 20 years Vietnam has consistently expanded pangasius production from some 40k in 1997 to 1.3m tonnes in 2018.

4.1.3 Species and chain

Key messages:

- Over the last ten years prices for imported whitefish have gradually increased challenging affordability, particularly haddock.
- Innovation and investment have triggered a change in specialisation amongst source countries targeting the premium chilled sector. Iceland has invested significantly in automation; Russia has also increased investment in vessels and onshore facilities; whilst Norwegian investment has been relatively conservative.
- Price increases and innovation have helped shift market preferences in species and formats. Haddock performed less well as it became more expensive than cod; buyers switched to substitute species i.e. Alaska pollock and pangasius. In product format, single frozen has become more acceptable and refreshed (single frozen) product has become the norm benefitting from being slightly cheaper and more consistent (in quality and supply) compared to fresh (never frozen) product.
- Over the last 10 years the UK appears to have rationalised its sourcing for single frozen and double frozen cod fillets. In single frozen, Iceland (with a focus on high quality) has thrived; Russia (with access to the resource and investment in frozen at sea) has performed well securing their place in the premium segment; with Norway performing less well. In double frozen fillets, China continues to be the preferred supplier providing frozen block fillets.

Whitefish supply chains have been primarily challenged in terms of affordability, preferences and innovation.

Affordability

Affordability has been affected by availability and general market conditions. The changing availability of cod and haddock in the water has been reflected in price shifts. UK sterling has been weaker for a number of years and this has made the UK slightly less competitive compared to other countries.

The average price of selected whitefish species imported into the UK is shown in figure 4.1. Over the last 10 years, prices were initially stable reflecting favourable availability (and cod prices fell given good availability). However, prices have increased as availability has tightened (particularly haddock and latterly with cod) with continued upward pressure as sterling has gradually deteriorated from 2014.

Higher prices, and the relative decline in purchasing power, have meant the UK has lost out to competitor buyers over a ten year period. This is evident in the sourcing of fresh fillets: in ten years the volume of fresh Icelandic cod fillets to the UK has halved, whilst volumes of these fillets to France and the US have doubled.

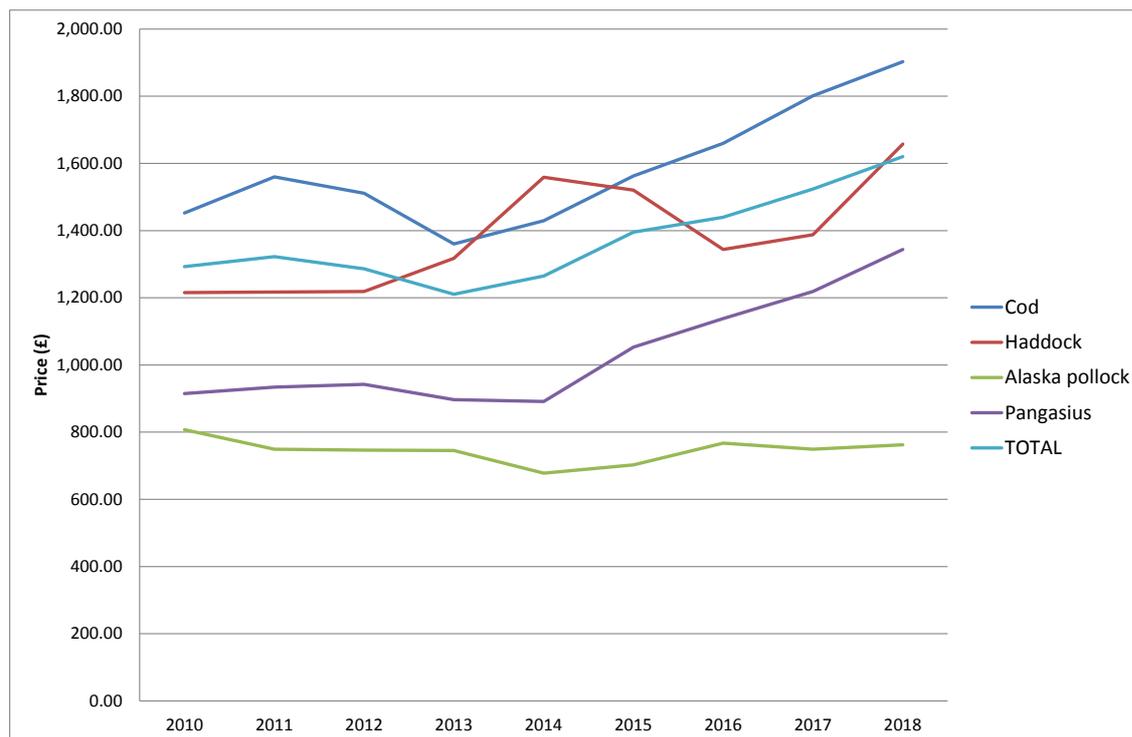


Figure 4.1 Prices for main whitefish species 2010-2018 (£/tonne liveweight, nominal prices)

Innovation

In the last 10 years affordability and innovation have driven supply chain improvements and a shift in source country specialisation. Supply chains and logistics have advanced, with more sophisticated operations and processing that is 'closer to the market', allowing rapid response. With increasing value in by-products, greater attention has been paid to how supply chains can be reshaped and supported by automation to fully utilise fish material, for example using water-jet cutting.

In 2009, source country specialisation was much more commodity based:

- Norway = frozen headed/gutted products.
- Russia = frozen headed/gutted products with poor reputation for quality fish and handling.
- Iceland = fresh headed/gutted products.

However, in the aftermath of the financial crash in 2008, Iceland and Russia prioritised investment and targeted the more premium, chilled whitefish sector. Iceland sought to move away from exporting whole fish, to domestically process and export high quality fresh and frozen fillets. Russia increased investment in frozen at sea fillets, incentivising this by tying quota allocation to investment commitments. Due to high labour costs and other factors, Norway has continued to focus largely on being a whitefish raw material supplier. Innovation and significant advances in thawing solutions, has meant refreshed (single frozen) product is as good, if not better than, fresh (never frozen) product. With these advances, Iceland and Russia are now competing in premium chilled sectors with fresh (never frozen) and refreshed (single frozen) products.

In consequence, source country specialisation in 2019 has shifted towards premium products for the chilled whitefish markets:

- Norway = frozen headed/gutted products.
- Russia = refreshed (single frozen) products.
- Iceland = fresh (never frozen) and refreshed (single frozen) products.

With the shift in specialisation, this has affected the UK industry - particularly the import dependent Grimsby/Hull processing hub. The volume of fresh whole whitefish coming into the region has reduced compared to earlier periods (e.g. 2000-2008), with Grimsby auction market stabilised at around 15,500 tonnes per year since 2010, largely from Iceland, but also with small volumes from Faroes, Norway etc. Similarly the structure of industry in the region has changed with a reduction in mid and smaller sized operators reliant on whole fish from the auction, relative to larger operators who source through other routes.

Preferences

Preferences for specific species and product formats have altered in response to price shifts. In the last 10 years, the overall volume of imported whitefish, across the main species, has remained broadly stable, with fluctuation in the share of particular species. Cod has remained a central preference with other whitefish species acting as short term substitutes around that. Cod volumes have fluctuated but have remained largely stable. As haddock prices increased above cod, this coincided with a fall in haddock volume and a switch to other species e.g. cod and others such as Alaska pollock.

The last 10 years has seen a shift in the balance of UK imported cod product formats, with the volume of:

- fresh and frozen whole fish declining.
- fresh fillets broadly stable.
- frozen fillets increasing (this peaked mid period as cod availability was highest).

For imported cod frozen fillets in this period, the volume of single frozen fillets with highest value has increased as well as volumes of lower value, double frozen fillets:

- Icelandic fillets have steadily increased over time and show the highest average price, with increasing volume this has driven overall value up.
- Russian fillets have increased prices reaching a mid-level average price. However with recent volumes and overall value tailing off, this suggests a price ceiling may have been reached.
- Norwegian average prices have also increased but suffered volume and overall value decline, in advance of other source countries. This suggests an earlier price ceiling may have been reached.
- Chinese average prices have increased but remain the lowest amongst source countries. Volume has increased, whilst volume from other EU countries has declined. However, in recent years the volume trend has gone in reverse with expanded volume in other EU countries.

4.2 How supply might change in future and implications for UK seafood

4.2.1 UK consumer market

Key messages:

- UK consumer loyalty to cod will support the UK being an important market and buyer preferences may evolve to ensure availability.
- The UK is expected to continue as an important market for cod, but faces serious competition from China and elsewhere in Europe as their markets develop.

Whitefish supply will continue to be challenged in the UK market by evolving preferences (scrutiny/public perception) and affordability (on price).

Preferences

With cod an iconic species, the loyalty of UK consumers is expected to continue; however, UK consumer preferences will continue to evolve, with price a central factor. If market conditions mean prices and price sensitivity remain high, then this could undermine the cod market as alternative species are introduced. However, if affordability challenges can be addressed, there may be opportunities for cod and whitefish to respond to the complex preferences of UK consumers. There may be opportunities to grow cod sales amongst the younger cohort (whose preferences are more fluid) and maintain cod sales amongst the older cohort (building on iconic and traditional aspects of this species).

In UK retail, and increasingly in food service, buyer preferences are expected to evolve further to reflect a much broader corporate social responsibility agenda. Sustainability is now a given, new requirements are already in train, for example authenticity (including DNA testing) and ethics. Some buyers are already looking at carbon footprint – this could affect fresh (never frozen) products and be a driver for refreshed (single frozen) products. However, there is a danger that buyer preferences become driven by technical managers and 'self-created concepts' that are impractical.

In the face of affordability, however, there may be changes in retailer sourcing policies. This may see new supply routes to some parts of the UK market e.g. in catch method (switching line to trawl), and broadening supply bases beyond a single country where other source countries are willing to innovate and respond to changing preferences. Beyond this buyers may resort to emerging alternative whitefish species (Alaska pollock, pangasius), other fish (salmon), or other proteins (chicken). The latter is a particular threat given its versatility.

Demand for cod products from developing countries is expected to grow. Chinese demand, for example, may be driven by a preference for higher standards and recognised product integrity.

Affordability

Cod in the UK is expected to face tough market conditions, with prospects for reduced spending power and upward pressure on prices:

- Weak prospects for the world economy with continued uncertainty in the UK economy could erode the confidence and spending power of the UK consumer.
- Continued pressure on sources of supply, a growing appetite from other countries, and a weak sterling exchange rate, could raise prices for the consumer.

This could polarise the sale of chilled (fresh and refreshed) and frozen cod products in retail and weaken cod sales in food service. The fish and chip shop sector is expected to contract due to the increasing price of fish. Recent experiences in sourcing haddock could be a foretaste of this challenge, with increased use of alternative species in capture (pollock) and farmed (pangasius) whitefish.

Increased competition is expected from markets in mainland Europe. Significant growth is anticipated, with good growth in the chilled market for cod in Belgium, Holland, Germany, Poland and Spain.

The US market will remain an important market. However, major change and significant growth, is not expected.

The Chinese domestic market will be an important competitor for the UK. Continued growth is expected in China with a growing middle class and increase in their domestic consumption of quality fish. China already consumes a considerable volume of fish, including pangasius and salmon. In line with urban trends in China (moving towards eight megacities with more than 10m people), the growing upper middle class is expected to develop an appetite for cod, particularly premium single frozen cod products. The Norwegian Seafood Council estimates the Chinese market for cod could be as much as 118k tonnes⁸.

4.2.2 Major supply regions

Key messages:

- Expect the availability of cod to fluctuate but to be steady over the longer term, if not showing a slightly upward trend.
- The anticipated availability of high volume substitutes is mixed; a decline in Alaska pollock, but an increase in pangasius is expected.

The anticipated supply of whitefish will be shaped by availability, preferences and environmental constraints.

Atlantic cod supply is anticipated to remain relatively stable over the next few years. The decline in SSB for Barents sea cod (Norway/Russia) looks to be approaching the bottom of the cycle, suggesting catches will stabilise if not start to increase in next few years. In the other direction, the SSB for Icelandic cod (Iceland) appears to be reaching a peak, suggesting recent increases in catch could stabilise if not decline.

Haddock supply is anticipated to increase over the next few years. The decline in SSB for Barents sea haddock (Norway/Russia) could be at the bottom of the cycle, suggesting catches could start to increase in the next few years. Although North sea haddock (EU) is expected to remain at a low level with low/reduced catches, the SSB for Icelandic haddock looks to be improving, suggesting increasing catches ahead.

Alaska pollock supply may now decrease over the next few years. The SSB for East Bering Sea pollock (US) appears on the downturn, suggesting catches could also reduce in the next few years. Although the SSB for Sea of Okhotsk (Russia) looks to be improving, this may not be reflected in upturn in catch if past catch performance continues at a stable low level.

Pangasius production is expected to increase over the next few years. Vietnamese production will develop further; having an annual target of 1.5-2m tonnes by 2020⁹ and further increase production in the medium term¹⁰. Key drivers for future growth¹¹ include:

- The recent agreement of a Free Trade Agreement (FTA) between the EU28 and Vietnam, expected to enter into force around the second half of 2019, will see EU28 tariffs for major Vietnamese pangasius products (currently standing at 5.5%) eliminated over the course of three years.
- An expected decline in total whitefish production and the trade war tariffs on whitefish imports into the USA and China will also strengthen pangasius' global market position.

4.2.3 Species and chain

Key messages:

- Expect continued pressure on the affordability of cod. Although cod is iconic, there is a risk of price barriers and of the species tracking downwards.
- Expect continued evolution of supply chains and greater pressure for processing near final markets. This could herald a re-shoring of processing to Europe from the Far East.
- Longer term source countries will aim to maximise value, with two potential pathways:
 - Path 1: Current specialisation continues and embeds (Iceland constantly innovating, advances in Russia, Norway sees no change).
 - Path 2: All source countries target the premium chilled sector, specialising in fresh/refreshed products (Norway changing its orientation and investing in these products via automation).
- Automation is likely to play a key role; driven by larger consolidated businesses with high volume and highly efficient operations.

Whitefish supply chains are expected to face challenges in terms of affordability, preferences and outliers (innovation).

Affordability

Prolonged weakness, or continued deterioration, in sterling is expected to continue with the risk the UK becomes uncompetitive in a number of areas. Although cod is iconic, pressure on cod affordability could see:

- The UK being unable to afford high quality cod products.
- Competitive pressure from more affordable product formats and species. This would be a shift towards the double frozen category and alternatives pollock and pangasius.

If prices continue to rise, cod risks tracking downward. At some point a price ceiling will be reached, at which point cod will be too expensive, volumes would decline and price would follow. The market could then polarise as some operators pursue a high price, high quality pathway and others focus on lower cost, lower quality. With cod having apparently hit a price ceiling in low and mid value frozen fillets, and the recent experience of sourcing haddock, this could be a warning sign.

⁹ Seafish (2018)

¹⁰ FAO

¹¹ Globefish

Innovation

Source countries are expected to maximise the value of their fish, however there are divergent views on how this might be achieved. Iceland and Russia will process more resource domestically, but there is uncertainty whether Norway will seek to do this.

Two potential pathways for sourcing country specialisation over the next 10 years are identified:

- Path 1 - Current specialisation continues and deepens.
 - Norway = frozen headed/gutted products.
 - Russia = refreshed (single frozen) products.
 - Iceland = fresh (never frozen) and refreshed (single frozen) products.

This pathway assumes that Norway cannot change a number of fundamental constraints. This includes the fragmented nature of the industry: the allocation of quota that favours the catching sector (particularly inshore), and geographically remote operations, preventing the emergence of large integrated operations. This also includes the high cost of labour which continues to favour 3rd country processing. Iceland will continue to invest focussing on fresh but move further into the refreshed format, with full utilisation and value of the fillet, carcass and by-products. Russia will continue to invest, focus on further premiumisation (e.g. moving from frozen fillets to onshore cod and loins) and be recognised as a credible source of quality products.

- Path 2 - All source countries target the premium chilled sector, specialising in fresh/refreshed products
 - Norway = new automated fresh (never frozen) product.
 - Russia = refreshed (single frozen) product.
 - Iceland = fresh (never frozen) and refreshed (single frozen) products.

This pathway is based on Norway changing its orientation, integrating salmon and whitefish operations, and investing in automation. This would see the likes of Mowi (Marine Harvest), Lerøy Seafood and Cermaq owning whitefish quota and a continuation, and deepening, of the likes of Lerøy Seafood that has both salmon & cod operations. This may be supplemented by a gradual increase in storage of live cod and the emergence of industrial scale farmed cod production¹². This would mean customers buying salmon and whitefish products from the same supplier (making it easier for customers). Norwegians have been able to keep their salmon prices high despite fluctuations in market prices. They have achieved this by managing cyclical changes in market demand and production, and could potentially use this capability to raise prices for their whitefish where they have joint operations.

There is a concern that the largest suppliers will continue to grow, secure more quota and potentially squeeze out smaller operators. If large consolidated operators in source countries concentrate quota ownership then this could remove local auctions and have knock-on consequences for UK industry, particularly Grimsby/Hull.

¹² <https://www.undercurrentnews.com/2019/11/22/norwegian-firms-industrial-scale-cod-production-is-chance-to-write-history/>

Preferences

Increasing concern about climate change, and carbon footprint, may result in a shift in the buying preferences of UK outlets. This would be a further driver for preferring refreshed (single frozen) over fresh (never frozen) products.

The move to double frozen product could undermine the perception of cod quality. Longer term, this could lead to perceptions of cod as a low price and inferior product, resulting in a switch to other species as equivalent, or a switch out of whitefish.

5. Cod supply to the UK – impacts and response to longer term developments

Key messages:

- UK cod supply to 2030 will be challenged by a combination of factors: *environmental constraints* and changes in *availability* in production; *affordability* and market *preferences* in consumption. *Innovation* will shape industry response.
- The future is uncertain but, in this review, three scenarios are envisaged: 1. Business as usual; 2. Investment in current supply arrangements; or 3. Re-invented, and digitally driven, supply arrangements.
- At present the UK buys a considerable volume of processed cod. Some source countries e.g. Iceland are exceptionally good at supplying this and the UK is currently able to live with that price premium.
- However, conditions are changing and appropriate strategies should be explored in responding to these new circumstances. Industry wide response has been 'reactive' aimed at maintaining cod supplies. There may be merits in a more proactive response.
- Suggested responses from some consultees include industry operators shifting away from lower price segments and maintaining relationships with the supply base. Seafish could helpfully respond by bringing stakeholders together, supporting industry reputation and addressing perceptions of the industry as unattractive to encourage new entrants, with businesses led by young people. Industry operators and Seafish could focus on securing more cod for the UK, exploring priorities with retailers and national marketing organisations, and giving reassurance on the responsible sourcing of cod.

5.1 Implications for UK industry

For the cod supply base, industry stakeholders provide a cautiously optimistic view that cod volumes will be maintained to 2030. This is in line with long term projections for capture whitefish from the World Bank.

