Supporting the Economic, Social and Environmental Sustainability of the UK's Marine Sectors:

Appendices

August 2020

Scottish Government
Riaghaltas na h-Alba
gov.scot

Contents

ekosgen

Report completed/submitted by:	Richard Weaver, Jeremy Hanks, Jessica Low, James Flint, Charlie Nixon, Adam Ferguson
Proof check completed by:	Adam Ferguson
Date:	31st January 2020
Report reviewed by:	Pamela Reid
Date:	31st January 2020

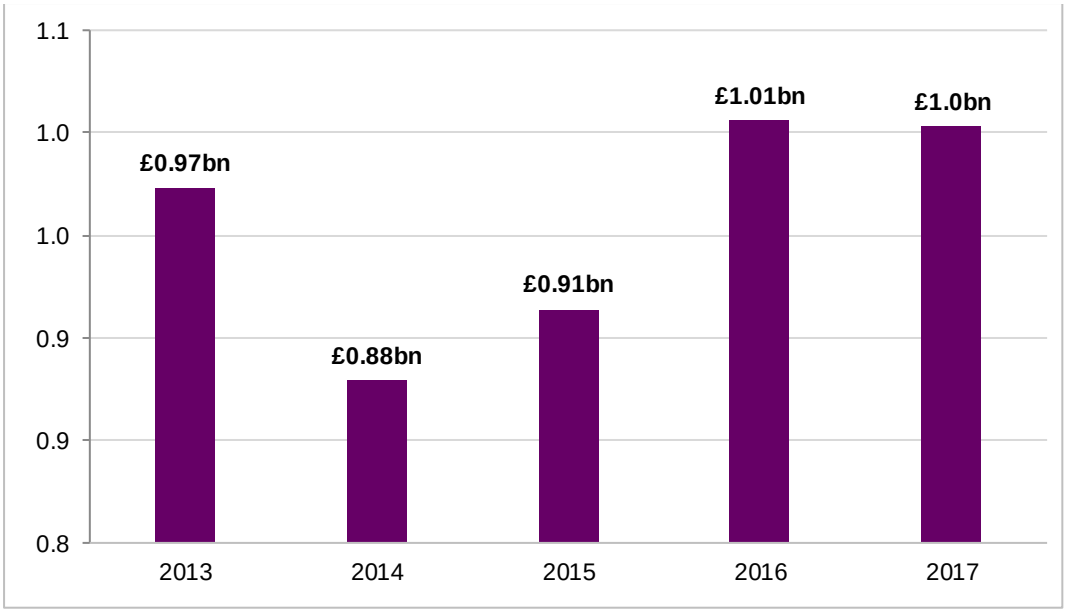
Appendix 1: Sector baseline analysis

1.1 Commercial capture fishing

1.1.1 Economic value and distribution of impacts

According to latest figures, the capture fishing industry in the UK is estimated at just over £1.0bn for 2017. Over the past five years, the sector has seen turnover growth of approximately 3.1%, but has seen significant growth since 2014 where turnover fell by 9.7% from the previous year to £0.88bn.

Figure A1.1: Commercial capture fishing – UK Turnover (£bn)[1]



Source: ONS, UK Non-Financial Business Economy Annual Business Survey: 2018

According to the latest figures from the Office of National Statistics[2], the wider fishing and aquaculture sector was valued at just under £1.5bn in 2016. The Scottish fishing and aquaculture makes up 65.8% of the sector, followed by England (27.9%); and Northern Ireland and Wales accounting for less than 1% collectively.

Over the period of 2012-2016, UK fishing and aquaculture sector turnover has grown by 55%, with Scotland witnessing the largest growth of just less than 75%. The Northern Irish fishing and aquaculture sector was the only sector to shrink over the 2012-2016 period. Across all countries, the sector shrank in 2015, with the UK turnover falling by 9.3% from the previous year. The UK capture fishing sector accounts for just less than 60% of the wider fishing and aquaculture sector with a GVA of approximately £571m in 2016.[3]

[1] This is business turnover, rather than value of landing at first sale

[2] Fishing and Aquaculture data cannot be separated.

[3] Marine Scotland: Scotland's Marine Economic Statistics (2018)

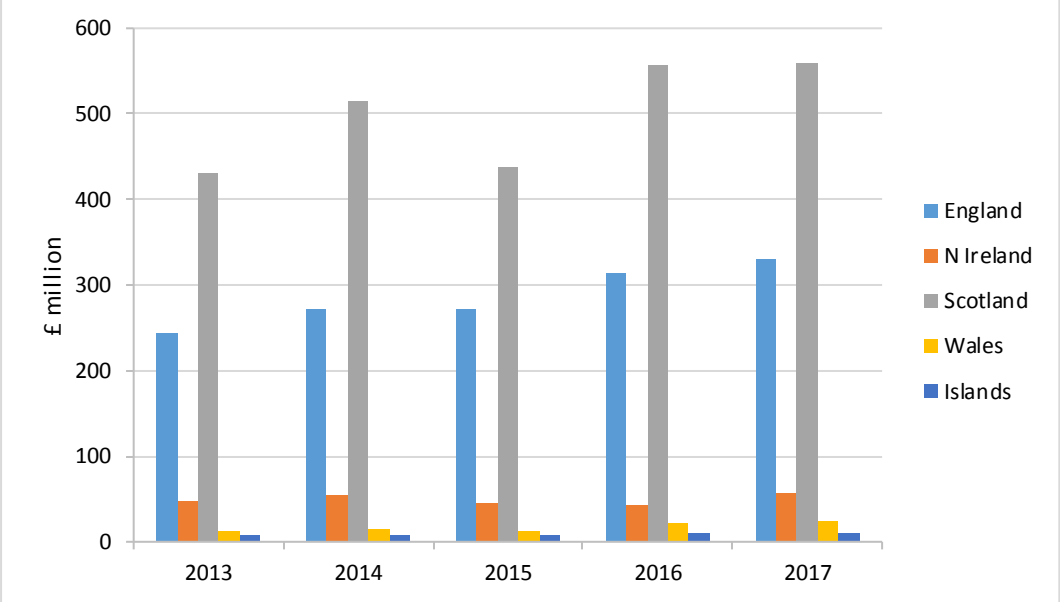
Table A1.1: Turnover, £ millions – Fishing and Aquaculture by Country

Date	UK	England	Scotland	Wales	Northern Ireland
2012	963	310	563	33	57
2013	1,089	325	666	36	62
2014	1,408	440	870	46	52
2015	1,277	386	805	39	48
2016	1,496	418	985	37	56
2012-2016 (%)	**55.3%**	**34.8%**	**75.0%**	**12.1%**	**-1.8%**

Source: ONS, Nominal and real regional gross value added (balanced) by industry (2018); Only SIC07 code 2-digit sector up to 2016 available. Fishing and Aquaculture data cannot be separated

The total value of landings by UK vessels stood at £980m in 2017, an increase of 32% on 2013 figures. In terms of tonnage, this was 724,000 tonnes, which had increased by 16% on 2013 landings. Scottish vessels account for the greatest share of landings in terms of tonnage (64%) and value (57%).