UK cod supply to 2030 is expected to be impacted by a combination of factors. Sourcing and production will be confronted by environmental constraints and changes in availability, whilst consumption will be shaped by shifting affordability and market preferences. Meanwhile, supply chains could be reinvented, with innovation recasting long established trade and supply routes.

In sourcing and production, environmental constraints are expected to limit the availability of cod and substitute whitefish with the exception of farmed pangasius (which is expected to expand). Whitefish production from European waters will remain insufficient to meet consumption; with the UK and EU still reliant on imported material to meet consumer

demand for whitefish. Longer term, capture fisheries may head north to higher latitudes, potentially reducing catch levels in European and Icelandic waters, but enhancing them in Norwegian, Russian, and US waters. The security of overseas supply will therefore become even more important for the UK and EU.

In consumer markets, affordability will continue to be a central factor for UK and western European countries, with upward price pressure as new markets expand with the increasingly affluent consumers in Eastern Europe and Asia (particularly China). UK consumer preferences, for versatility and value for money, are unlikely to reverse; this will pressure UK outlets and suppliers to innovate, adjust their buyer preferences and secure value for money products. Longer term, consumers in expanding markets will follow western consumption pathways, sustaining competitive pressure.

In supply chains, innovation will have an important bearing on whether source countries, and existing supply routes, can ensure cod retains its iconic position in the UK market. With the future uncertain, three scenarios can be envisaged:

1. *Business as usual.* Whereby supply routes continue as they are currently arranged; Iceland (with fresh and refreshed product) and Russia (with refreshed product) focus on the premium chilled sector, Norway focus on whole fish (with frozen whole supporting double frozen product via China/Eastern Europe).
2. *Investment in current supply arrangements.* Whereby Iceland and Russia continue to invest in, and deepen, their current specialisation. Investment in automation would enhance specialisation of source and supply and help reduce costs for refreshed (single frozen) product. Double frozen product would continue via China/Eastern Europe.
3. *Re-invented, and digitally driven, supply arrangements.* Where the supply of whitefish is largely made up of fresh (never frozen) and refreshed (single frozen) products, is delivered via short supply chains that are highly integrated and automated. This could involve all source countries investing in automation and integration, or a combination of corporate alliances between UK operators and source country operators. Reinvented supply arrangements could provide a much higher volume of refreshed (single frozen) product at reasonable prices.

Scenario 1 Business as usual

- This scenario suggests a downward spiral driven by external forces. What could begin with an initial polarisation in whitefish products (with high price/ quality products co-existing with low price/quality) may result in a much diminished market for whitefish as the iconic status of cod is gradually eroded and consumers switch out of the category.
- The focus is on affordability and how to respond to continued upward price pressure driven by limited resource and competition from other markets. Whitefish is constrained by the difficulty in maintaining a value for money perception, as prices increase without enhancing quality.
- Cod might be expected to reach a price ceiling beyond which consumers will switch out, or the retailer/food service outlet will take action.
 - In an effort to control costs, retailers might explore switching formats and supply routes in the chilled sector e.g. towards refreshed (single frozen) and Russia, move from chilled to frozen by switching supply chain (from single to double frozen), reduce portion size, and then ultimately switch to a different, lower value species.
 - In food service, the higher cost of supply would see loss of business in the lower end of fish and chip shops as consumers are unwilling to pay higher prices.
- The availability of lower price formats (single and then double frozen) might be a useful substitute in the near term but could also undermine quality perception longer term. The switch to a different species, might lead to consumers moving out of category rather than into substitute species.

- For the import dependent Grimsby/Hull processing hub, there could be a range of impacts under this scenario. Some processors in the region are strongly influenced by retailer preferences; these processors may find it easier to respond to retailer demands in meal and coated products, but find it more difficult in natural products (as the retailer may opt to skew their portfolio to other, lower price species). Small processors and Grimsby auction market, reliant on the fresh trade, may benefit in the nearer term in being able to service premium chilled markets with high price/high quality product. Large processors, contracted to provide large volumes of price competitive product to chilled sectors in retail and food service, may benefit from economies of scale in the near term but ultimately be forced - by circumstances - further into supplying lower priced frozen cod or lower priced species. Medium sized processors, without the volume to provide buying clout with suppliers, nor to secure meaningful operating efficiencies, will face considerable pressure.

Scenario 2 Investment in current supply arrangements

- This scenario maintains an uneasy status quo that balances internal forces (industry action) and external forces. The focus here is on addressing issues of affordability, through increased automation that can reduce costs and maintain quality of final product. In this way upward price pressure driven by limited resource and competition from other markets, is contained.
- In order to maintain cod within current price brackets, supply chains in Iceland and Russia will be further integrated, automated and highly responsive to end market needs. Ultimately Icelandic and Russian suppliers could deal directly with retail and food service outlets in final markets.
- For Grimsby/Hull, there could be a range of impacts under this scenario. Small processors and Grimsby auction market, reliant on the fresh trade, may benefit from a sustained premium chilled market with high price/high quality product provided locally. Large processors, contracted to provide large volumes of price competitive product to chilled sectors in retail and food service, may lose this business to suppliers in source countries and be forced - by circumstances - further into the frozen sector. Medium sized processors, without the volume to provide buying clout with suppliers, nor to secure meaningful operating efficiencies, will face considerable pressure.

Scenario 3 Re-invented, and digitally driven, supply arrangements

- This scenario suggests an upward spiral driven by internal forces (industry action). The focus here is on addressing issues of affordability, through wider adoption of automation that not only reduces costs and maintains product quality, but also expands the volume of processed product. In this way upward price pressure, driven by limited resource and competition from other markets, is not only contained but may even be counteracted.
- In order to deliver competitively priced products, the wider adoption of technology and integrated supply chains across all source countries (Iceland, Norway and Russia) reduces costs and provides higher volumes of single frozen product, and less double frozen. Although retail and food service outlets in final markets might source direct from suppliers in source countries, there may be scope to have integrated chains that include UK and source country operators e.g. in taking in whole whitefish and processing domestically.
- For Grimsby/Hull, there could be a range of impacts under this scenario. Small processors and Grimsby auction market, reliant on the fresh trade, may be challenged through the premiumisation of the market as prices moderate for high quality product. Large processors, contracted to provide large volumes of price competitive product to chilled sectors in retail and food service, may lose this business to suppliers in source countries. However there may be opportunities to reinvent their role, particularly if high

volumes of whole whitefish can be secured and processed through highly automated facilities in the region. Medium sized processors, without the volume to provide buying clout with suppliers or to justify the investment in automation, nor to secure meaningful operating efficiencies, will face considerable pressure.

5.2 How might industry and Seafish respond?

Although one or other of these scenarios may appear more likely, the actual future may see elements of each. For example scenario one (business as usual) may prevail in the very near term with a subsequent move towards scenario two or three.

Consultees suggested a range of responses for industry and Seafish, the suitability of which will depend on which future plays out. Suggested responses from some of the consultees are shown in table 5.1.

Industry	<ul style="list-style-type: none"> • Shift away from lower price segments: <ul style="list-style-type: none"> ○ Encourage new entrants, with businesses led by young people, raising standards and producing good products and charging higher prices. ○ Retailers to focus on quality product and avoid double frozen that undermines product experience. • Maintain and develop ongoing relationships with the supply base. These partnerships are important, particularly if supply consolidates further and fewer businesses control the access to raw material.
Seafish	<ul style="list-style-type: none"> • Support industry reputation given its importance in whether consumers eat fish. Keep on top of any changes or potential bad news stories to protect industry reputation (already doing a good job on this so more of the same). • Bring stakeholders together, across panels not just one panel. • To encourage new entrants, help address the perception of industry; particularly it being perceived as unattractive career-wise.
Industry & Seafish	<ul style="list-style-type: none"> • Focus on getting more fish into the UK. • Explore future priorities with retailers (their future sourcing strategies) and national marketing plans for source countries (Alaska Seafood Marketing Institute and Norwegian Seafood Council). • Support and provide knowledge of cod direct to the consumer – reassurance of responsible sourcing.

At present the UK buys a considerable volume of primary processed cod. Some source countries e.g. Iceland are exceptionally good at supplying this and UK buyers are currently able to accept that price premium.

However, conditions are changing and appropriate strategies should be explored in responding to these new circumstances. To date, an industry wide response has, arguably, been 'reactive' aimed at maintaining cod supplies (e.g. this review was prompted by the view that we want to defend cod). However, stakeholders may wish to consider the opportunities of a more proactive response, and discuss how that would look. If that were to happen, points for discussion might include whether UK cod suppliers want to focus on:

- Growing the UK consumer market for seafood e.g. by expanding the UK market through higher quality at reasonable prices (effectively a larger share of the protein market), or
- Securing a larger share of the existing UK consumer market for seafood, e.g. by competing on price.

Consultees

1. Martyn Boyers, Grimsby Auction Market
2. Stuart Caborn, Young's
3. Sturri Haraldsson, Norebo group
4. Frank Isaksen, Norwegian Seafood Council
5. Mike Kendrick, Caistor Seafoods
6. Andrew Knudsen, Seachill
7. Simon Rilatt, Espersen
8. Lee Smales, Smales
9. Andrew Weightman, Fastnet Fish
10. Jonas Vidarsson, Matis

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Appendix 1 Framing changes in seafood supply: definition and dimensions

Changes associated with seafood supplies are summarised in table A1.1. Specific changes vary by system (domestic or international), species and production type (capture or aquaculture).

Dimension	Areas of specific change	Example change impact (opportunity/threat)
Availability	Trading conditions	Tariffs, non-tariff barriers, legality, traceability (e.g. IUU) and human rights (e.g. ILO188) requirements that could mean trading and logistics enhanced/ impeded.
	Inflexible regulations	Rigid operating conditions.
	Robust/loose fisheries governance	Well managed/ data-deficient fisheries.
	Marine user opposition/collaboration	Constrained/ expanded production.
	Species characteristics	Volume, seasonality and technical requirements (size grade and specification i.e. whole/ fillets/ portions/ pairs/ triples/ skin or shell on/off) that could affect species availability.
Affordability	Economy and market conditions	Pricing points vis-à-vis buyers purchasing criteria that can determine UK industry competitiveness. Viable catch/aqua production/onshore supply options through existing or new/redundant business models (including operator practices).
	Competing sectors	Shortage of labour.
	Investment/disinvestment	Consolidation, smaller fleet, more efficient/ targeted capture, vertically integrated chains.
Nutrition, safety	Industry practice/malpractice	Product quality improved/ impaired.
	Composition	Nutritional profile, minimum water/protein content. Loss of product integrity e.g. water addition Product format (chilled v frozen - single/double, etc).
	Safety	Contaminants, microbiological safety.
Preferences	Certification	Responsible sourcing requirements such that industry reputation weakened/ improved.
	Consumer preferences	Tastes/ changing tastes.
	Scrutiny/public perception	Social and environmental responsibility assurance such that market access is improved/ impeded.
Environmental constraints	Growth conditions	Giving rise to disease.
	Environmental conditions	Contaminants, climate change (e.g. warming waters).
	Natural biological cycles	Overexploited/ healthy resource.
	Environmental impact of gear	Impact on seabed/ ecosystem.
Outliers/ innovation	Gear innovation	New gear e.g. pulse trawling.
	Process innovation	New refrigeration techniques e.g. super-freezing.
	Product/packaging innovation	New formats e.g. Individual Quick Frozen (IQF) product.
	Production innovation	New aquaculture systems e.g. offshore aquaculture, and recirculating aquaculture systems (RAS)..

Appendix 2 Production data for key whitefish sources

Atlantic cod (*Gadus morhua*)

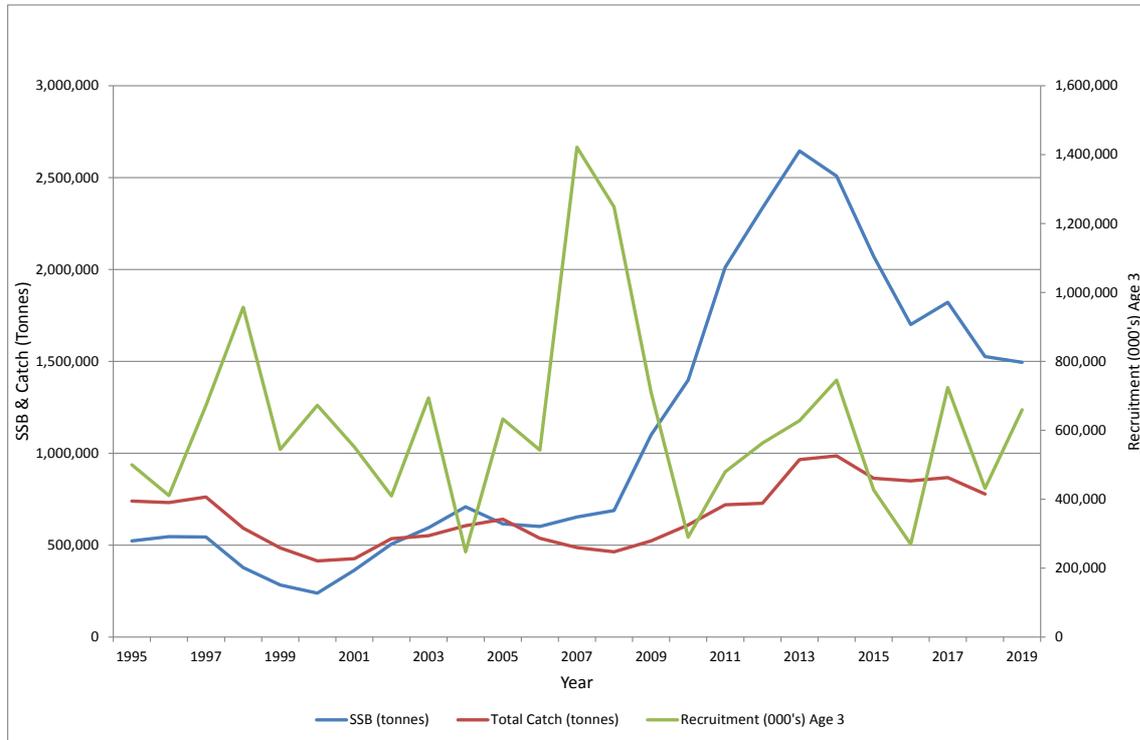


Figure A2.1 Cod (*Gadus morhua*) spawning stock biomass, recruitment and total catch in Subareas 1 and 2 (North East Arctic)

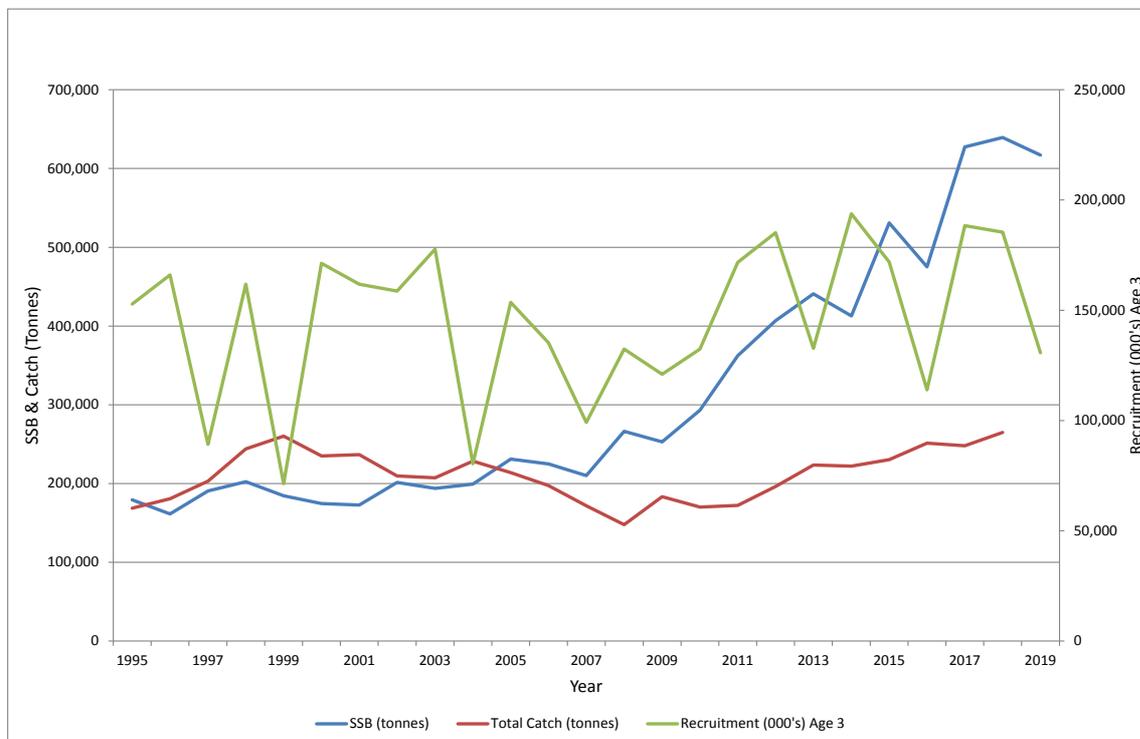


Figure A2.2 Cod (*Gadus morhua*) spawning stock biomass, recruitment and total catch in Division 5a (Iceland grounds)

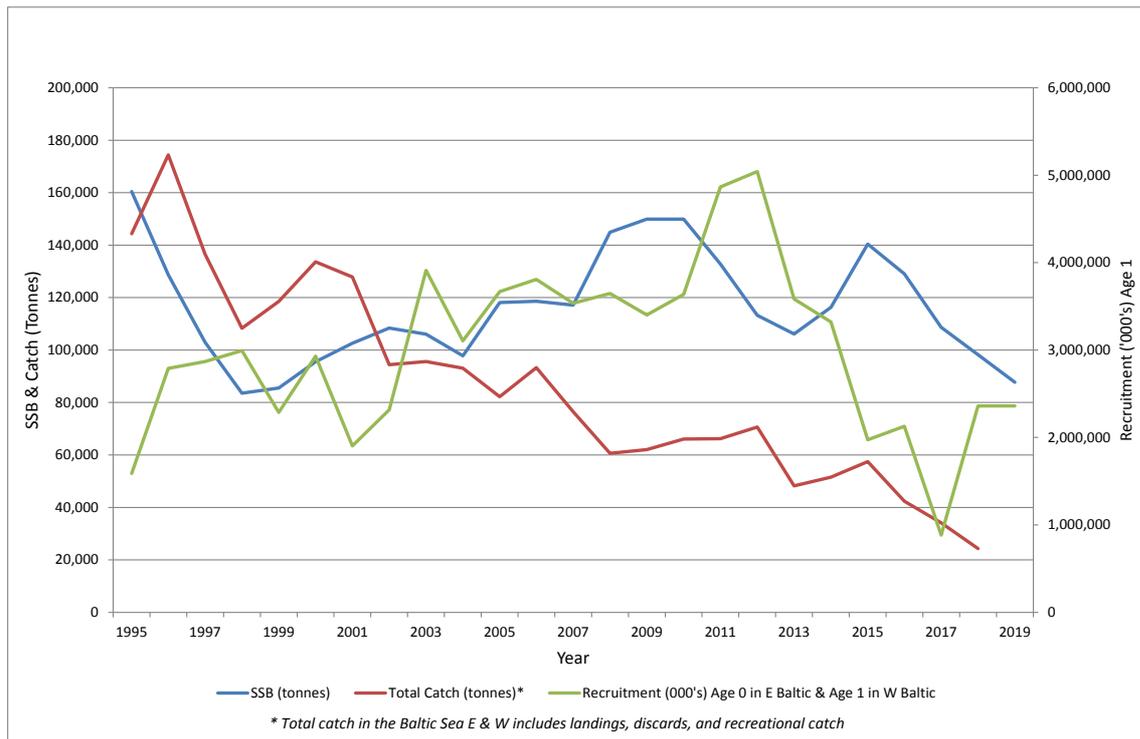


Figure A2.3 Cod (*Gadus morhua*) spawning stock biomass, recruitment and total catch in Subdivisions 22-32 (Eastern and Western Baltic Sea)