Figure A1.2: Landings into the UK and abroad by UK vessels: value, 2013 to 2017

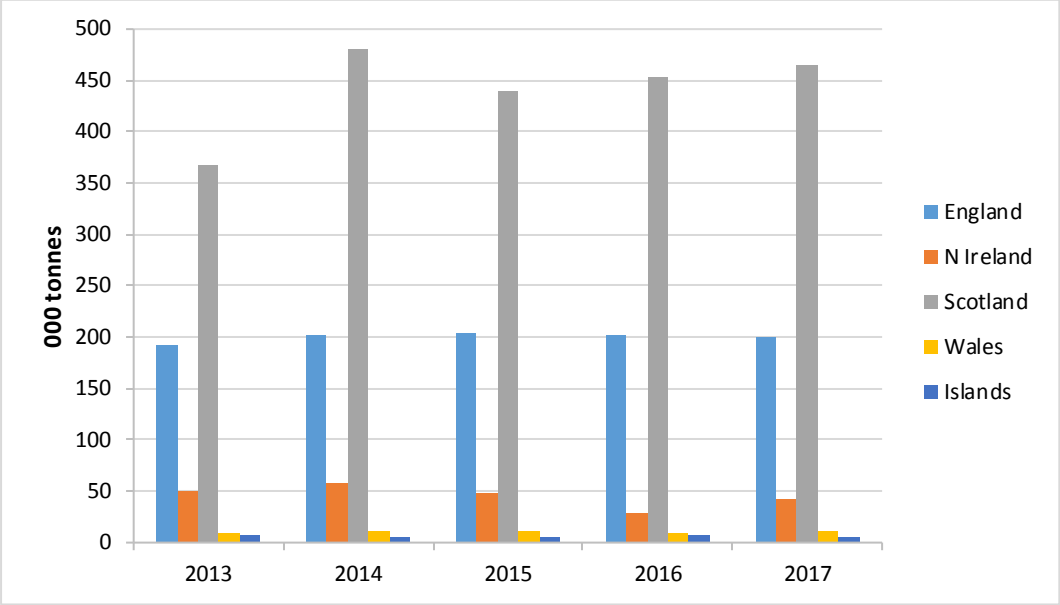


MMO (2018) UK Sea Fisheries Statistics, 2017

Of fish landings into UK ports, the Scottish ports of Peterhead, Lerwick and Fraserburgh account for a significant proportion. Just over 50% of the 434,057 tonnes landed at UK ports was landed at these ports, which represented 35% of the total value of £720.7m.

In terms of total landings by UK vessels both in the UK and abroad, Scottish vessels accounted for 64% of the total tonnage, and 57% of value of landings in 2017 (465,820 tonnes; £560.5 million). English vessels accounted for just under 200,000 tonnes (28%), worth £330.5 million (34%).

Figure A1.3: Landings into the UK and abroad by UK vessels: tonnage, 2013 to 2017

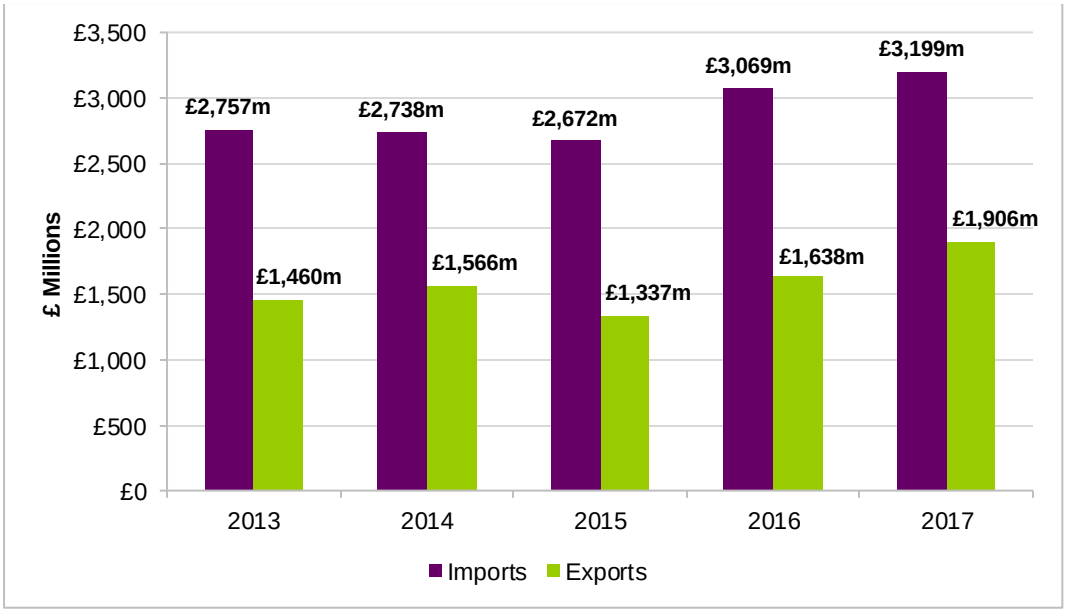


MMO (2018) UK Sea Fisheries Statistics, 2017

1.1.2 Trade

The UK fishing sector had a net import value of £1,293m in 2017. Fishing exports grew by 30% between 2015 and 2017, rising to £1,906m from £1,337m. Imports also grew over the same time period, albeit by around half the growth of exports, at growth rate of 16%.

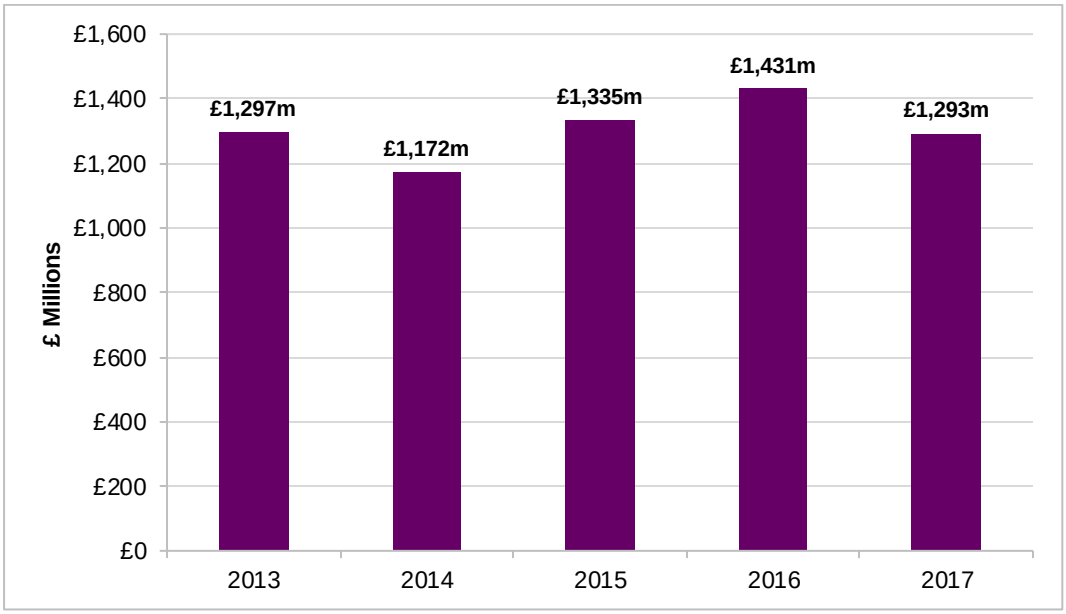
Figure A1.4: Fishing – UK Imports and Exports (£m)



Source: UK Sea Fisheries Statistics, 2017

Net fishing imports totalled £1,293m in 2017, with the trade deficit having remained largely the same since 2013 (when it was £1,297m). However, following a period of deficit growth between 2014 and 2016, the trade deficit decreased by 10% between 2016 and 2017 (falling from £1,431m).

Figure A1.5: Fishing - Net Imports (£m)



Source: UK Sea Fisheries Statistics, 2017

Vessels containing all types of sea fish (demersal, pelagic, and shellfish) landing into the UK (imports) totalled approximately 696m tonnes in 2018, a decline of 3.9% from the previous year. Furthermore, the value of fish sold from the UK has increased by 3% to just over £1bn in 2018.[4]

UK vessels landing abroad for all seafood types accounted for approximately 272m tonnes in 2018, which has also declined by 6.2% from the previous year, valued at approximately £273m. Landings predominantly pelagic fish (herring, mackerel) which account for approximately 83% of vessel quantity and 65% of vessel value.

1.1.3 Business base and employment

Data for the number of businesses in the capture fishing and aquaculture sectors were obtained from the data gathered by the ONS Non-Financial Business Economy Annual Business Survey. In 2017, the UK fishing and aquaculture industry contained approximately 3,515 businesses. Just under half of these businesses were based in Scotland, with a further 41% registered in England.

The UK capture fishing sector is purely micro and small-sized businesses, and is predominantly microbusinesses who account for 97.7% of the sector. As such, more than one-third of businesses in the fishing sector turnover less than £49,000 per year. Eighty-two percent of fishing businesses in the UK are estimated to have a turnover of less than £200,000.

Between 2012 and 2017, the number of businesses in the UK fishing industry grew by 4.1%. The highest level of growth was seen in Scotland (6.1%) followed by;

[4] ONS, Marine Management Organisation Provisional Results: Monthly UK Sea Fisheries Statistics, Reported Landings December 2018.

England (3.6%) followed by no change in wales and a decline in Northern Ireland (-2.9%).

Table A1.2: Business base – Commercial capture fishing by country

Date	UK	England	Scotland	Wales	Northern Ireland
2012	3,375	1,390	1,635	170	175
2013	3,405	1,435	1,635	175	165
2014	3,435	1,450	1,650	175	165
2015	3,450	1,460	1,655	180	155
2016	3,480	1,455	1,690	170	165
2017	3,515	1,440	1,735	170	170
2012-2017 (%)	**4.1%**	**3.6%**	**6.1%**	**0%**	**-2.9%**

Source: ONS, UK Non-Financial Business Economy Annual Business Survey (2018)

The UK capture fishing sector in the UK employs just under 6,500 employees, declining by approximately 8% between 2012 and 2017. This is predominantly from employees situated in England or Scotland, who account for approximately 85.6% of the sector employment base. Over the 2012-2017 period, the English capture fishing sector grew by 7.1%%, equating to approximately 125 new employees, whereas the Scottish sector over the same time period saw a decline in the employment base of 11.8%, equating to a loss of approximately 500 employees.

Table A1.3: Employment base – Commercial capture fishing by country

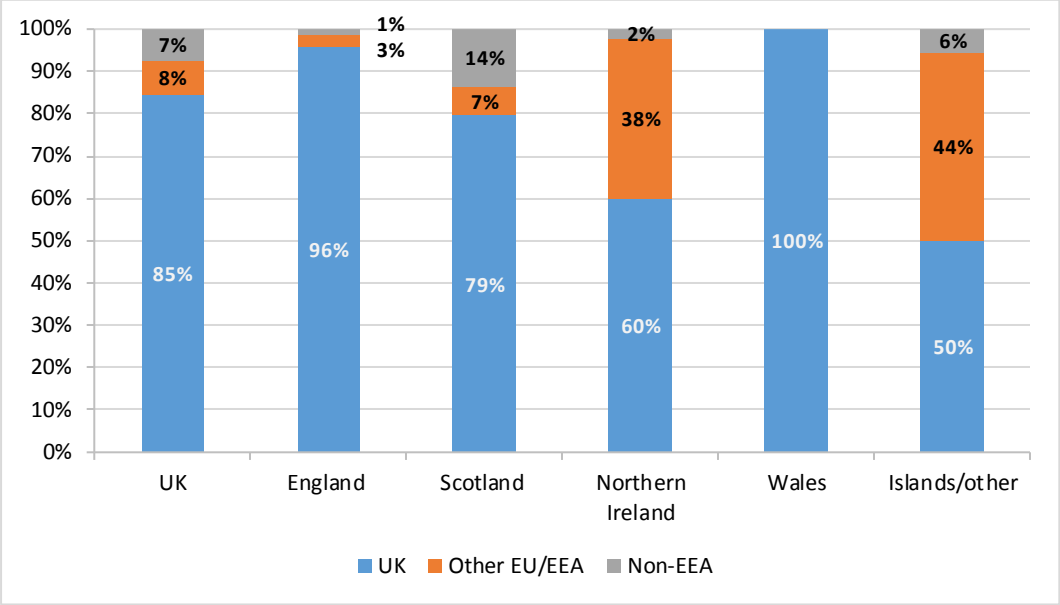
Date	UK	England	Scotland	Wales	Northern Ireland
2012	7,012	1,750	4,250	375	637
2013	5,838	1,750	3,250	210	628
2014	6,620	2,000	3,750	400	470
2015	5,874	2,375	2,500	240	759
2016	7,828	3,250	3,750	350	478
2017	6,499	1,875	3,750	200	624
2012-2017 (%)	**-8.0%**	**7.1%**	**-11.8%**	**-46.7%**	**-2.0%**

Source: ONS, UK Non-Financial Business Economy Annual Business Survey: 2018; Annual Business Inquiry[5] (2013-2017)

According to Seafish data, nearly 85% of fleet workers are from the UK. However, this varies by country: in Scotland, the proportion is lower at 79%, but around 14% of workers are from outside the EEA. In Northern Ireland, around 40% of workers are non-UK, with most coming from elsewhere in the EU.

[5] The Annual Business Inquiry sample is designed at an industry section level, so large year on year changes may occur when broken down by SIC3 level

Figure A1.6: Commercial capture fishing workers by nationality



Source: Seafish (2019) 2018 Employment in the UK Fishing Fleet

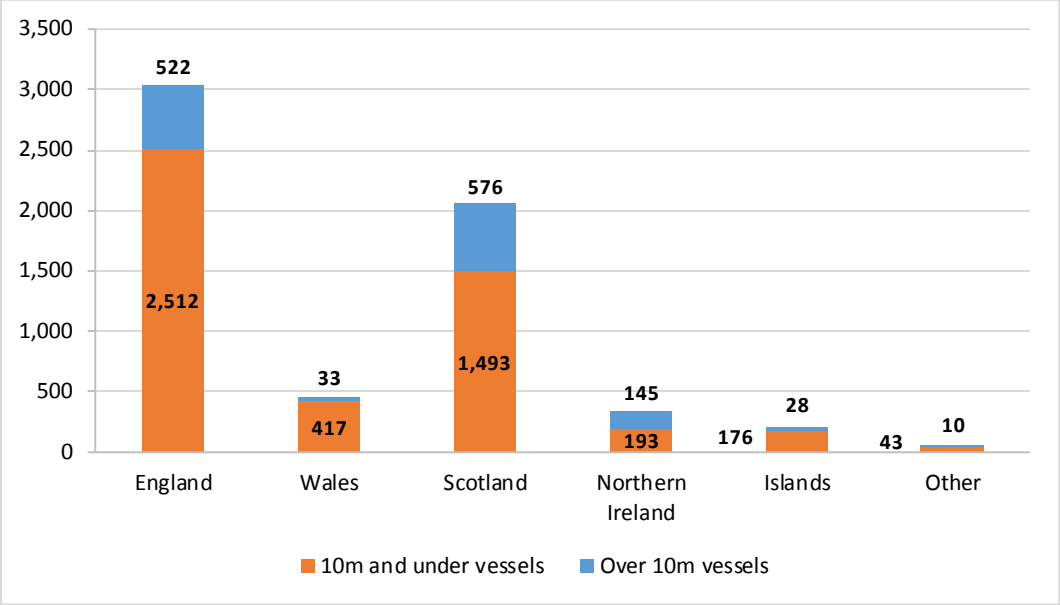
In 2017 the UK had 6,148 registered fishing vessels, 43 fewer than the previous year. There was an overall decrease in vessels across the UK by just under 4% since between 2014 and 2017, however the number of registered Scottish vessels had increased by just over 1% during the same time period (rising to 2,069).