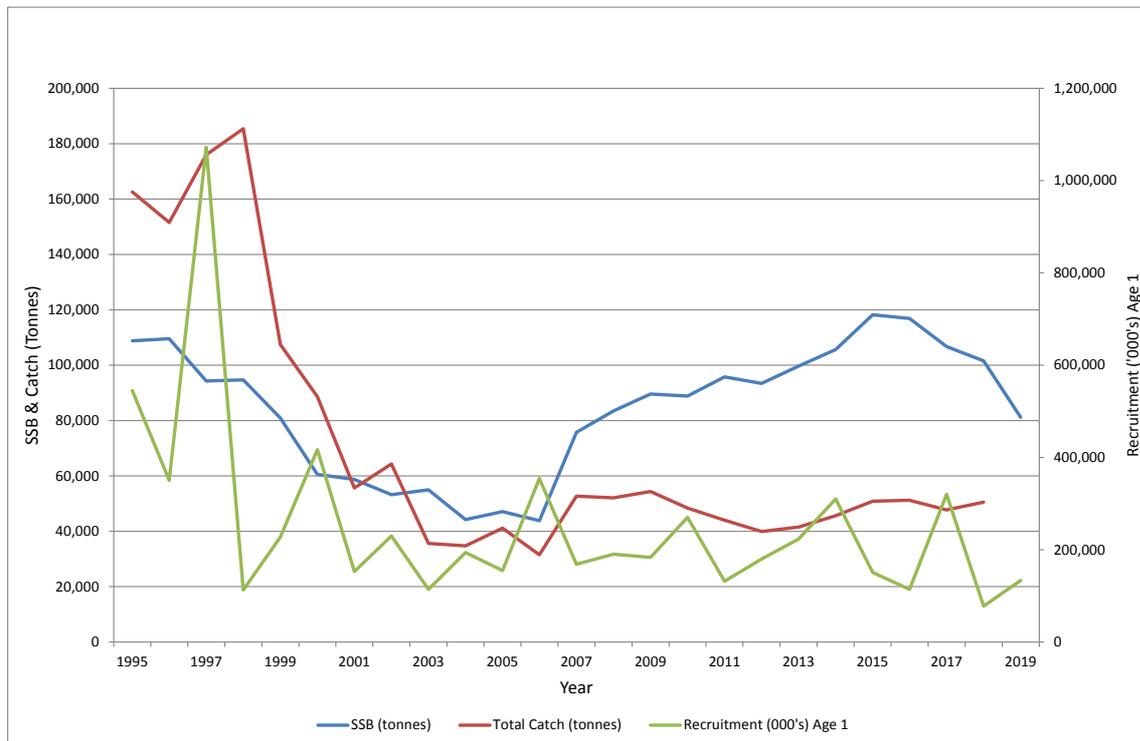


Figure A2.4 Cod (*Gadus morhua*) spawning stock biomass, recruitment and total catch in Subarea 4, Division 7d, and Subdivision 20 (North Sea, Eastern English Channel, Skagerrak)

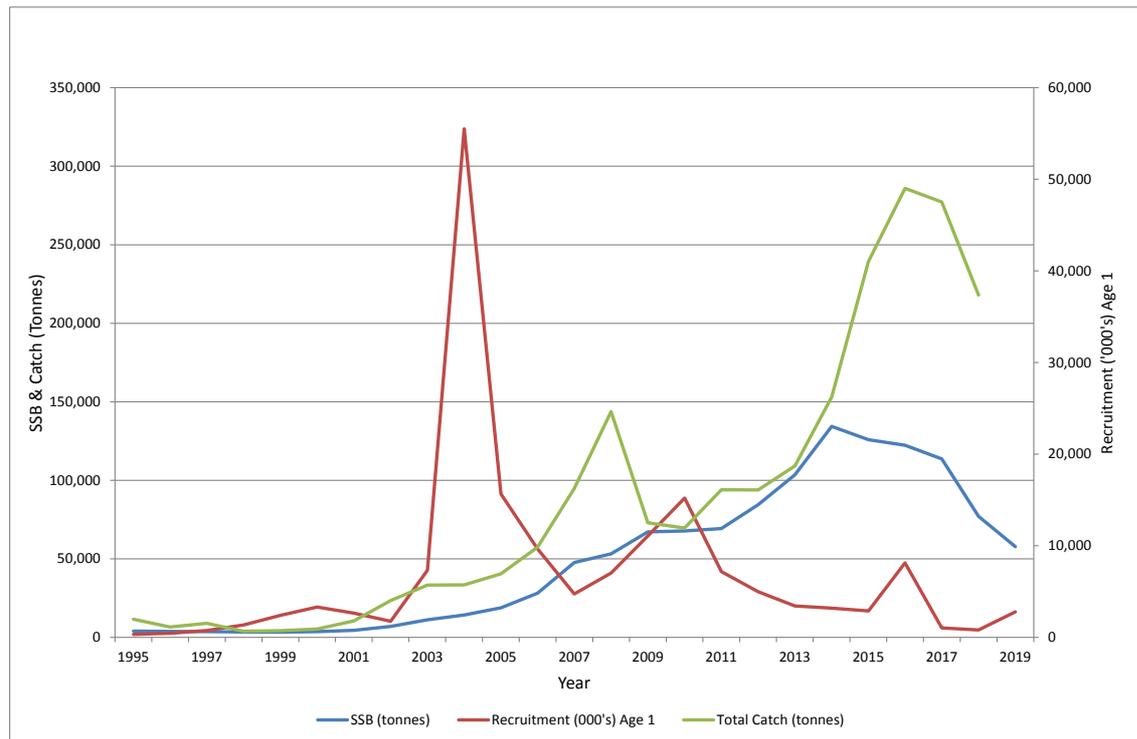


Figure A2.5 Cod (*Gadus morhua*) spawning stock biomass, recruitment and total catch in NAFO Subarea 1, inshore (West Greenland cod) & Subarea 14 and NAFO Division 1F (East Greenland, South West Greenland)

Haddock (*Melanogrammus aeglefinus*)

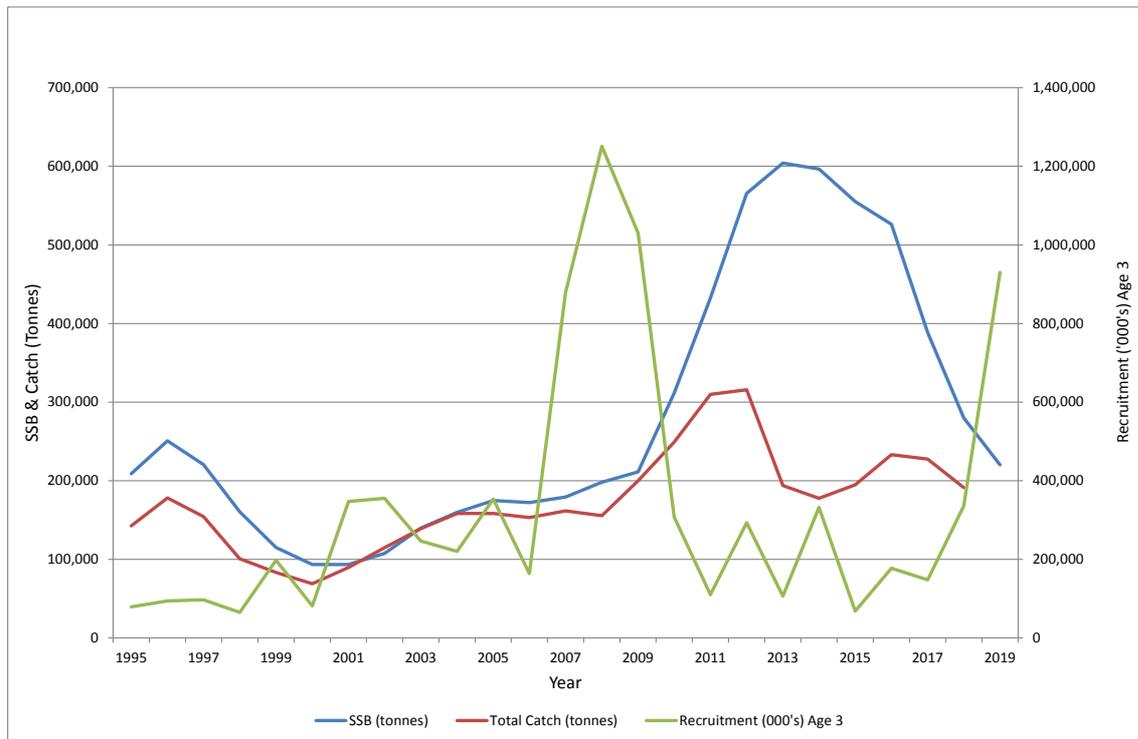


Figure A2.6 Haddock (*Melanogrammus aeglefinus*) spawning stock biomass, recruitment and total catch in Subareas 1 and 2 (North East Arctic)

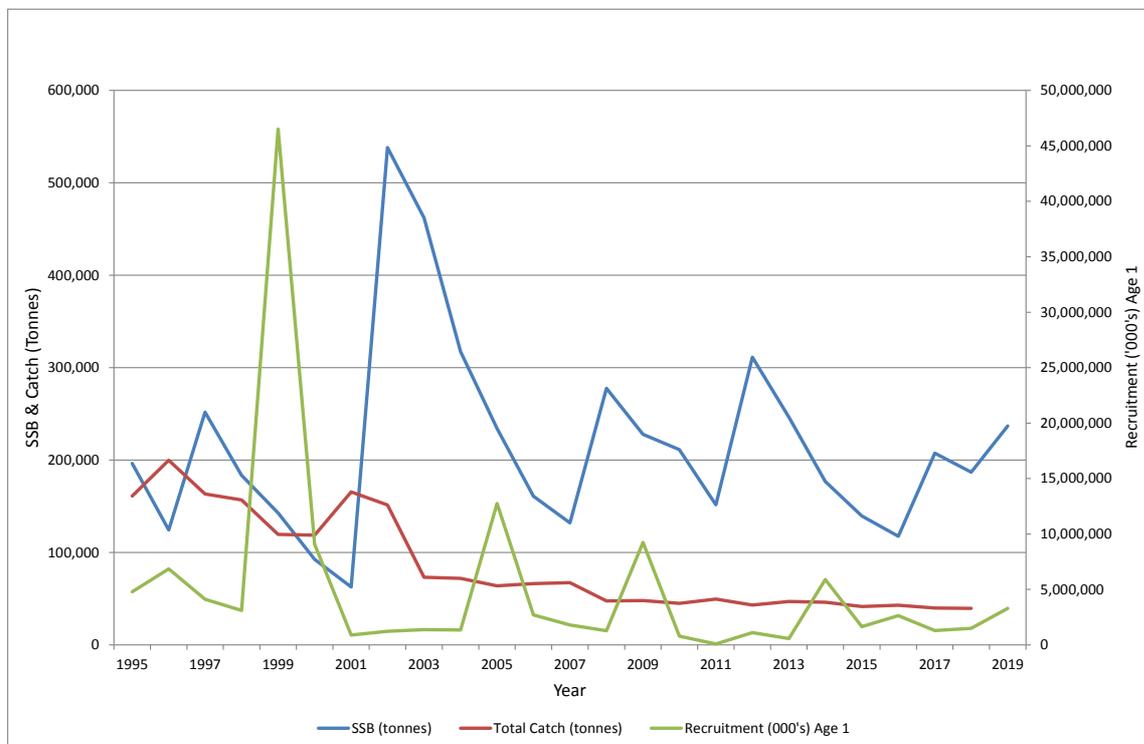


Figure A2.7 Haddock (*Melanogrammus aeglefinus*) spawning stock biomass, recruitment and total catch in Subarea 4, Division 6a and Subdivision 20 (North Sea, West of Scotland, Skagerrak)

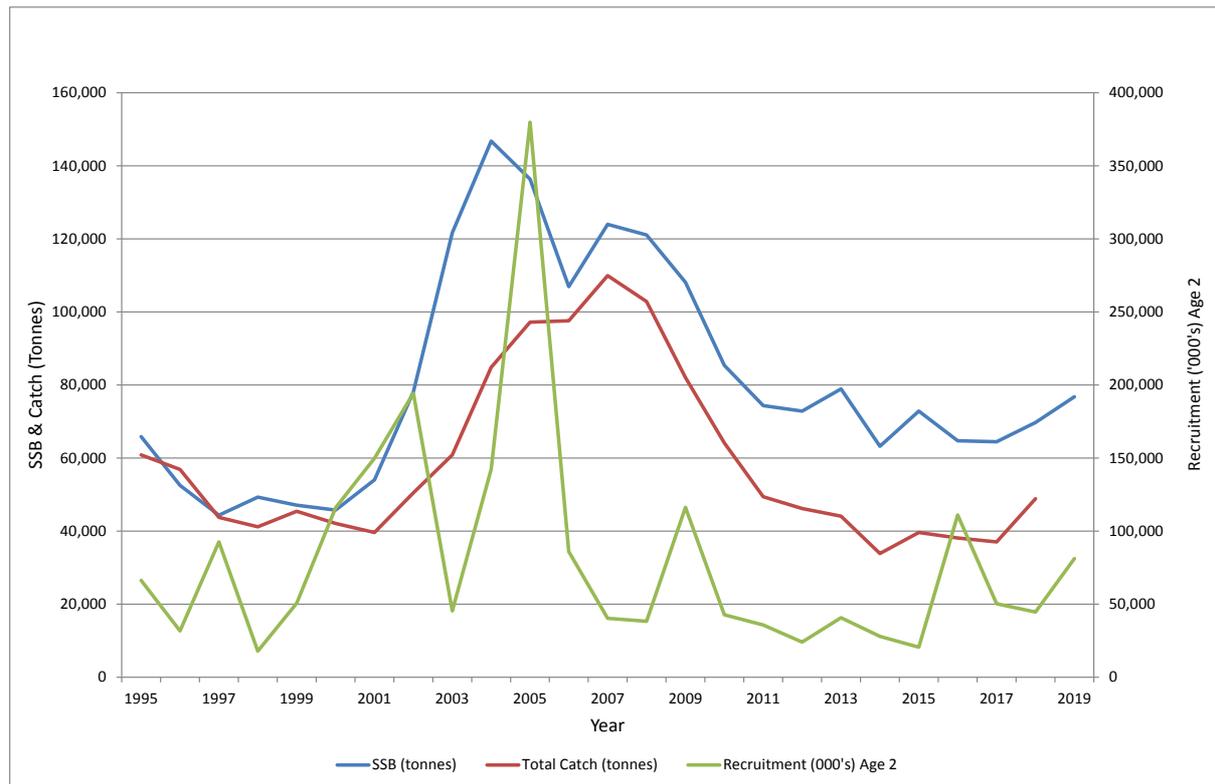


Figure A2.8 Haddock (*Melanogrammus aeglefinus*) spawning stock biomass, recruitment and total catch in Division 5a (Iceland grounds)

Alaska pollock (*Gadus chalcogrammus*)

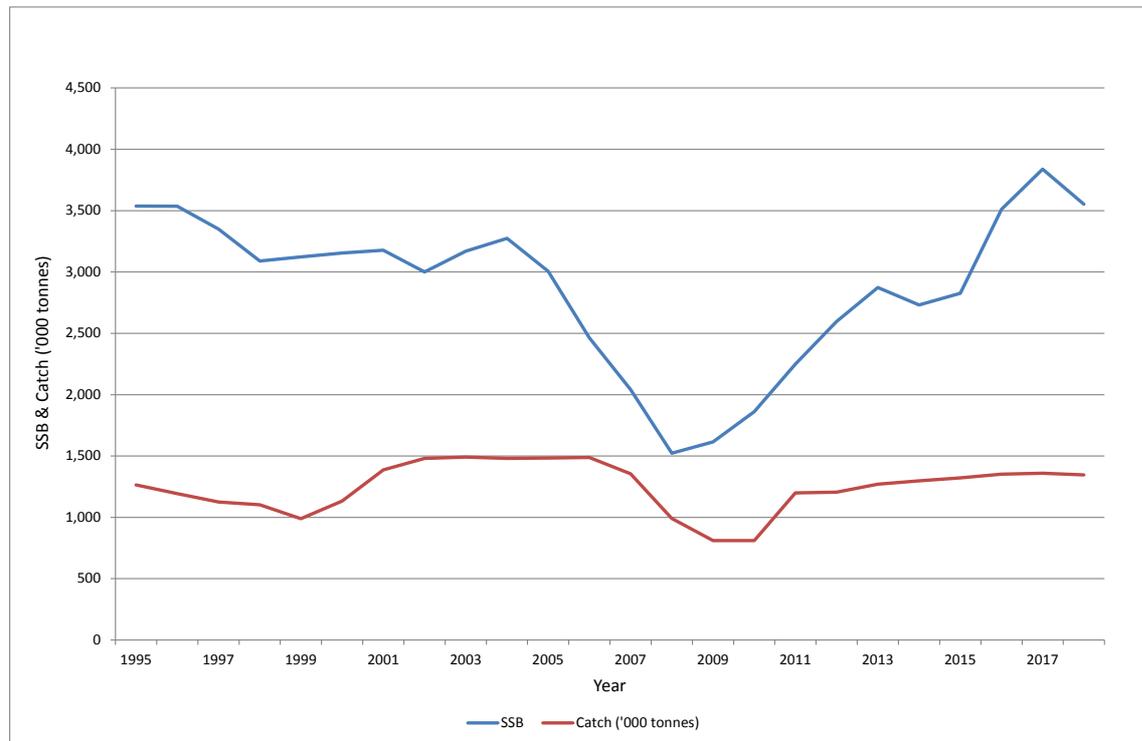


Figure A2.9 Alaska pollock (*Gadus chalcogrammus*) spawning stock biomass and total catch in East Bering Sea, USA

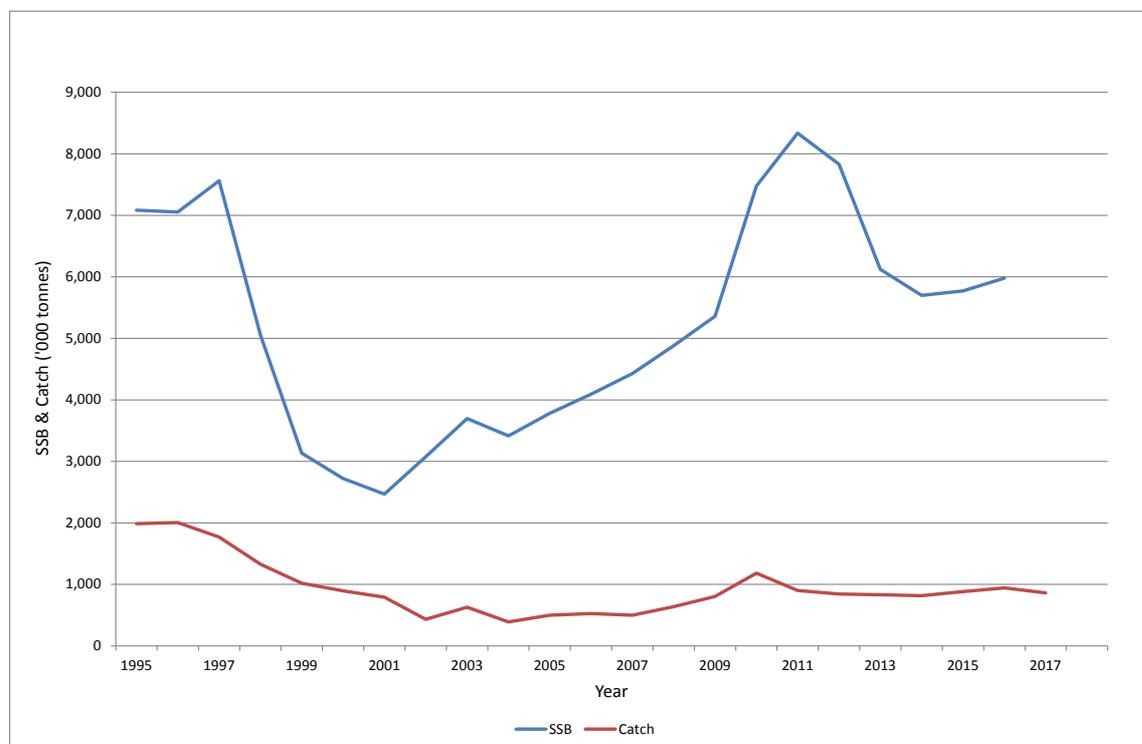


Figure A2.10 Alaska pollock (*Gadus chalcogrammus*) spawning stock biomass and total catch in Sea of Okhotsk, Russia

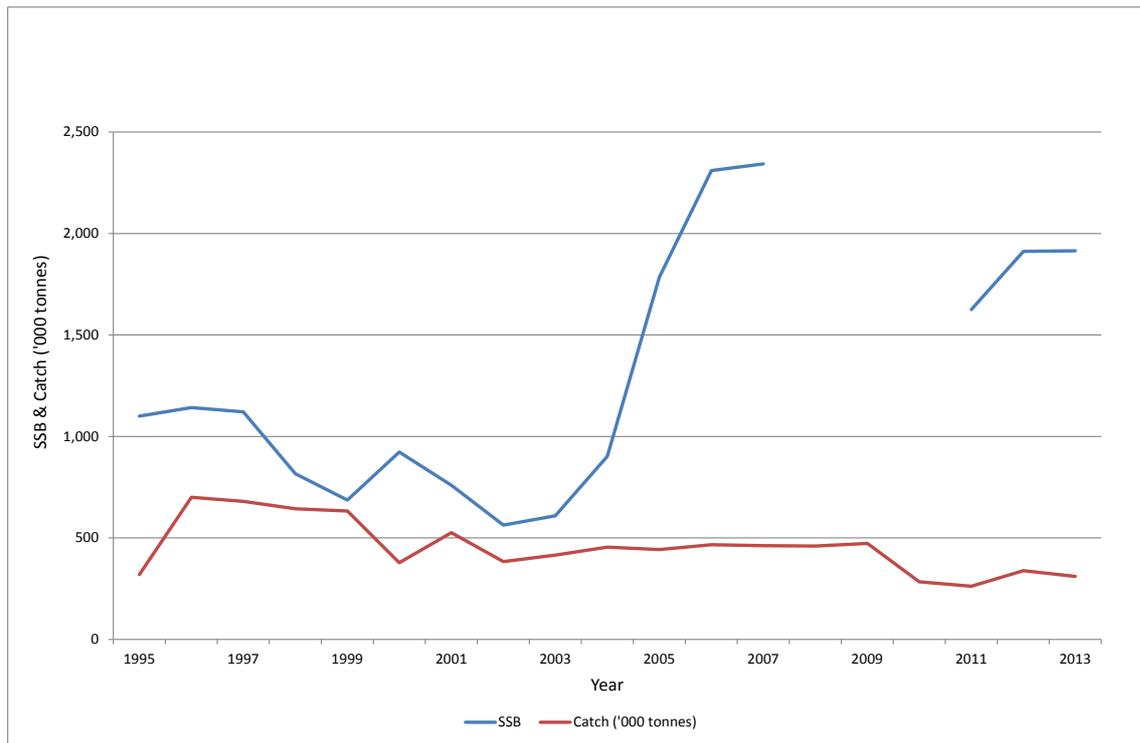


Figure A2.11 Alaska pollock (*Gadus chalcogrammus*) spawning stock biomass and total catch in Navarinsky, Russia

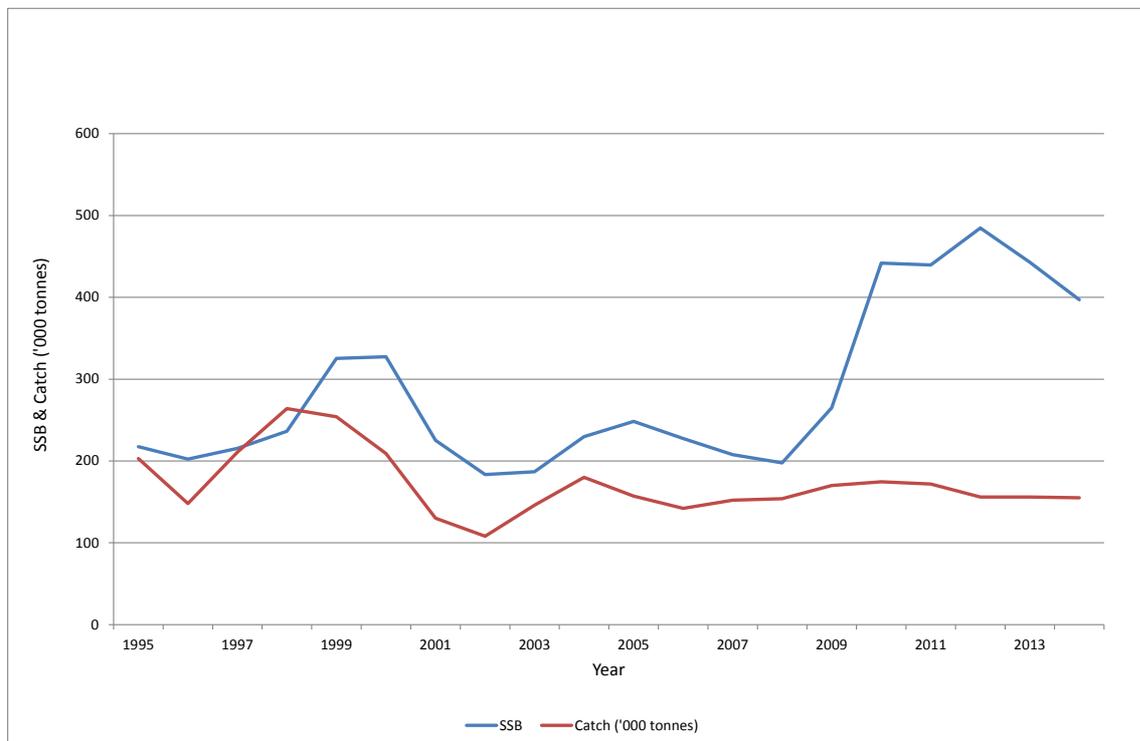


Figure A2.12 Alaska pollock (*Gadus chalcogrammus*) spawning stock biomass and total catch in the Japanese Pacific Coast, Japan

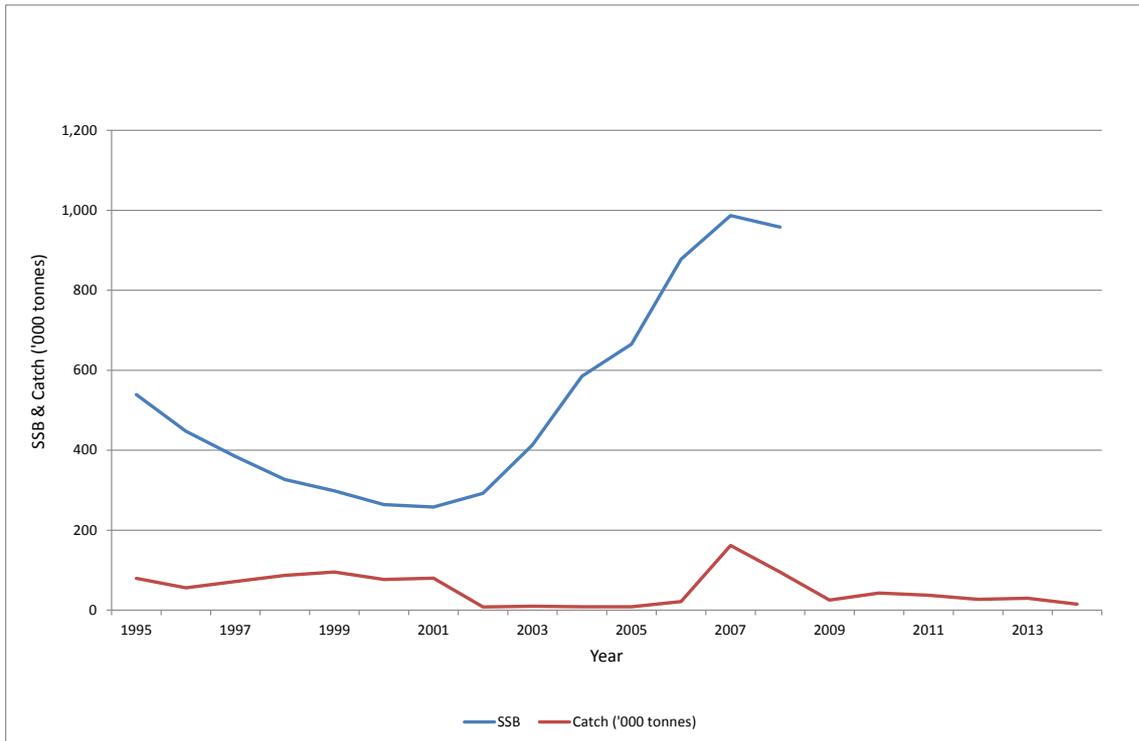


Figure A2.13 Alaska pollock (*Gadus chalcogrammus*) spawning stock biomass and total catch in the Western Bering Sea, Russia

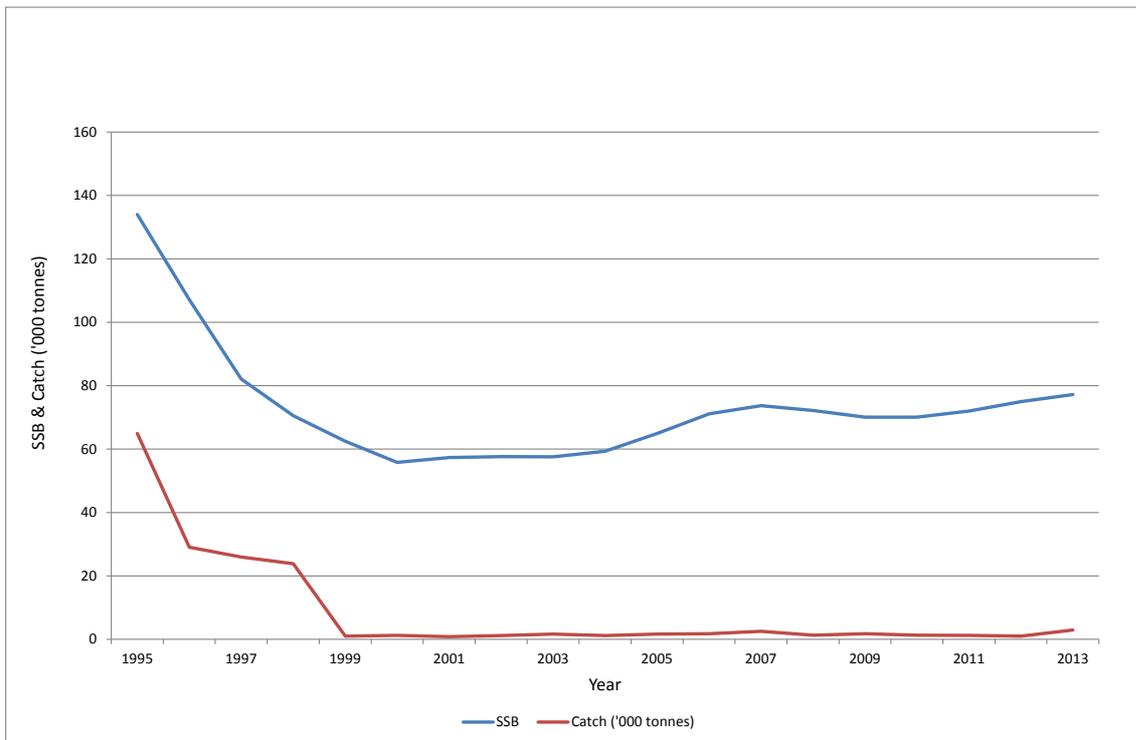


Figure A2.14 Alaska pollock (*Gadus chalcogrammus*) spawning stock biomass and total catch in the Aleutian Islands/Bering Sea, USA

Pangasius

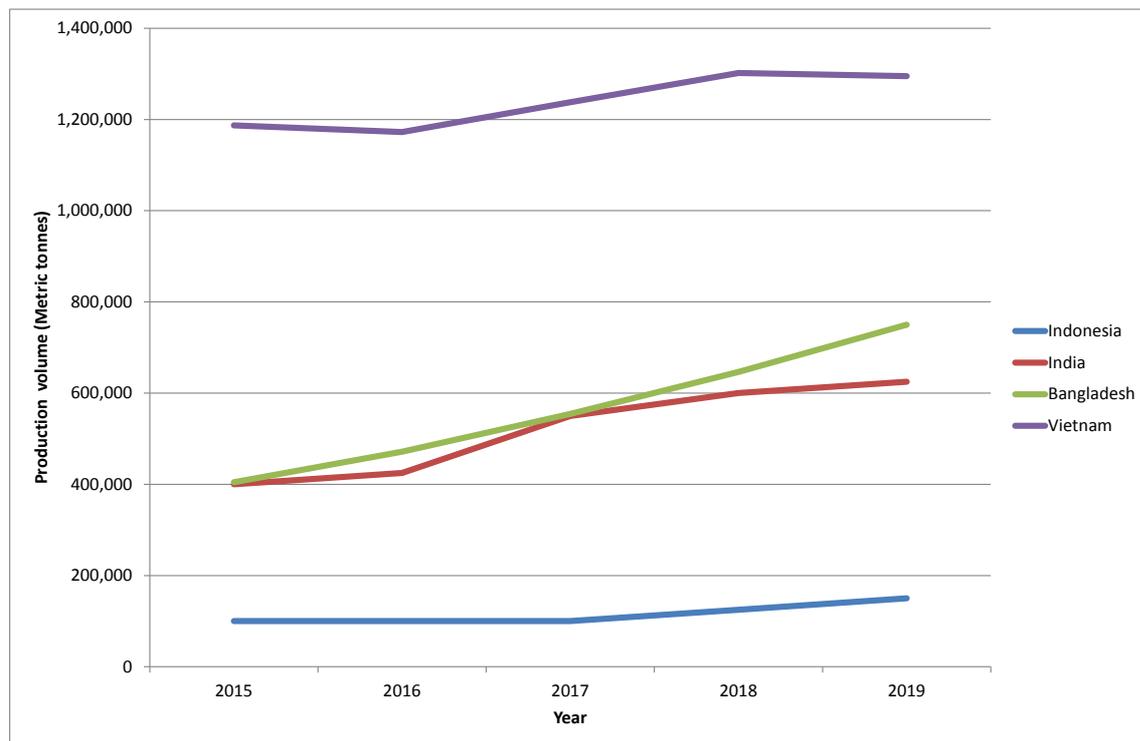


Figure A2.15 Pangasius production and anticipated production 2015-2019 (metric tonnes). Source: Professor Ragnar Tveteras, GAA Conference, Dublin 2017 (based on data from Md. Mahadi Hasan, Nesar Ahmed, Prof. Dr. AKM Nowsad Alam, P.E. Vijay Anand, Ho van Chien, and several anonymous).

Sources

Cod (from ICES)

- [ICES Advice on fishing opportunities, catch, and effort: Greater North Sea Ecoregion. Cod \(Gadus morhua\) in Subarea 4, Division 7.d, and Subdivision 20 \(North Sea, eastern English Channel, Skagerrak\) 28th June 2019](#)
- [ICES Advice on fishing opportunities, catch, and effort: Arctic Ocean, Barents Sea, and Norwegian Sea ecoregions. Cod \(Gadus morhua\) in subareas 1 and 2 \(Northeast Arctic\) 13th June 2019](#)
- [ICES Advice on fishing opportunities, catch, and effort: Greenland Sea and Icelandic Waters ecoregions. Cod \(Gadus morhua\) in Division 5.a \(Iceland grounds\) 13th June 2019](#)
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- [ICES advice on fishing opportunities, catch, and effort: Baltic Sea ecoregion. Cod \(Gadus morhua\) in subdivisions 22–24, western Baltic stock \(western Baltic Sea\) 26th July 2019](#)
- [ICES Advice on fishing opportunities, catch, and effort Greenland Sea and Icelandic Waters ecoregions: Cod \(Gadus morhua\) in NAFO Subarea 1, inshore \(West Greenland cod\) 13th June 2019](#)
- [ICES Advice on fishing opportunities, catch, and effort Greenland Sea and Icelandic Waters ecoregions: Cod \(Gadus morhua\) in ICES Subarea 14 and NAFO Division 1F \(East Greenland, Southwest Greenland\) 13th June 2019](#)

Haddock (from ICES)

- [ICES Advice on fishing opportunities, catch, and effort: Celtic Seas and Greater North Sea ecoregions Haddock \(Melanogrammus aeglefinus\) in Subarea 4, Division 6.a, and Subdivision 20 \(North Sea, West of Scotland, Skagerrak\) 26th August 2019](#)
- [ICES Advice on fishing opportunities, catch, and effort: Arctic Ocean, Barents Sea, Faroes, Greenland Sea, Icelandic Waters, and Norwegian Sea. Haddock \(Melanogrammus aeglefinus\) in subareas 1 and 2 \(Northeast Arctic\) 13th June 2019](#)
- [ICES Advice on fishing opportunities, catch, and effort: Greenland Sea and Icelandic Waters ecoregions. Haddock \(Melanogrammus aeglefinus\) in Division 5.a \(Iceland grounds\) 13th June 2019](#)

Alaskan pollock (from Fish Source)

- [Alaska Pollock: Sea of Okhotsk](#)
- [Alaska Pollock: E Bering Sea](#)
- [Alaska Pollock: Bering Sea/Aleutian Islands](#)
- [Alaska Pollock: Japanese Pacific coast](#)
- [Alaska Pollock: W Bering Sea](#)
- [Alaska Pollock: Navarinsky](#)

Appendix 3 Specialisation in source countries (Source: Various including Groundfish Forum)

Specialisation in Atlantic cod product formats

The majority of cod resource is in frozen format (62%) and frozen whole (H&G) in particular (48%). A relatively small share of the resource is in fresh format (21%) or salted (18%).