Table A1.4: Fishing fleet – Commercial capture fishing: vessels by country

Date	UK	England	Scotland	Wales	Northern Ireland
2014	6,383	3,218	2,046	466	368
2015	6,187	3,139	2,007	444	349
2016	6,191	3,098	2,031	451	351
2017	6,148	3,034	2,069	450	338
2014-2017 (%)	**-3.8%**	**-6.1%**	**1.1%**	**-3.6%**	**-8.9%**

Source: MMO UK Sea Fisheries Statistics (2017)

Figure A1.7: Size of the UK fishing fleet, by country[6]



MMO (2018) UK Sea Fisheries Statistics, 2017

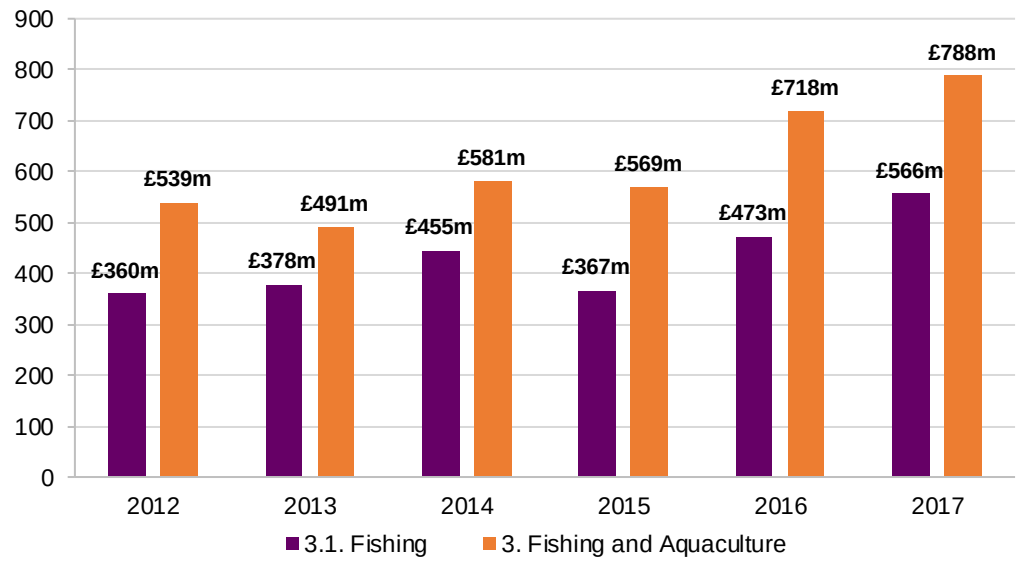
1.1.4 GVA and labour productivity

The GVA of the wider UK fishing and aquaculture sector for 2017 was estimated to £788m[7], a growth of 46% since 2012. The Scottish fishing and aquaculture sector accounts for 59% of the UK sector, followed by England (31.2%), Northern Ireland (6.7%), and Wales (3.1%). The Scottish fishing and aquaculture sector has grown by more than 54% since 2012, the strongest sector growth out of all countries in the UK and equivalent to an increase in GVA of approximately £164m. Growth in the English, Welsh, and Northern Irish sectors are all below the UK average.

[6] Islands include Guernsey, Jersey and Isle of Man. Other typically includes new vessels, or vessels switching port of administration.

[7] Based on ONS data. MMO Fisheries statistics for 2017 estimates UK Fisheries sector GVA at £795m

Figure A1.8: Fishing and Aquaculture - UK GVA (£m)



Source: ONS GVA Statistics, Annual Business Survey (2018)

According to latest figures from the Office of National Statistics, the UK fishing sector has an estimated GVA of £556m, equivalent to just over 70% of GVA in the wider fishing and aquaculture sector. Despite a 17.5% fall in GVA in 2015, the UK fishing sector has seen a significant growth over the past five years, rising by 54.4%. In 2016, 63% of GVA for the fishing sector was generated from the Scottish sector, accounting for £296m.[8]

Table A1.5: GVA, £ millions – Fishing and Aquaculture by country

Date	UK	England	Scotland	Wales	Northern Ireland
2012	539	176	302	20	41
2013	491	146	289	14	42
2014	581	180	339	18	44
2015	569	190	316	18	45
2016	718	230	417	24	47
2017	788	246	466	23	53
2012-2017 (%)	**46.2%**	**39.8%**	**54.3%**	**15.0%**	**29.3%**

Source: ONS GVA Statistics (2018)

GVA per worker[9] in the English fishing and aquaculture sector was just less than £103,600 in 2017, an increase of 25% since 2012. Likewise, the Scottish fishing and aquaculture sector saw a significant increase of 38% over the same time period,

[8] Marine Scotland: Scotland's Marine Economic Statistics (2018)

[9] Based on ONS data. Estimated GVA per head based on MMO Fisheries statistics for 2017 is approximately £68,000.

rising to £98,105. These figures are in stark contrast to the Scotland's Marine Economic Statistics report which identified GVA per worker was £61,344 in 2016.[10]

Table A1.6: GVA per worker, £ – Fishing and Aquaculture by country

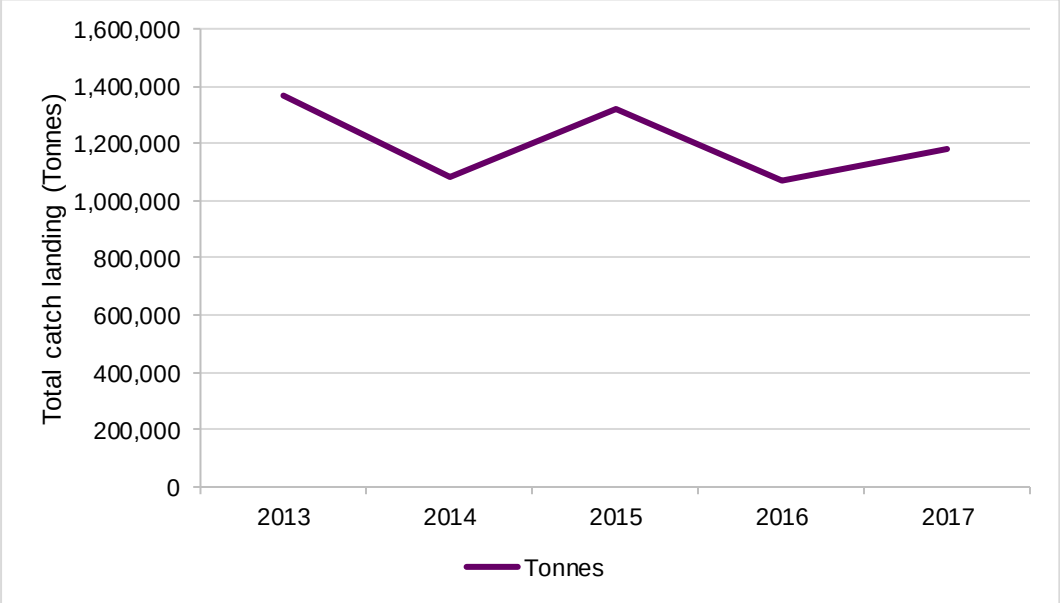
Date	UK	England	Scotland	Wales	Northern Ireland
2012	-	£82,824	£71,059	£72,727	-
2013	-	£73,000	£77,067	£60,870	-
2014	-	£80,000	£75,333	£32,727	-
2015	-	£63,333	£84,267	£105,882	-
2016	-	£70,769	£87,789	£56,471	-
2017	£104,454	£103,579	£98,105	£121,053	£231,441
2012-2017 (%)	**-**	**25.1%**	**38.1%**	**66.5%**	**-**

Source: Annual Business Survey, ONS GVA Statistics, Open data NI (2018); Only SIC07 code 2-digit sector up to 2016 available. Only 2017 figures available for Northern Ireland; UK figures a sum of the corresponding countries

1.1.5 Competitor comparison: commercial capture fishing in Iceland and Norway

Though it has been overtaken by tourism in terms of importance to the Icelandic economy, fishing remains an important sector in Iceland. Total catch in Iceland in 2017 amounted to 1.18 million tonnes. This represented a decrease of 14% since 2013, when total catch by weight totalled 1.37 million tonnes.

Figure A1.9: Total catch by weight (tonnes), Iceland, 2013-17

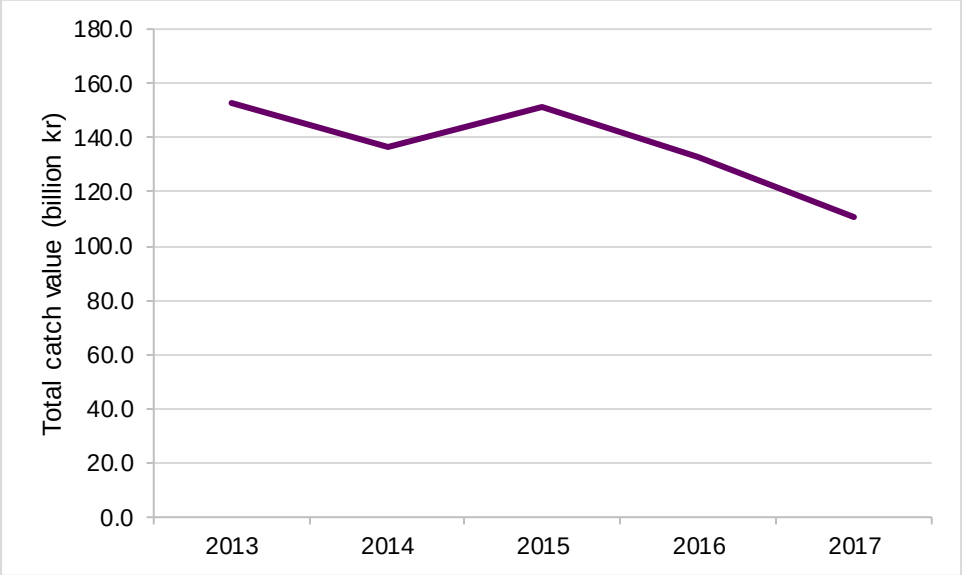


Source: Statistics Iceland, 2019

By value, the Icelandic fleet landed almost Kr 111 billion in 2017, though this represented a decrease of around 17%.