- Frozen – whole (H&G) fish (33% of all cod) – dominated by Russia then Norway.
- Frozen – fillets/block (28% of all cod) – dominated by Iceland and Russia.
- Fresh - whole(H&G) and fillets (21% of all cod) – dominated by Iceland (fillets) and Norway (whole H&G).
- Salted (18% of all cod) – dominated by Norway then Iceland.

A number of countries specialise in one or other format:

- Iceland on providing primary processed cod (frozen and fresh fillets, dried cod).
- Norway on providing whole cod with limited processing (frozen and fresh, salted cod).
- Russia on providing frozen cod in processed and unprocessed form (whole/H&G and fillets).

Specialisation in Alaska pollock product formats

The entire pollock resource is in frozen format (100%) and frozen whole (H&G) in particular (47%). A relatively small share of the resource is in fillet/block format (30%) or surimi (23%).

- Frozen – whole (H&G) fish (47% of all pollock) – dominated by Russia.
- Frozen – fillets/block (30% of all pollock) – dominated by the US then Russia.
- Frozen – surimi (23% of all pollock) – dominated by the US then Japan/Korea.

A number of countries specialise in one or other format:

- Russia on providing frozen pollock in processed and unprocessed form (whole/H&G and fillets).
- US on providing primary processed pollock (frozen fillets/block and surimi).
- Japan/Korea on providing primary processed pollock (frozen surimi).

Specialisation in pangasius product formats (Vietnam) ¹³

The majority of pangasius resource is in frozen format (99.9%) and frozen fillets in particular (88%). A smaller share of the resource is in fresh format (0.1%).

- Frozen – fillets (88% of all pangasius).
- Fresh – fillets (0.1% of all pangasius).

Vietnam specialises in providing primary processed pangasius (frozen and – increasingly - fresh, fillets).

Specialisation in haddock product formats

The majority of haddock resource is in frozen format (68%) and frozen whole (H&G) in particular (44%). A smaller share of the resource is in fresh format (32%).

- Frozen – whole (H&G) fish (44% of all haddock) – dominated by Norway then Russia.
- Frozen – fillets/block (24% of all haddock) – dominated by Russia then Iceland.
- Fresh – whole (H&G) and fillets (32% of all haddock) – dominated by the EU and Norway (whole H&G) then Iceland (fillets).

¹³ Includes Seafish estimates

A number of countries specialise in one or other format:

- Iceland on providing primary processed haddock (frozen and fresh fillets).
- Norway on providing whole cod with limited processing (frozen and fresh).
- Russia on providing frozen haddock in processed and unprocessed form (whole/H&G and fillets).
- The EU on providing fresh in unprocessed form (whole/H&G).

Appendix 4 Selected UK trade data for key whitefish species (Source: British Trade Statistics (UK), Iceland export / customs)

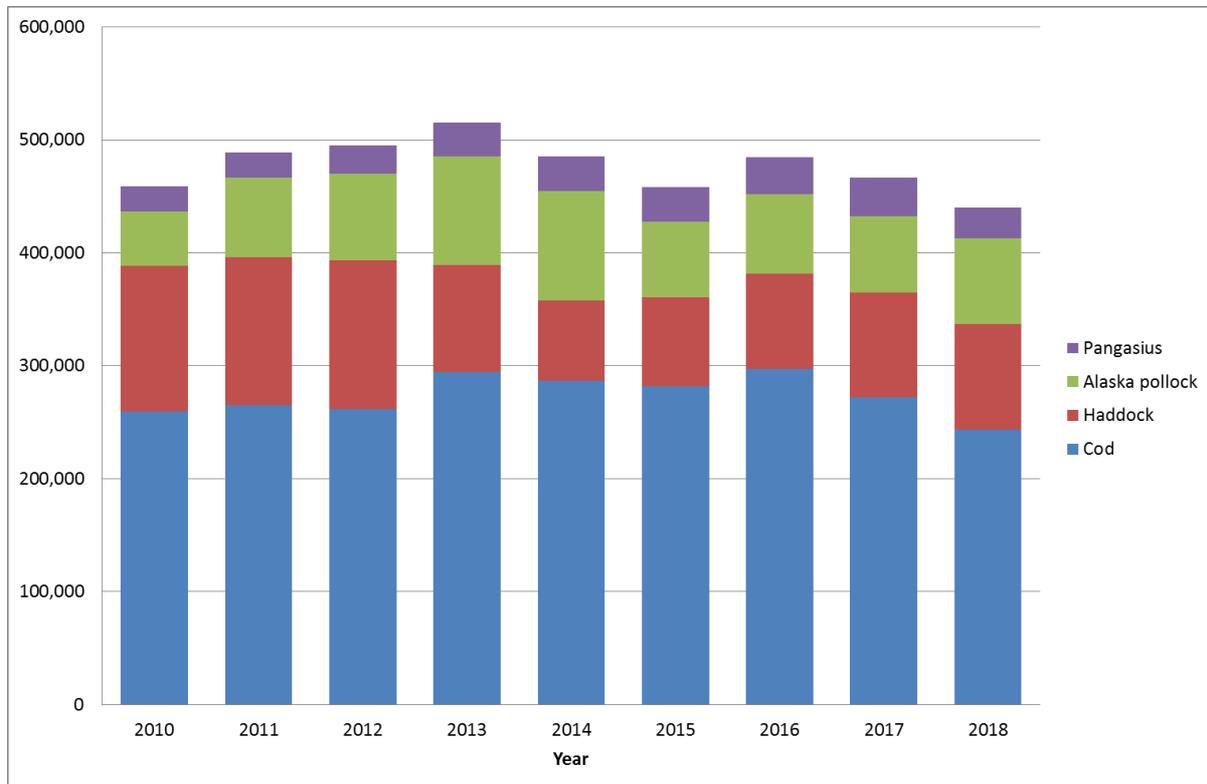


Figure A4.1 UK imports of main whitefish species 2010-2018 (live weight tonnes)

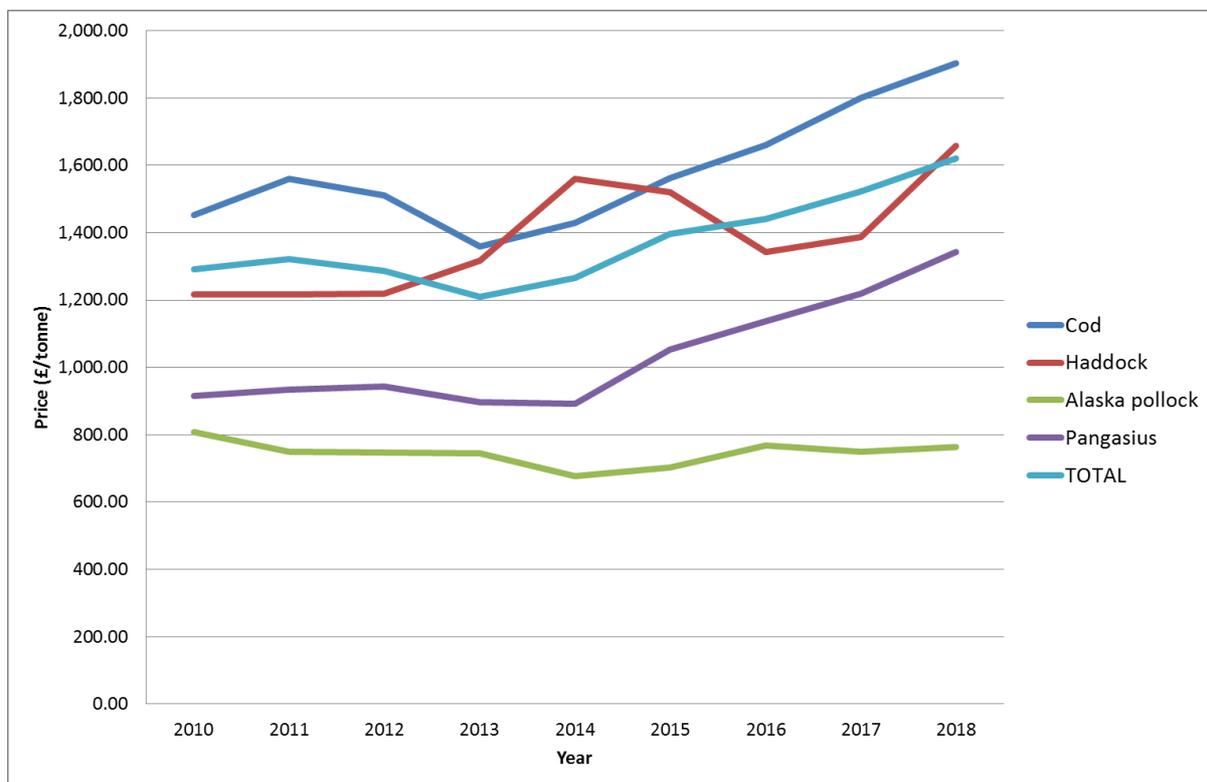


Figure A4.2 Price per tonne of main UK imported whitefish species 2010-2018 (£/tonne liveweight, nominal prices)

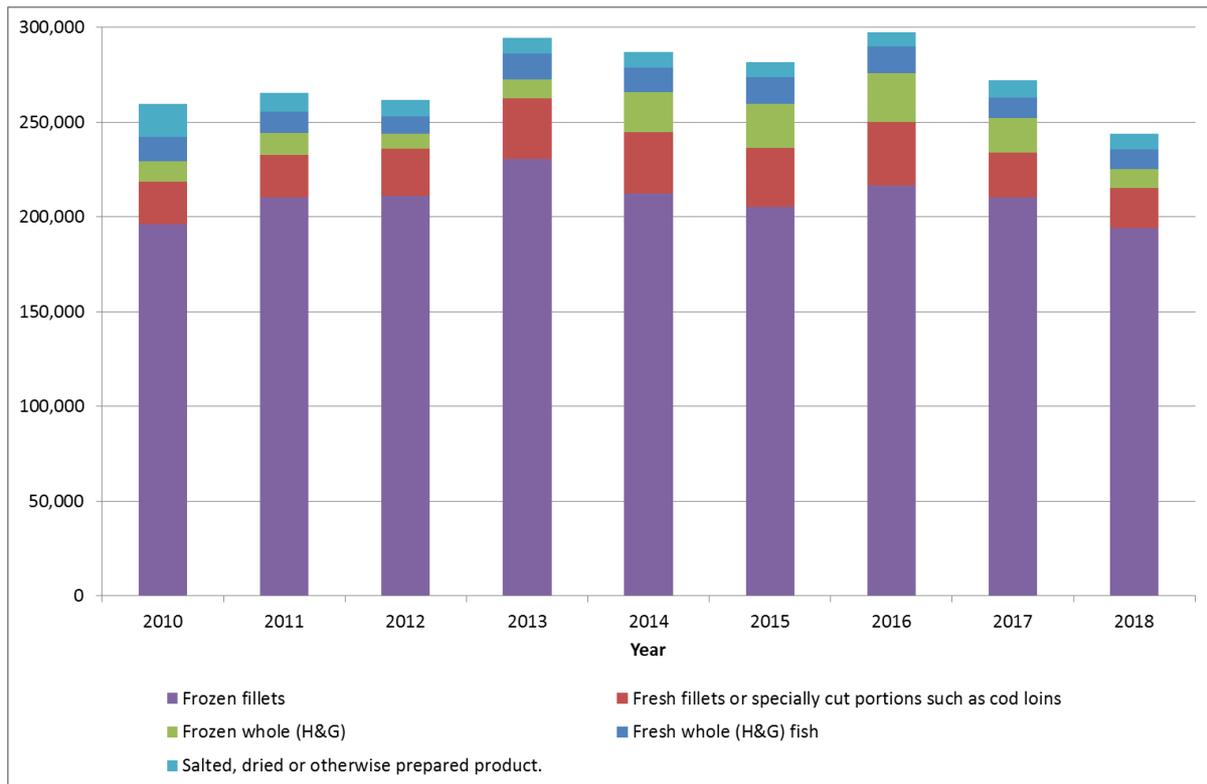


Figure A4.3 UK imports of cod by main product format 2010-2018 (live weight tonnes)

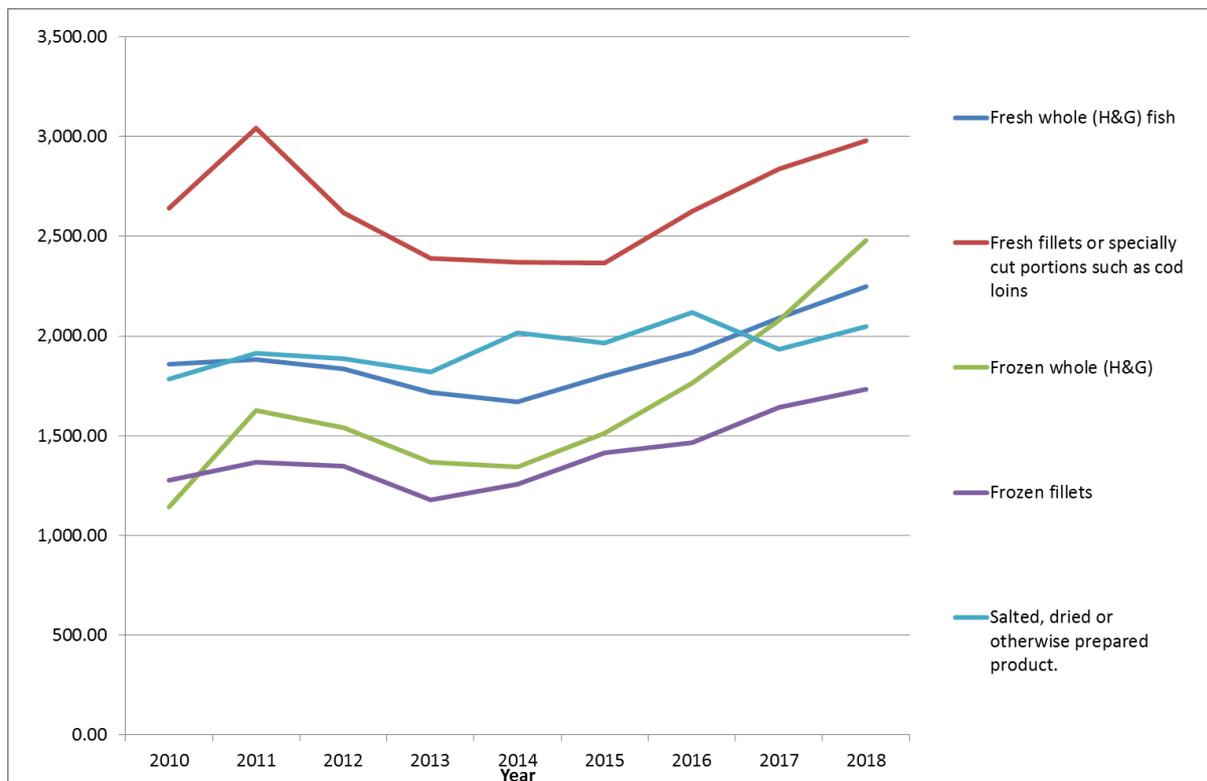


Figure A4.4 Cod price per tonne by main product format 2010-2018 (£/tonne liveweight, nominal prices)

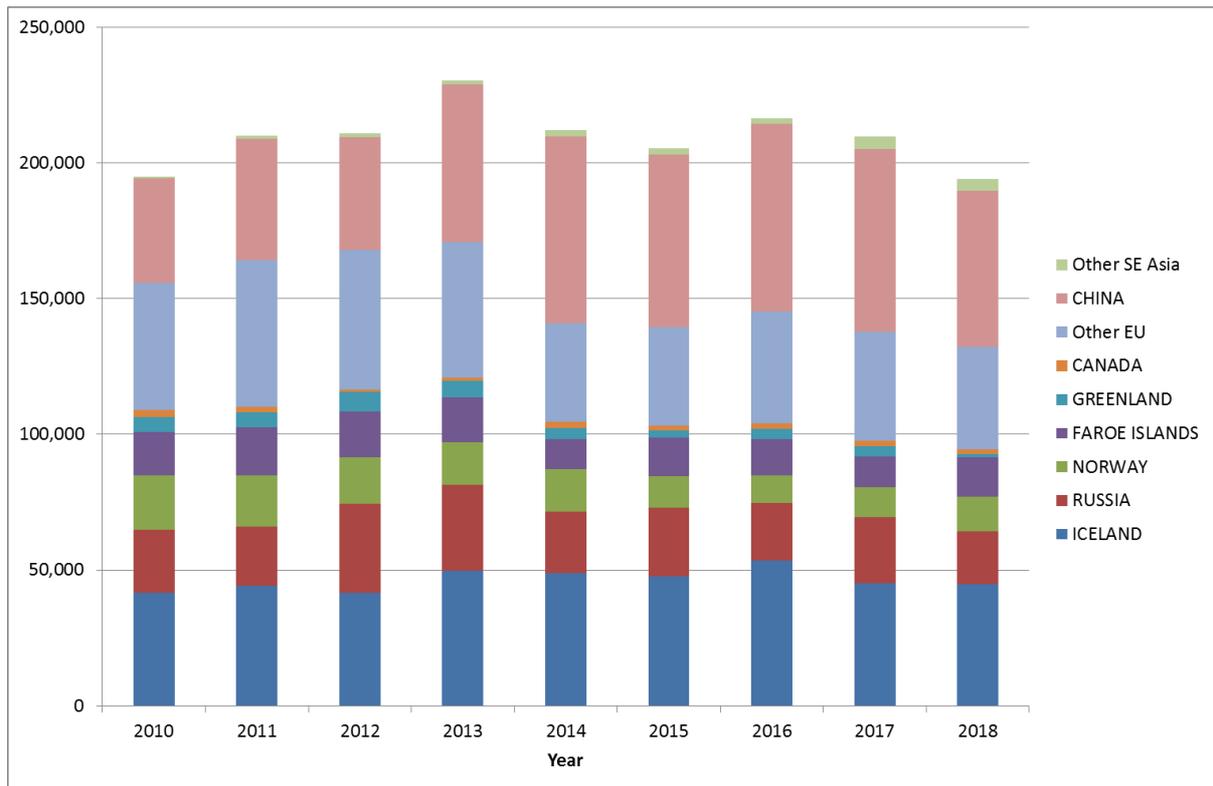


Figure A4.5 UK imports of cod frozen fillet by main import source country 2010-2018 (live weight tonnes)