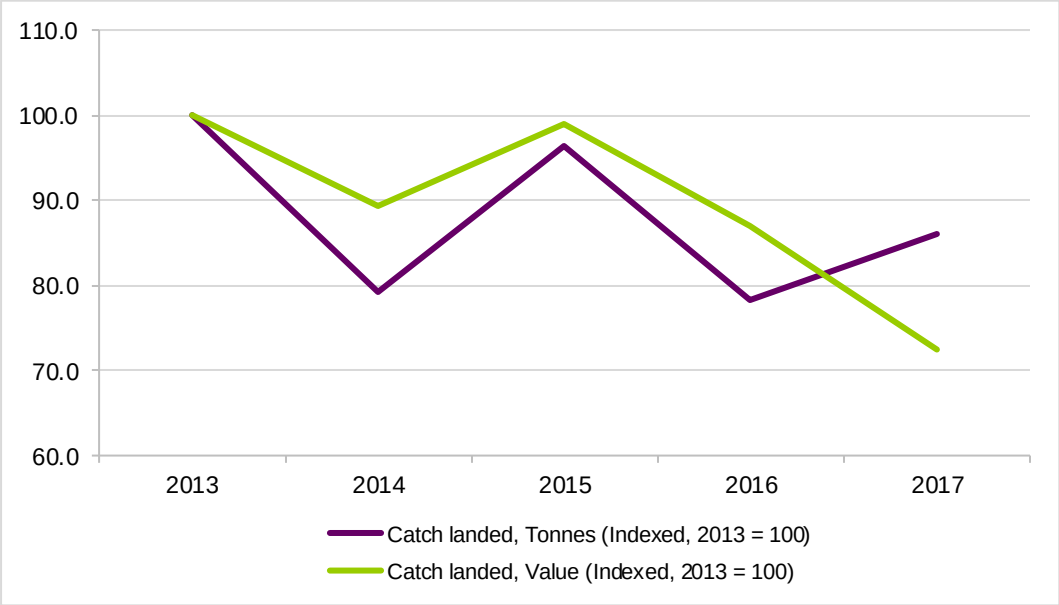
[10] Marine Scotland: Scotland's Marine Economic Statistics (2018)

Figure A1.10: Total catch by value (Kr), Iceland, 2013-17



Source: Statistics Iceland, 2019

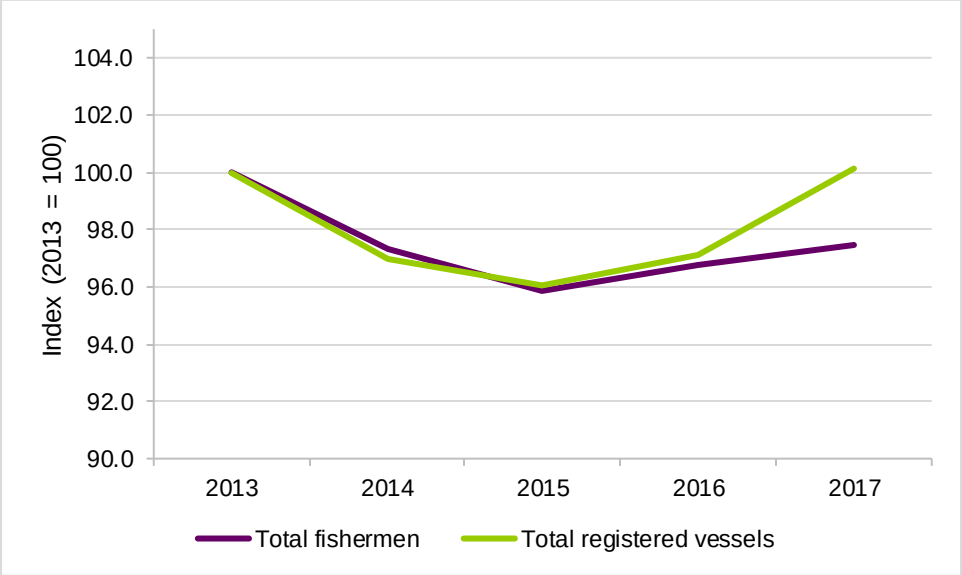
Figure A1.11: Total catch (indexed), value and weight, 2013-17



Source: Statistics Iceland, 2019

Norway's fishing workforce has decreased in recent years. Between 2013 and 2017, it decreased 2.5% from 11,611 to 11,320, whilst its fleet saw no overall change.

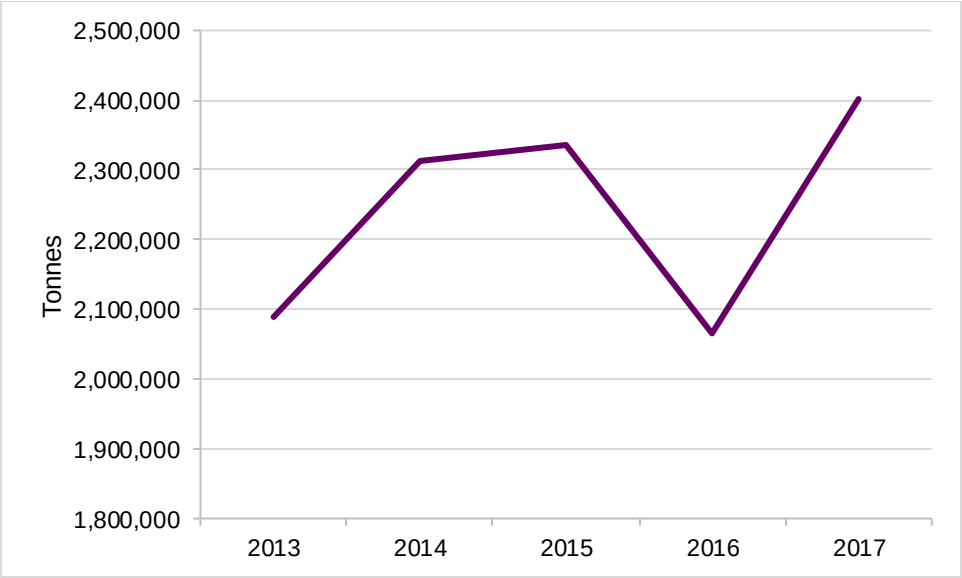
Figure A1.12: Workforce and fleet in Norwegian fisheries (indexed), 2013-17



Source: Directorate of Fisheries, Norway, 2019

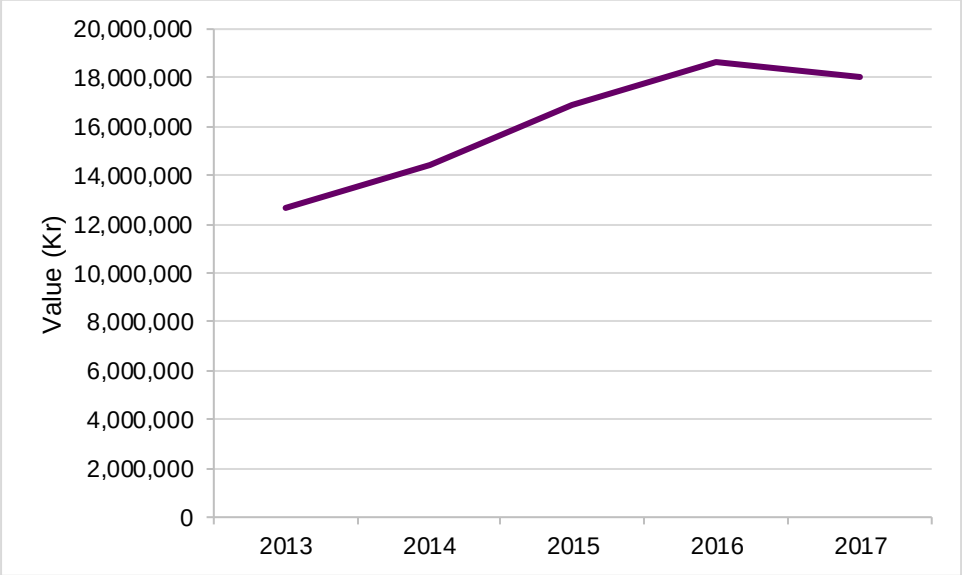
The total tonnage landed by the Norwegian fleet increased 15% to 2.4 million tonnes between 2013 and 2017, with a corresponding increase in value of almost 43%, to over Kr 18 million.

Figure A1.13: Total catch by weight (tonnes), Norway, 2013-17



Source: Directorate of Fisheries, Norway, 2019

Figure A1.14: Total catch by value (Kr), Norway, 2013-17



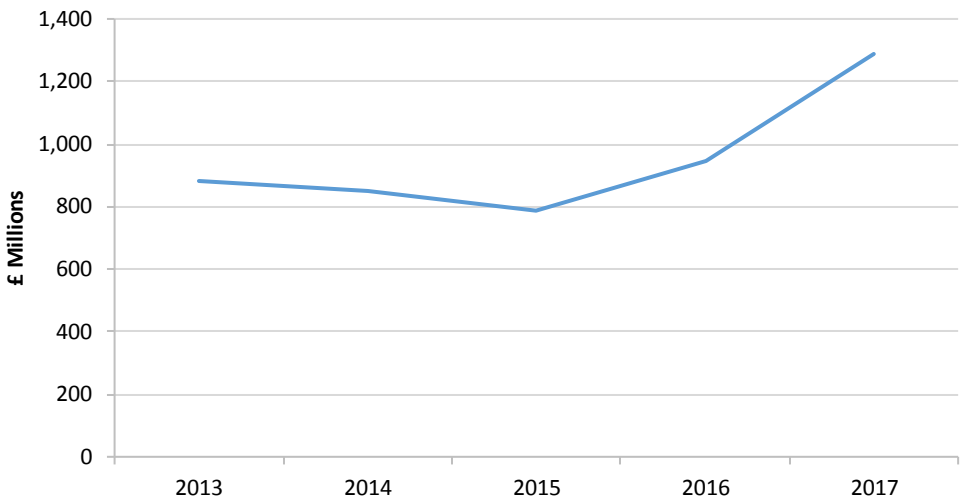
Source: Directorate of Fisheries, Norway, 2019

1.2 Aquaculture

1.2.1 Economic Value and Distribution of Impacts

The turnover of the Aquaculture sector in the UK was estimated at £1.3bn for 2017. However, the economic impact of the industry could support nearly £2bn[11] of turnover more widely in Scotland's economy as well as several thousand Scottish jobs.[12] There has been very significant growth (47%) since 2013 and this has been particularly concentrated in the period from 2016 to 2017 when turnover grew by £343m or 36%.

Figure A1.15: Turnover of UK Aquaculture sector, 2013-2017



Source: ONS, UK Non-Financial Business Economy Annual Business Survey: 2018

Within the UK Scotland is a particularly important area for the Aquaculture industry. As shown at Figure A1.6, turnover of Scottish aquaculture more than doubled between 2012 and 2016, based on SABS data. As with the UK as a whole, growth was particularly concentrated in the later period with an increase of £137m or 27% between 2015 and 2016. In contrast, based Marine Scotland data, the sector's growth was lower but still significant, and the scale of turnover is estimated to be greater overall. Given its size compared to the UK as a whole, Scotland accounts for a disproportion amount of Aquaculture turnover, reflecting its strength in the industry. By 2016 Scottish Aquaculture turnover amounted to £797m according to Marine Scotland estimates[13], around 84% of that of the UK as a whole, despite accounting for just 8% of the UK population.[14]

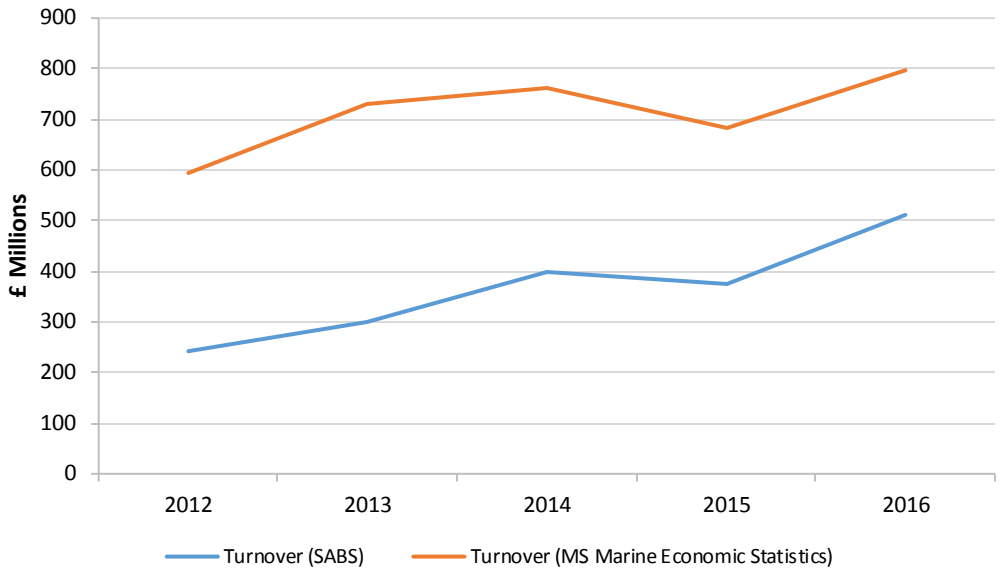
[11] IT should be noted that this figure also includes indirect and induced impacts

[12] https://d178ivhysawugh.cloudfront.net/1556530716/salmon-impact.pdf

[13] https://www.gov.scot/publications/scotlands-marine-economic-statistics/pages/7/

[14] In contrast to SABS, the Marine Scotland Marine Economic Statistics draws on Marine Scotland Aquaculture Survey statistics Shellfish Production Survey and Fish Farm Production Survey, and Cefas Data Collection Framework (DCF) economic data to calculate business bae, employment, turnover and GVA

Figure A1.16: Turnover of the Scottish Aquaculture sector, 2012-2016



Source: SABS, 2019; Marine Scotland, 2018

Data is not available for turnover in the Aquaculture sector for the other countries in the UK. However, Table A1.7 shows the turnover for the Fishing and Aquaculture sectors. This again indicates the strength of the Scottish sector, which accounted for nearly two thirds (66%) of the total UK turnover in 2016. This was followed by England (28%), Northern Ireland (4%) and finally Wales (2%). Scotland also had by far the highest rate of turnover growth from 2012 to 2016, at 75%. This was followed by England (35%). Accordingly, Scotland accounted for 79% of the total growth in UK Fishing and Aquaculture turnover between 2012 and 2016.