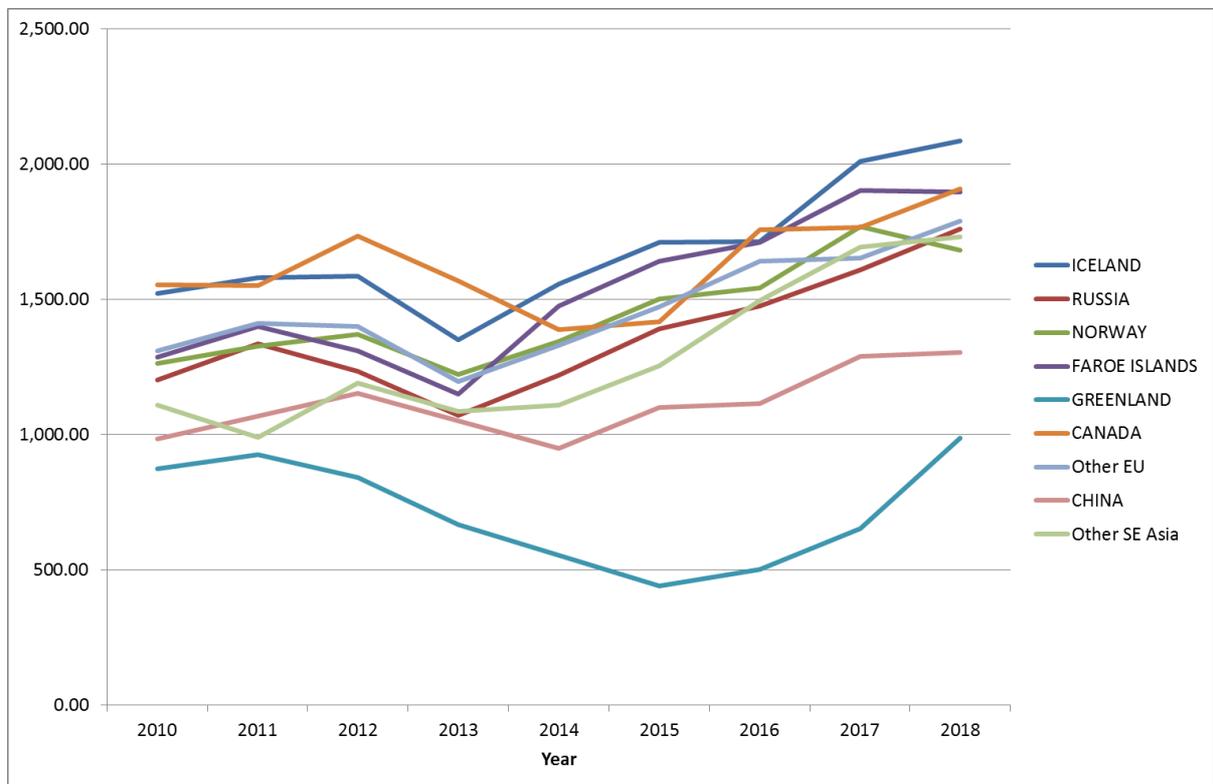


Figure A4.6 Cod frozen fillet price per tonne by main import source 2010-2018 (£/tonne liveweight, nominal prices)

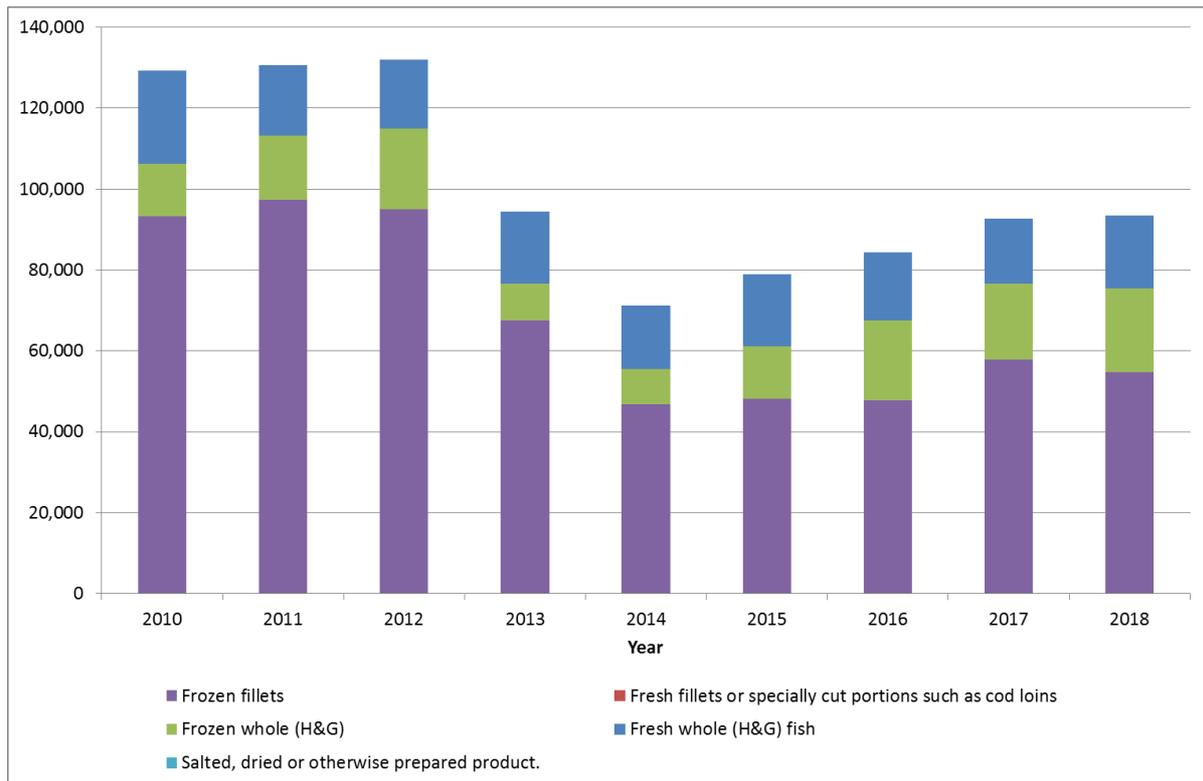


Figure A4.7 UK imports of haddock by main product format 2010-2018 (live weight tonnes)

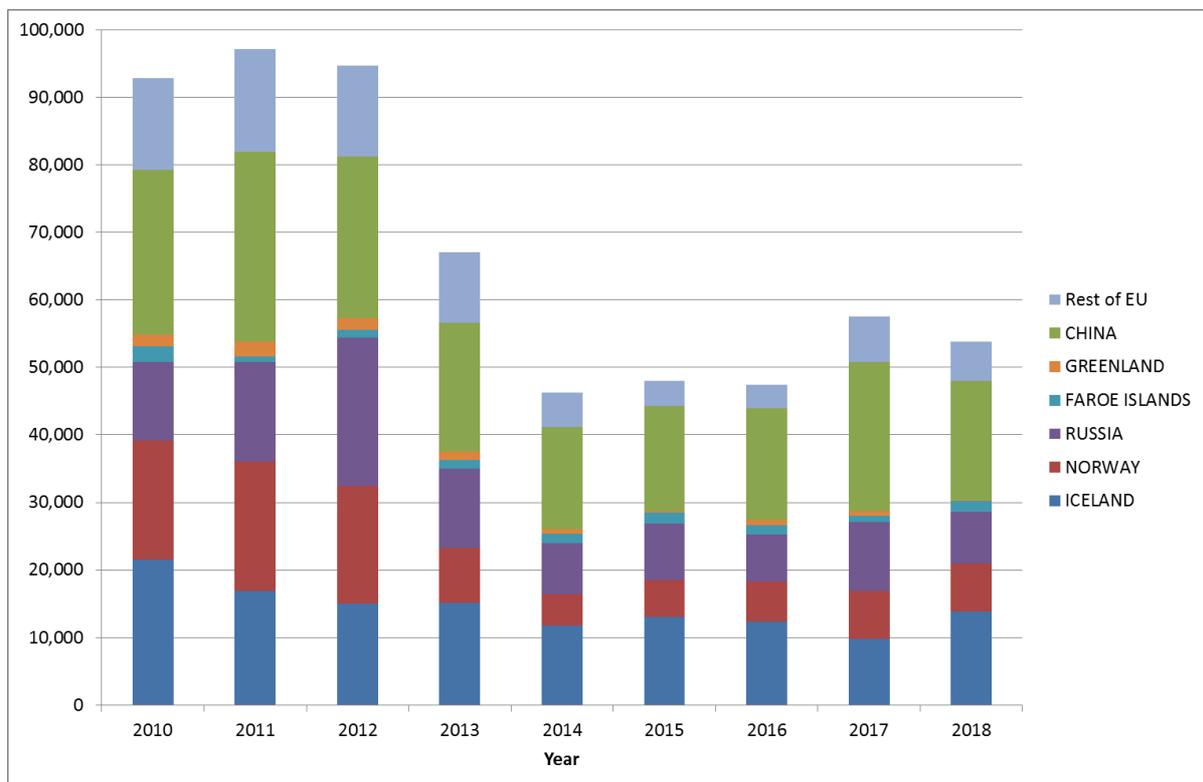


Figure A4.8 UK imports of haddock frozen fillet by main import source country 2010-2018 (live weight tonnes)

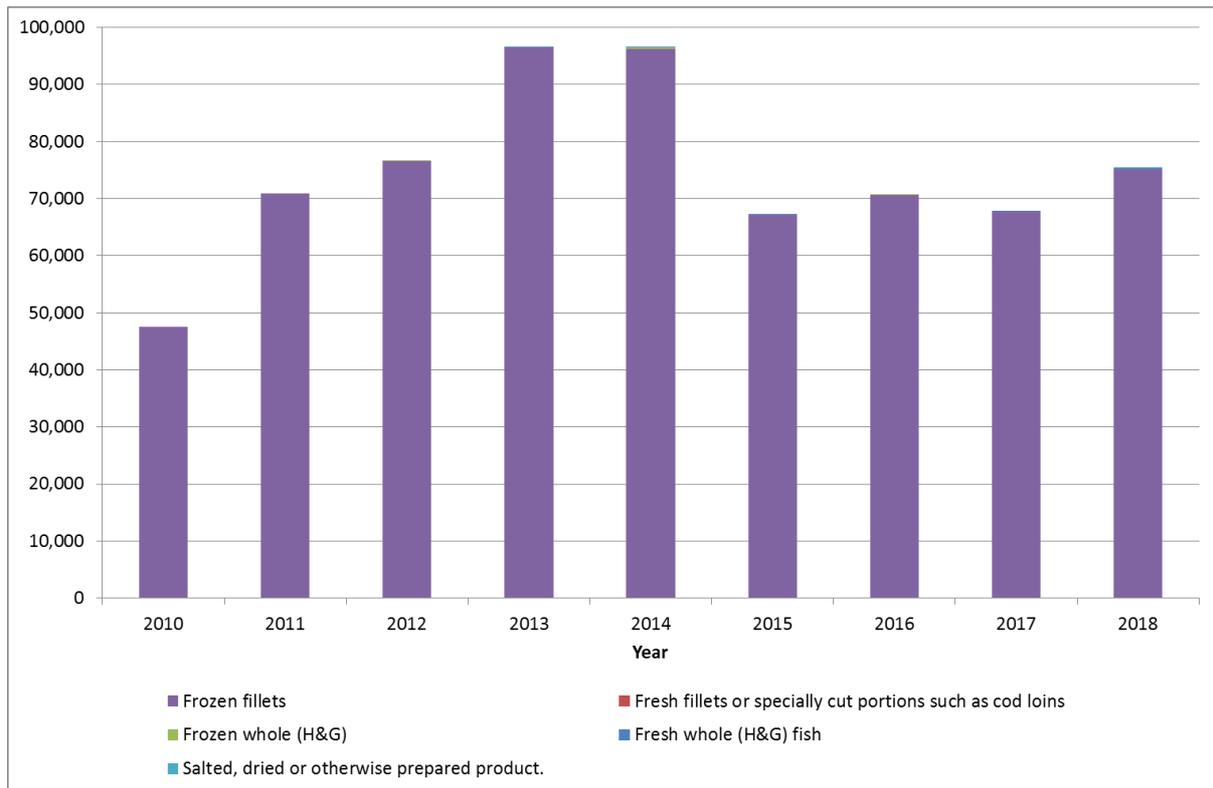


Figure A4.9 UK imports of Alaska pollock by main product format 2010-2018 (live weight tonnes)

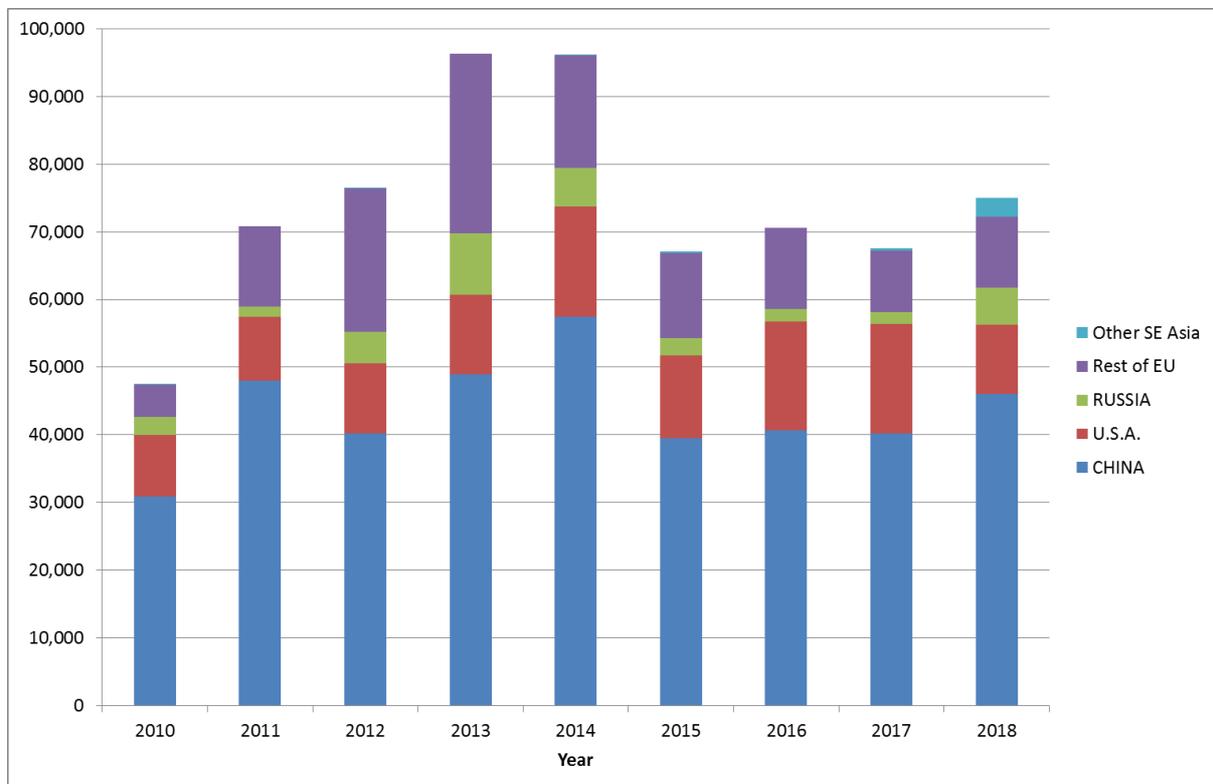


Figure A4.10 UK imports of pangasius frozen fillet by main import source country 2010-2018 (live weight tonnes)

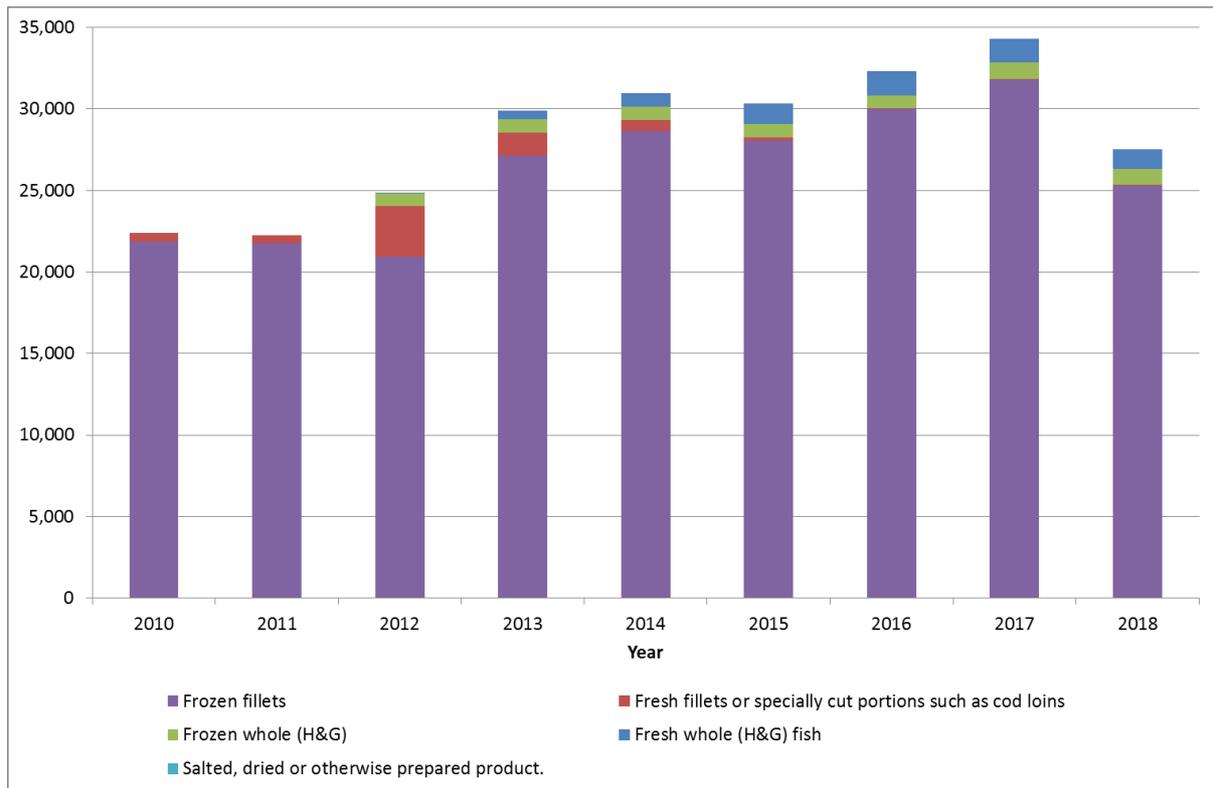


Figure A4.11 UK imports of pangasius by main product format 2010-2018 (live weight tonnes)