Table A1.7: Turnover (£million) of the Fishing and Aquaculture sector, 2012-2016

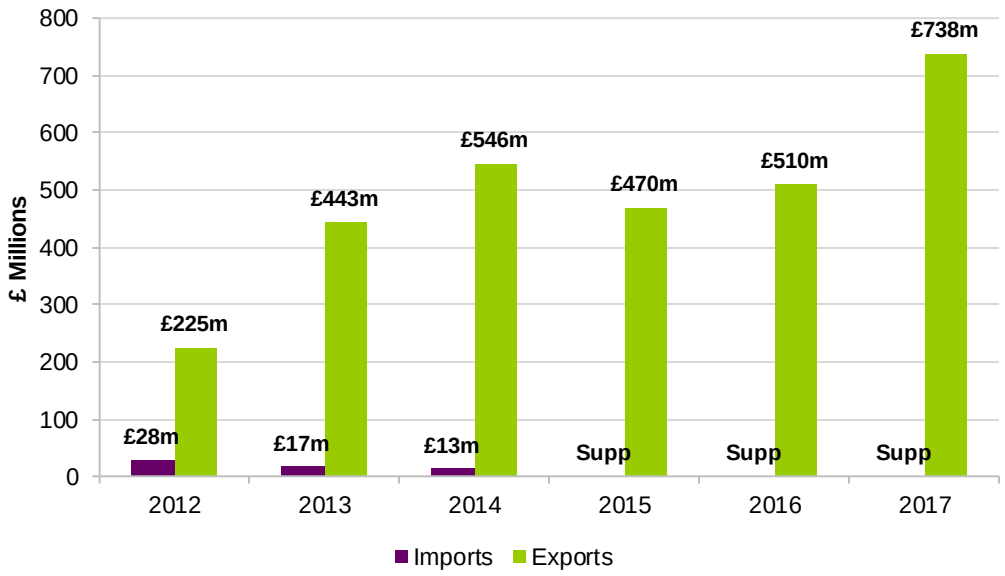
Date	UK	England	Scotland	Wales	Northern Ireland
2012	963	310	563	33	57
2013	1,089	325	666	36	62
2014	1,408	440	870	46	52
2015	1,277	386	805	39	48
2016	1,496	418	985	37	56

Source: ONS, Nominal and real regional gross value added (balanced) by industry (2018)
Only SIC07 code 2-digit sector up to 2016 available

1.2.2 Trade

Figure A1.17 shows the value of Fishing and Aquaculture exports and imports (data for Aquaculture on its own was not available) for the UK from 2012 to 2017. After a fall from 2014 to 2015, exports rose again to a high of £510m in 2016 and higher still in 2017 to £738m. This represents an overall growth of £513m or 228% from 2012 to 2017. However, much of this growth took pace from 2012 to 2013, when exports grew by £218m to £443m, and from 2016 to 2017, where growth was £228m. Import values have been declined since 2012, falling from £28m to £13m in 2014. Import figures for the years 2015 to 2017 are suppressed.

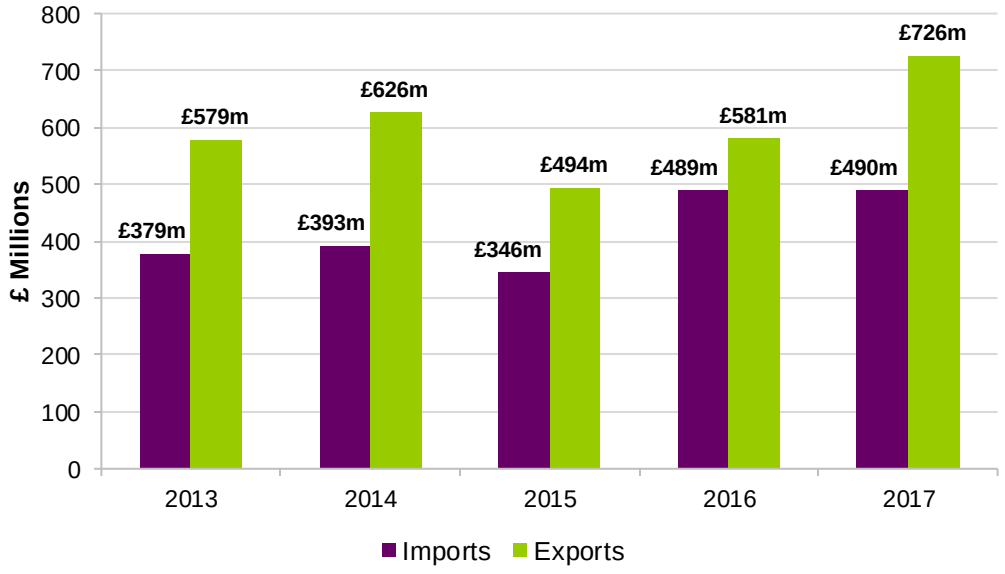
Figure A1.17: Fishing and Aquaculture export and import values (UK), 2012-2017



Source: ONS, UK Trade in Goods by Industry, Country, and Commodity (2019)

Data for salmon imports is available, with imports valued at £490m in 2017 and exports valued at £726m (as shown in Figure A1.18), amounting to a trade surplus of £236m. Despite a 12% decline in 2015, import value has increased over the last five years, rising from £379m in 2013 (an increase of 23%). Export value has also increased over the same time period (despite a fall in value of 21% in 2015), increasing by 20% since 2013.

Figure A1.18: Salmon export and import values (UK), 2013-2017

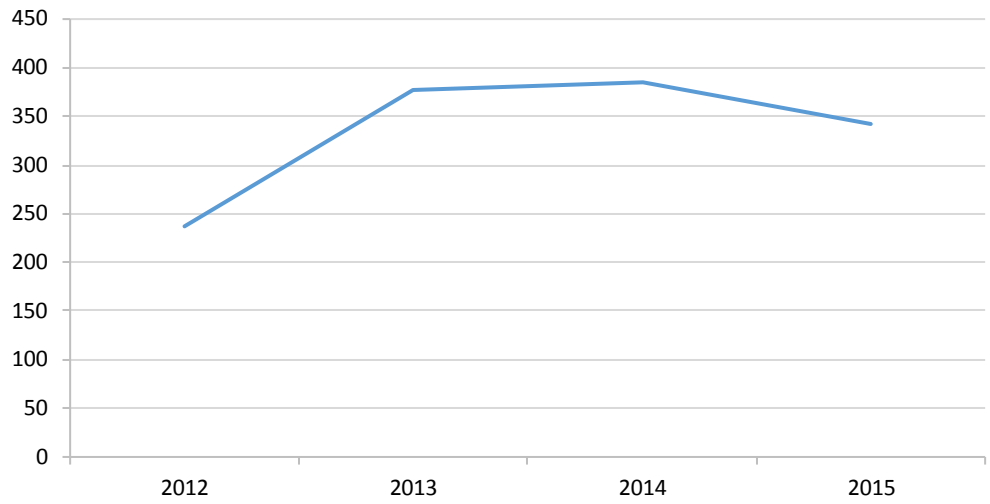


Source: MMO UK Sea Fisheries (2017)

As shown at Figure A1.19, reflecting the increasing export value, UK net exports grew considerably from 2012 to 2014, with an increase of £148m or 62%. As a result

of a lower export value, there was a slight decrease in 2015, but given the growth in export values it is likely this increased in 2016.

Figure A1.19: Fishing and Aquaculture net export value (UK), 2012-2015



Source: ONS, UK Trade in Goods by Industry, Country, and Commodity (2018)
Note: Data for 2016 and 2017 suppressed

1.2.3 Business base and employment

Data from UK Business Counts (Table A1.8) indicates that in 2018 there were 435 Aquaculture businesses in the UK. From 2013 to 2018 the number of Aquaculture businesses in the UK grew by 4%. Somewhat surprisingly given Scotland's economic dominance of the sector, England accounted for the majority of businesses at 54%, followed by Scotland (34%, though Scotland is highly consolidated), Northern Ireland (7%) and finally Wales (5%). However it should be noted that Scotland still accounted for a disproportionately high number of businesses given its population size, and that Scotland's economic dominance of UK Aquaculture is likely due to the fact that Scotland is the only country in the UK in which medium and large Aquaculture businesses are based.

Overall Aquaculture businesses in the UK tend to be micro and small sized (98%), with just five medium and five large sized companies in operation. Reflecting this, 43% of UK Aquaculture businesses had a turnover of less than £100,000 in 2018 and 83% had a turnover less than £500,000. All ten UK Aquaculture businesses with a turnover greater than £10m were based in Scotland.