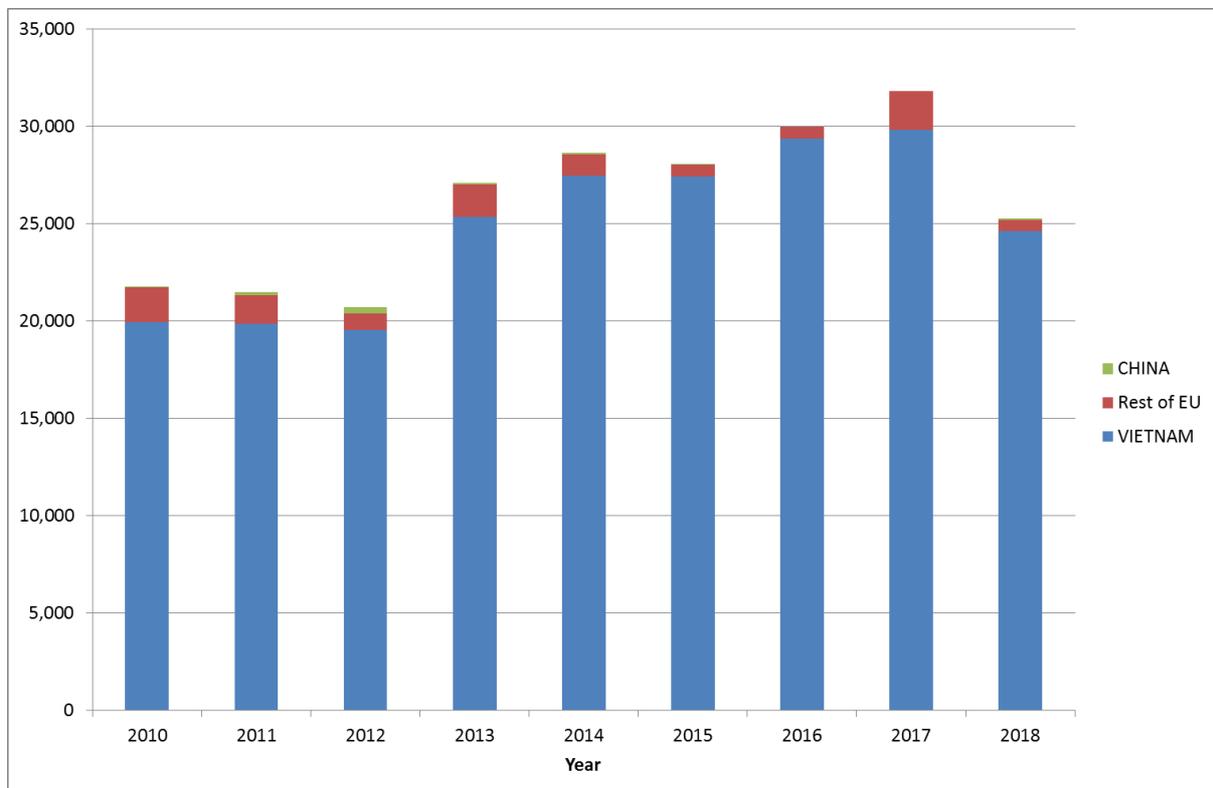


Figure A4.12 UK imports of pangasius frozen fillet by main import source country 2010-2018 (live weight tonnes)

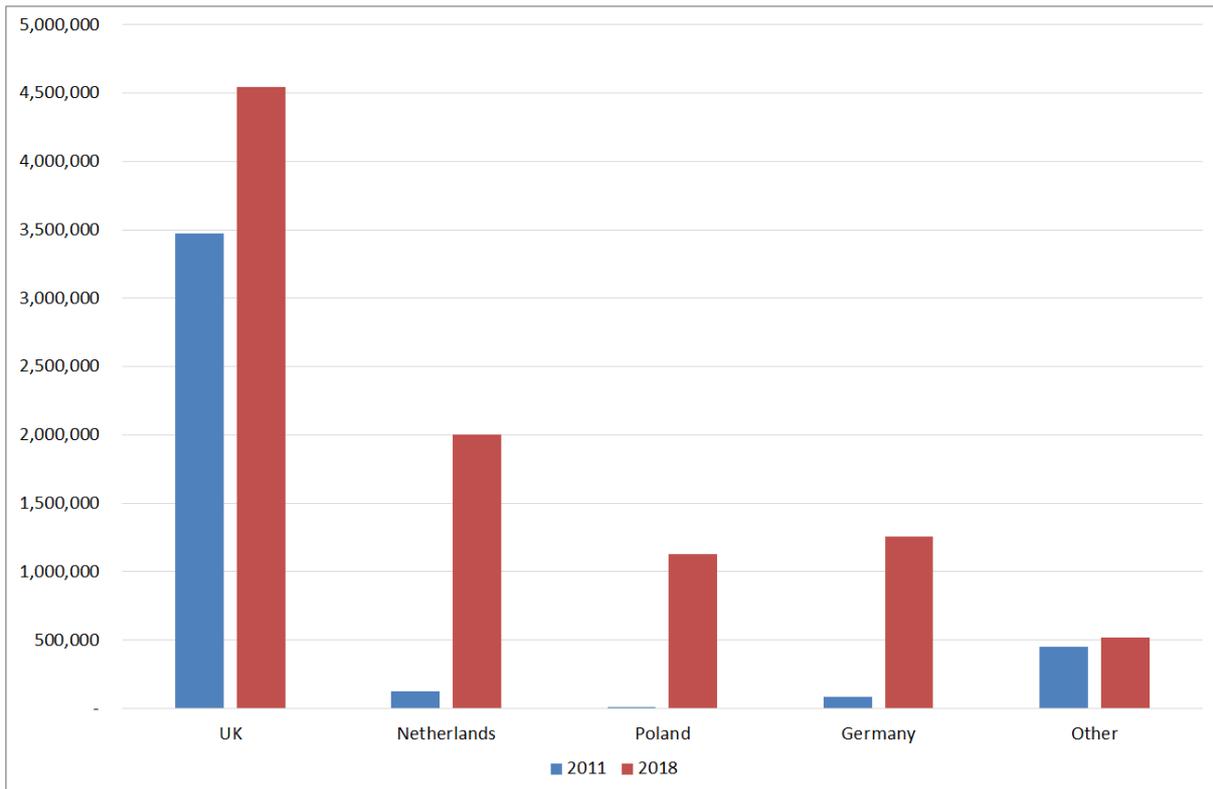


Fig A4.13 Fresh whole (head on gutted) cod exports from Iceland 2011-2018 (kg product weight)

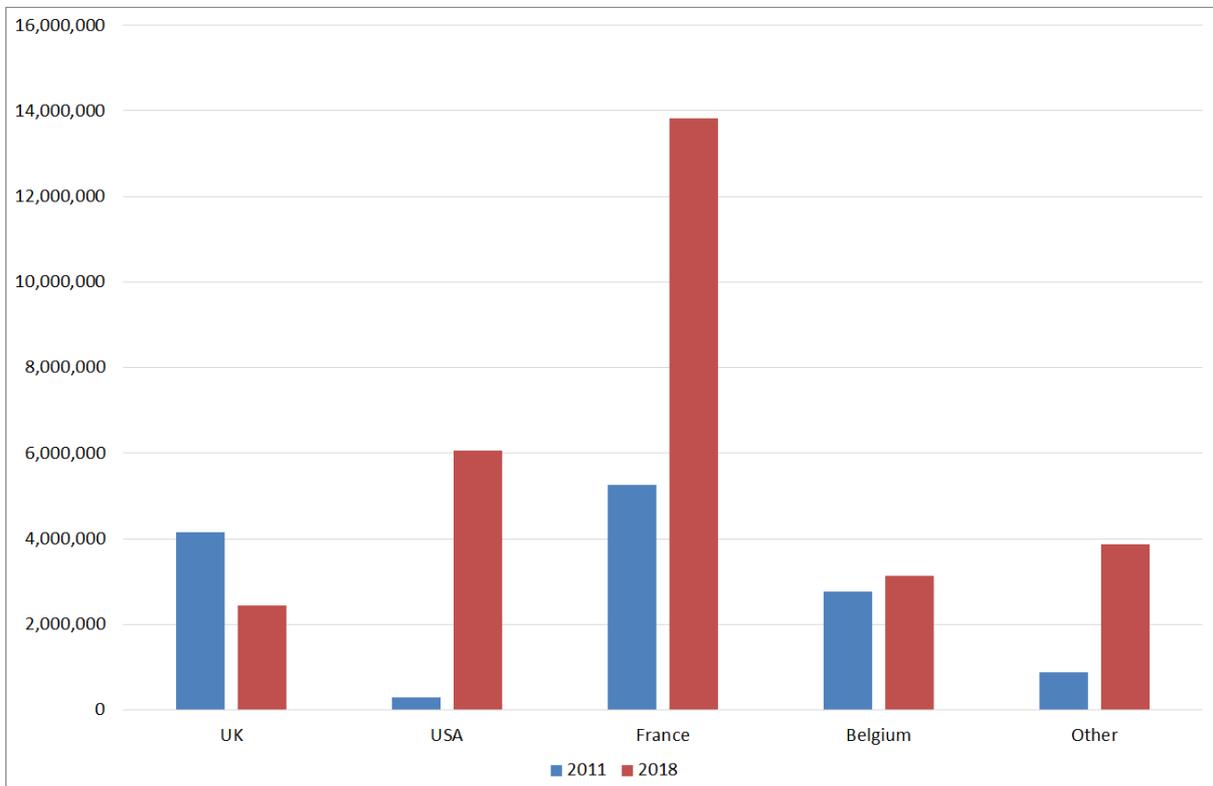


Fig A4.14 Fresh cod fillets and portions (cod loins) exported from Iceland 2011-2018 (kg product weight)

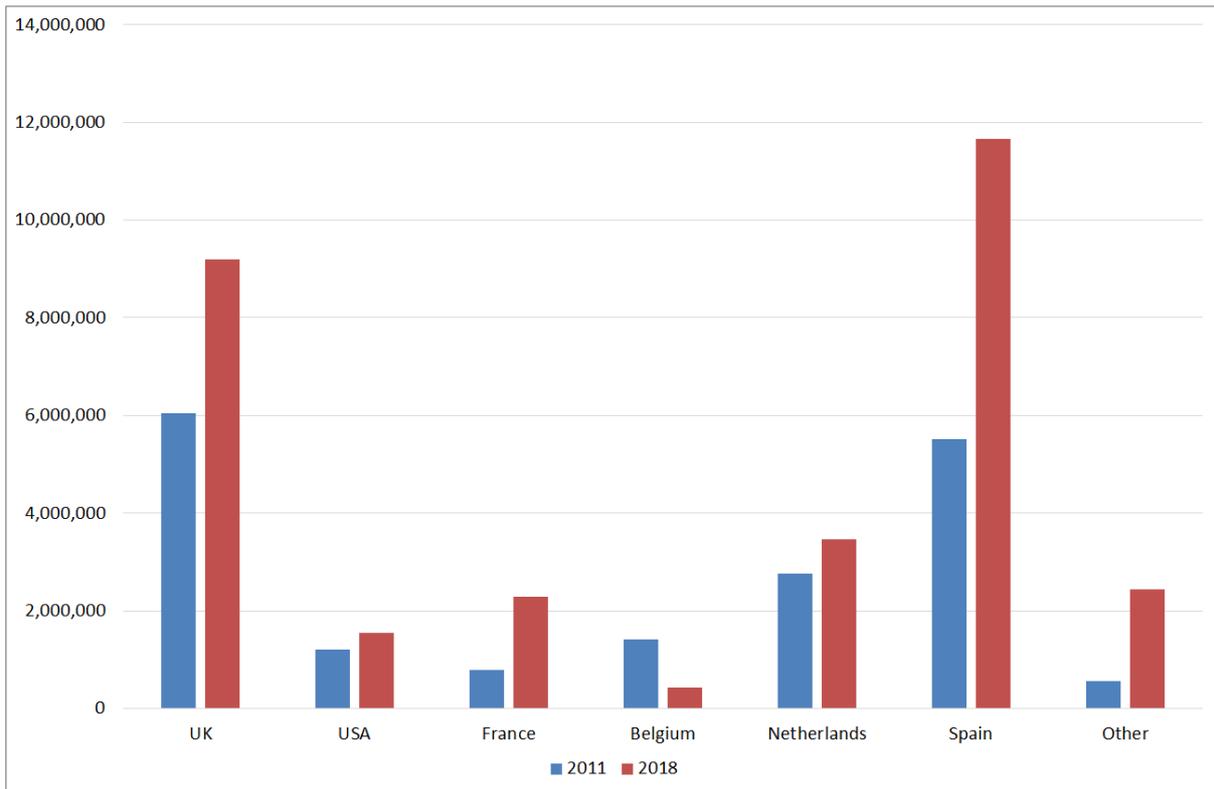


Fig A4.15 Frozen cod fillets and portions exported from Iceland 2011-2018 (kg product weight)

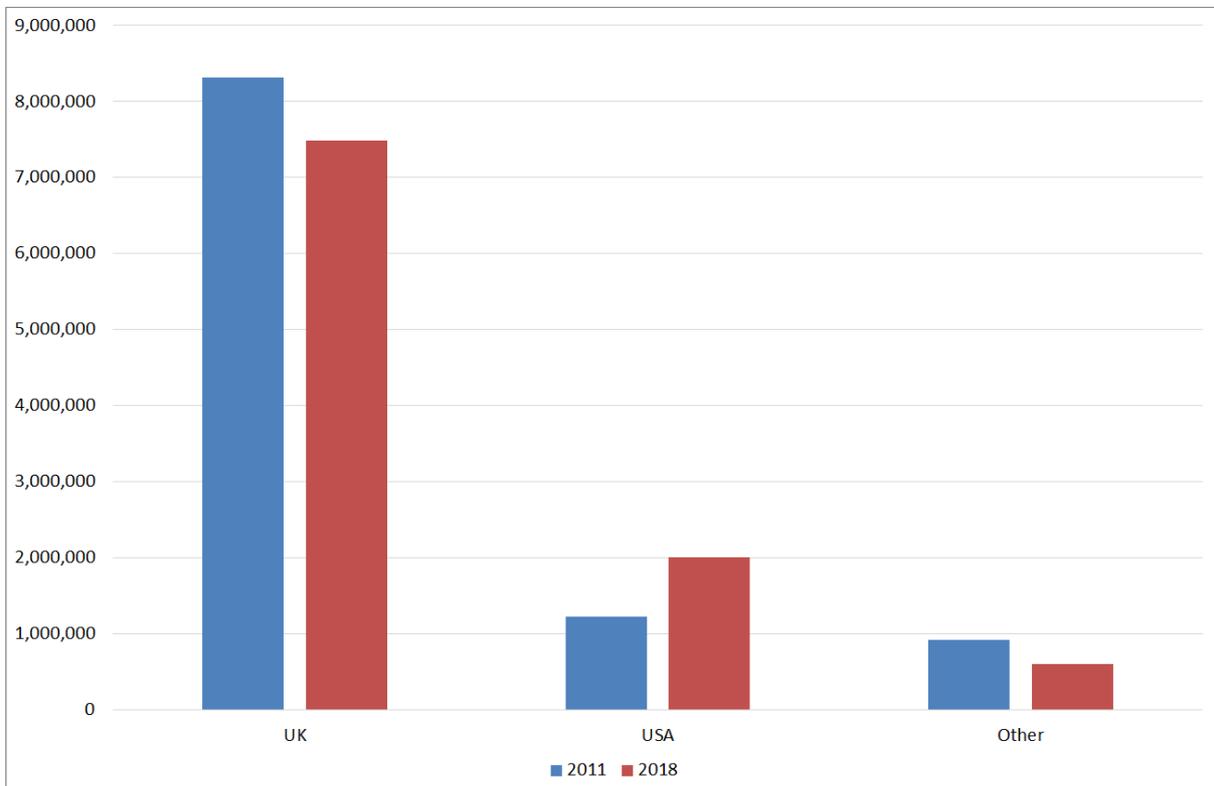


Fig A4.16 Frozen at sea cod fillets exported from Iceland 2011-2018 (kg product weight)

Appendix 5 Sterling exchange rate trends 2010-2019

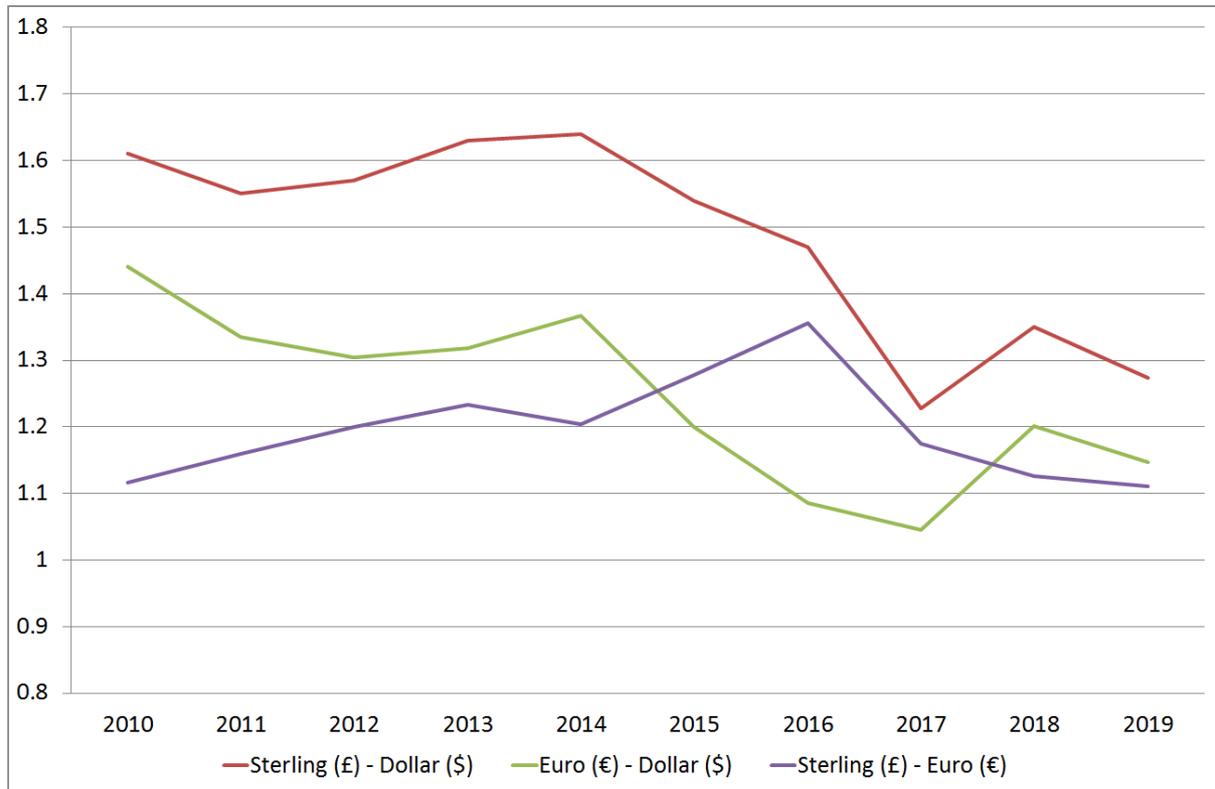


Figure A5.1 Exchange rate 2010-2019: Sterling - Dollar (£/\$); Euro – Dollar (€/\$); Sterling – Euro (£/€)

Appendix 6 Projected production and consumption to 2030 (Source; World Bank, 2013)

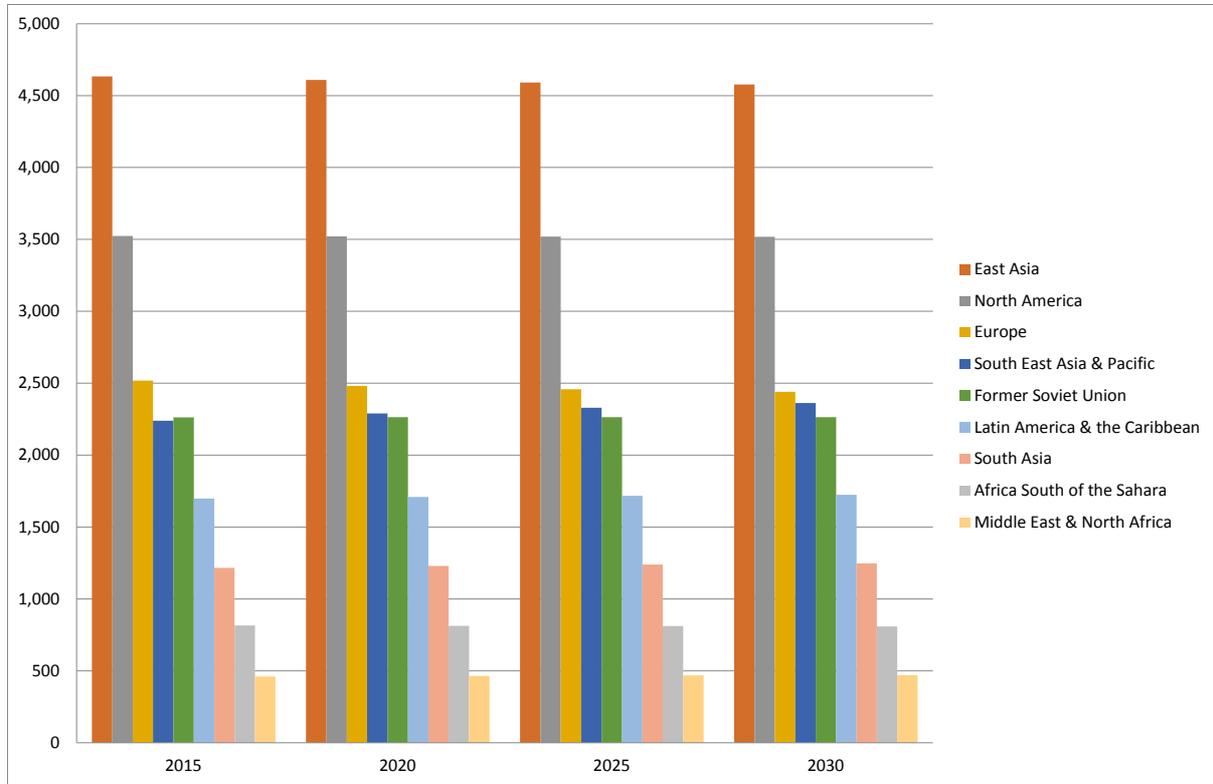


Fig A6.1 Production of demersal fish, 115 region to 2030 (units = thousands of metric tons)

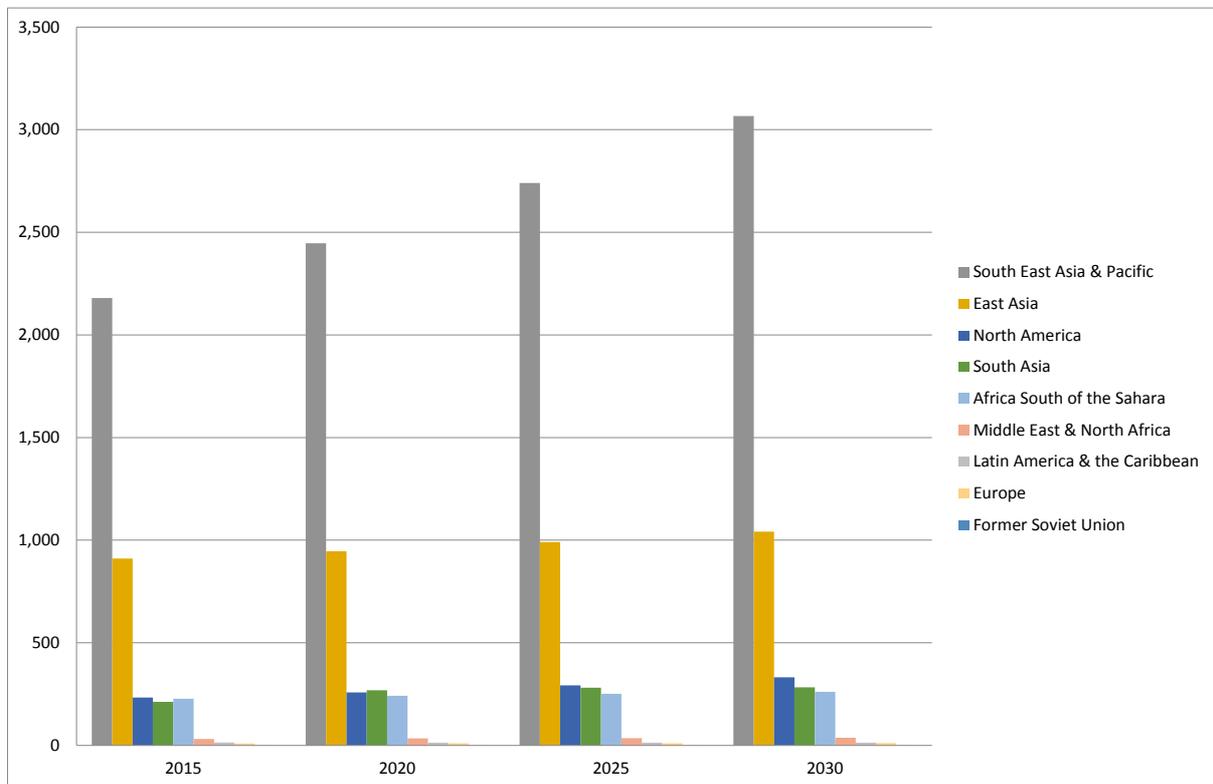


Fig A6.2 Production of pangasius, 115 region to 2030 (units = thousands of metric tons)

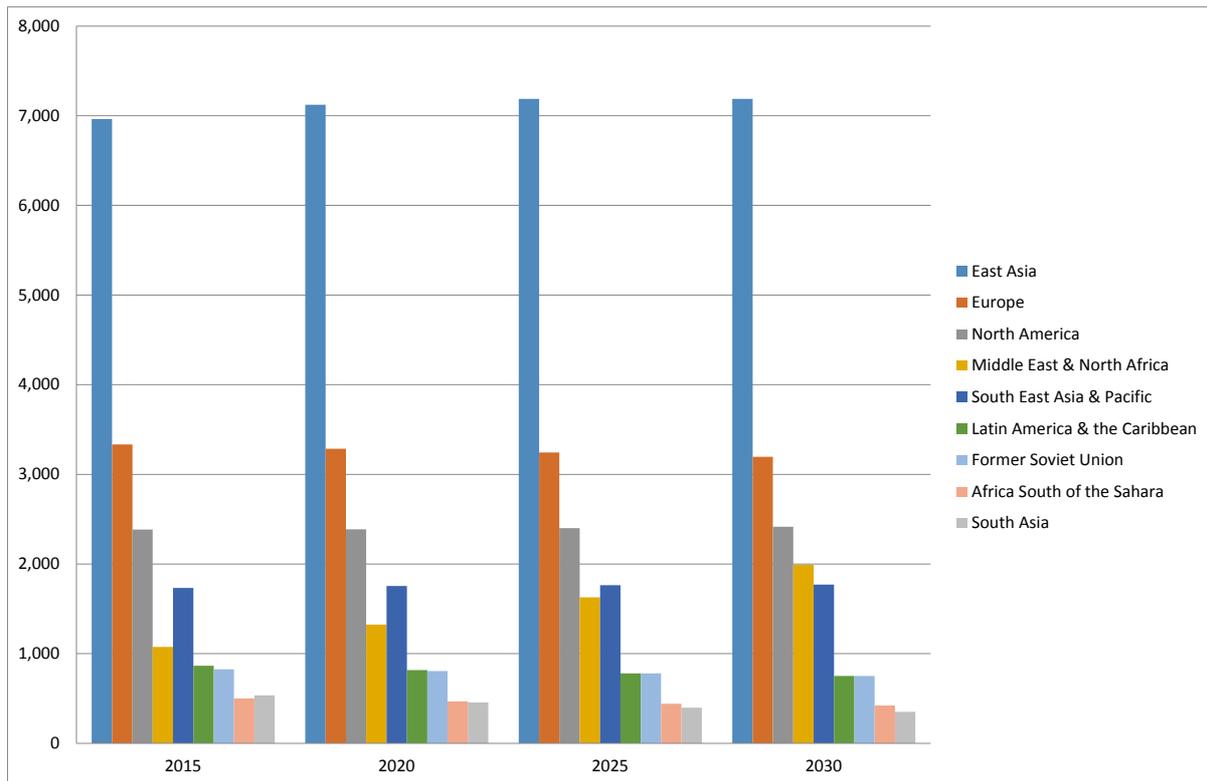


Fig A6.3 Total (including food) consumption of 'other demersal fish' by (aggregate consumption) by major region to 2030 (units = thousands of metric tons)

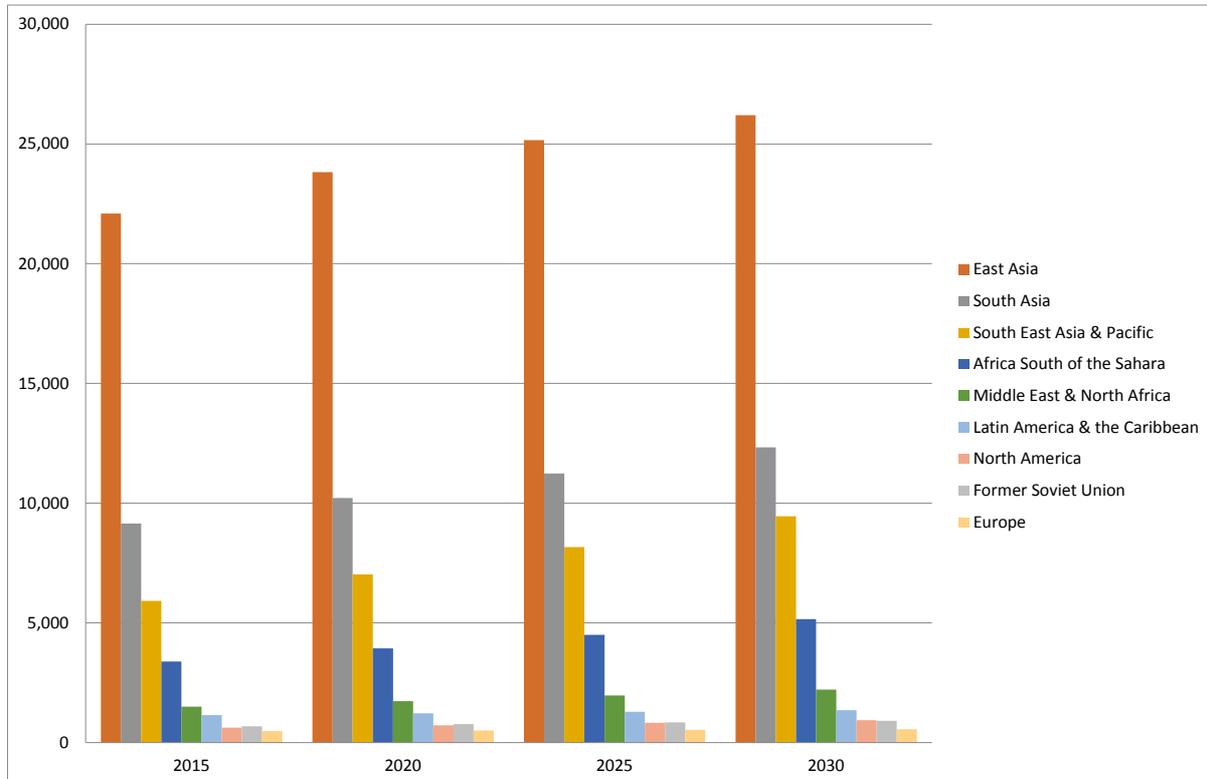
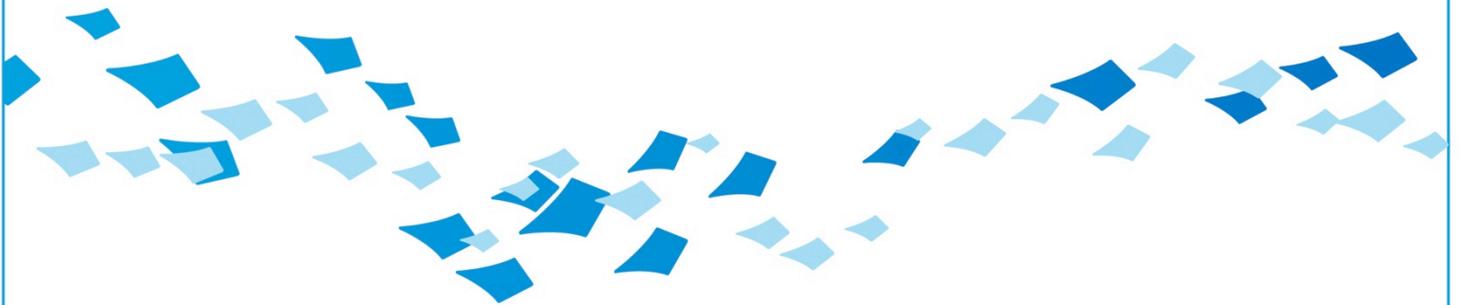
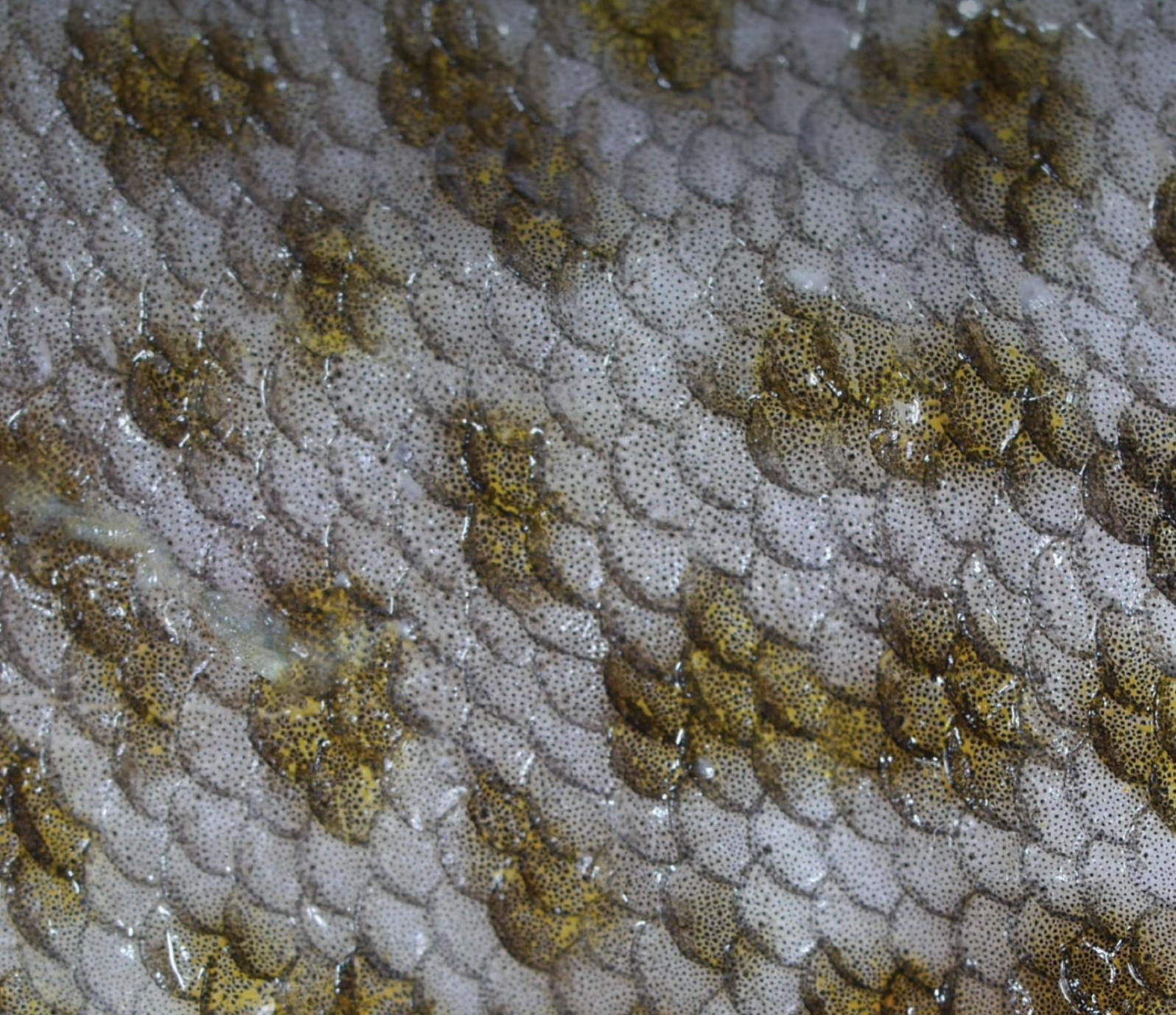


Fig A6.4 Total (including food) consumption of 'freshwater and diadromous fish' by (aggregate consumption) by major region to 2030 (units = thousands of metric tons)



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