Table A1.8: Aquaculture businesses in the UK, 2014-2018

Date	UK	England	Scotland	Northern Ireland	Wales
2014	420	235	140	25	20
2015	445	245	150	25	25
2016	450	255	145	30	20
2017	430	240	140	25	20
2018	435	235	150	30	20

Source: UK Business Counts (2018)

As well as the UK Business Counts, Marine Scotland also collects data on the Aquaculture business base in Scotland through its annual survey of Finfish and Shellfish production. There were 210 Aquaculture businesses operating in Scotland in 2017, representing a small decrease from 214 in 2013 (Table A1.9). This decrease is for the most part due to a fall in the number of Shellfish and Atlantic salmon (both producing and non-producing businesses). The decrease would be more significant (23 businesses or 11%) if it were not due to the fact that 2017 is the only year in which data on businesses producing other species is available.

By species, shellfish accounts for the largest number of businesses, at 63%. This is likely due to the fact that is a large number of small producers working within Shellfish. Conversely, actively producing Atlantic salmon businesses account for just 4% of all Aquaculture businesses, reflecting the fact that there is a small number of large businesses working in this area.

Table A1.9: Aquaculture businesses in Scotland by species, 2013-2017

Species	2013	2014	2015	2016	2017
Shellfish (authorised and active)	142	144	144	138	132
Atlantic salmon: ova and smolts	27	26	25	26	24
Rainbow trout	24	24	24	24	23
Atlantic salmon: producing	15	11	10	10	8
Atlantic salmon: non-producing	6	7	6	5	4
Other species[15]	-	-	-	-	19
Total	**214**	**212**	**209**	**203**	**210**

Source: Marine Scotland (2018)
Scottish Shellfish Farm Production 2017 and Scottish Fish Farm Production 2017

In 2017 there were 3,249 people employed in the Aquaculture sector in the UK (Table A1.10). This represents a decrease of 256 or 7%, despite the fact that 2017 is the only year in which data is available for Northern Ireland. There has been a particularly significant decrease in Aquaculture employment in England, which has fallen by 425 in absolute terms and 31% proportionally. Aquaculture employment in Wales also fell substantially from 2016 to 2017, at 47%, representing a fall of 70 employees. On the other hand Aquaculture employment in Scotland has increased by 125 or 6%. As a result Scotland accounted for nearly two thirds (65%) of total UK Aquaculture employment in 2017. This is followed by England (29%), Northern Ireland (3%) and Wales (2%).

[15] The number of businesses producing other species was only available for 2017.

Table A1.10: Aquaculture employment in the UK, 2015-2017[16]

Date	UK	Scotland	England	Northern Ireland	Wales
2015	3,505	2,000	1,375	-	130
2016	3,400	2,125	1,125	-	150
2017	3,249	2,125	950	94	80

Source: BRES (2018) and NISRA (2018)

As with the number of Aquaculture businesses, Marine Scotland collects data on Aquaculture employment through its annual surveys of Finfish and Shellfish production. Table A1.11 shows this data by year and species, indicating a growth of 15% in Scottish Aquaculture employment from 2013 to 2017. This increase has been largely driven by Atlantic salmon production, which saw a growth of 21% or 251 employees over the period. Atlantic salmon accounts for nearly two thirds of total Aquaculture employment in Scotland (65%), followed by Shellfish (14%) and Atlantic salmon ova and smolts (13%).

Table A1.11: Aquaculture employment in Scotland by species, 2013-2017

Species	2013	2014	2015	2016	2017
Atlantic Salmon: production	1,180	1,325	1,363	1,486	1,431
Shellfish	333	345	344	315	328
Atlantic Salmon: ova and smolts	285	309	294	294	291
Rainbow trout	110	113	126	121	132
Other species	50	49	50	63	62
Total	**1,958**	**2,141**	**2,177**	**2,279**	**2,244**

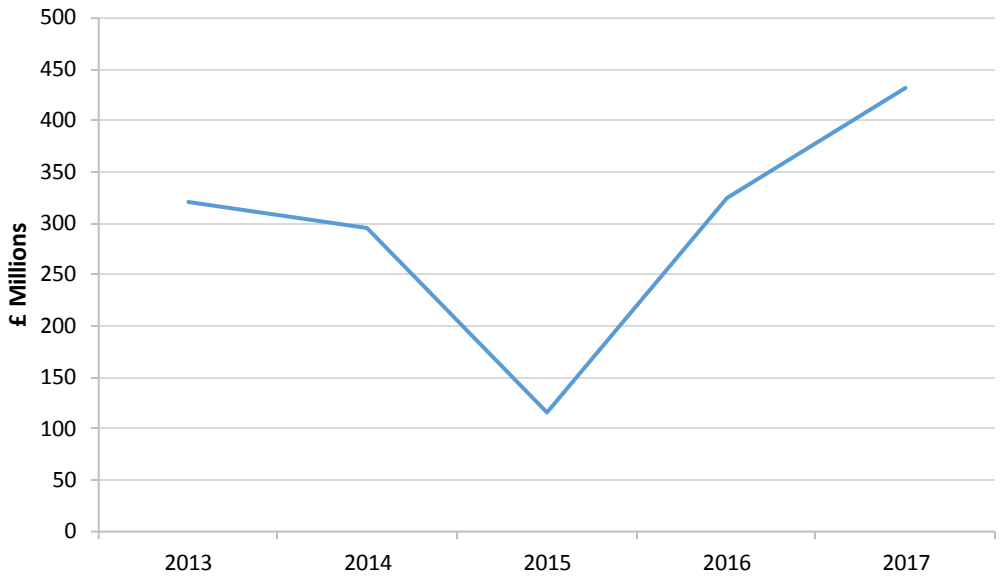
Source: Marine Scotland (2018) Scottish Shellfish Farm Production 2017 and Scottish Fish Farm Production 2017

1.2.4 GVA and labour productivity

Figure A1.20 shows approximate GVA at basic prices for the UK Aquaculture sector. GVA for the sector was £432m in 2017, representing a 26% increase since 2013. Within this increase there was a significant fall in 2015 to £116m, representing a decrease of 61% between to 2014 and 2015. This was followed by a significant increase (beyond 2014 levels) to £325m in 2016 and a further increase of £107m to £432 in 2017.

[16] Only figures for 2015-2017 are shown as a change in BRES methodology means that data prior to 2015 is not comparable.

Figure A1.20: GVA at basic prices for the UK Aquaculture sector, 2013-2017



Source: ONS (2018) Annual Business Survey

Table A1.12 shows regional GVA at current prices for the Fishing and Aquaculture sector.[17] Scotland accounts for the highest proportion of total UK Fishing and Aquaculture GVA, at 59%. This is followed by England (31%), Northern Ireland (7%) and Wales (3%). Scotland has also seen the most significant growth in absolute terms from 2013 to 2017, at £177m. However in proportional terms the biggest growth has been in England (68%).

Table A1.12: GVA at current prices for the Fishing and Aquaculture sector (£million), 2013-2017

Date	UK	England	Scotland	Wales	Northern Ireland
2013	491	146	289	14	42
2014	581	180	229	18	44
2015	569	190	316	18	45
2016	718	230	417	24	47
2017	788	246	466	23	53

Source: ONS (2018) Nominal and real regional gross value added (balanced) by industry

Table A1.13 shows GVA per worker for the Fishing and Aquaculture sector in Scotland, England and Wales. Employment figures were not available for Northern Ireland and so this also precluded analysis of the UK as a whole.[18] GVA per worker in 2017 was highest for England (£89,500) and lowest for Scotland (£77,700). The biggest increase in GVA per worker from 2013 to 2017 took place in Wales where it more than doubled from £40,000 to £83,600. GVA per worker is proportionally higher across England and Wales in 2017 than in previous years due to reduced employment numbers.

[17] Fishing and Aquaculture has been used as data is not available for the Aquaculture sector alone.

[18] NISRA provides employment data but this is only for employee jobs.

Table A1.13: GVA at current prices for the Fishing and Aquaculture sector per worker, 2013-2017

Date	England	Scotland	Wales
2013	53,090.9	57,800.0	40,000.0
2014	60,000.0	61,636.4	27,692.3
2015	50,666.7	70,222.2	48,000.0
2016	54,117.6	69,500.0	48,000.0
2017	89,454.5	77,666.7	83,636.4

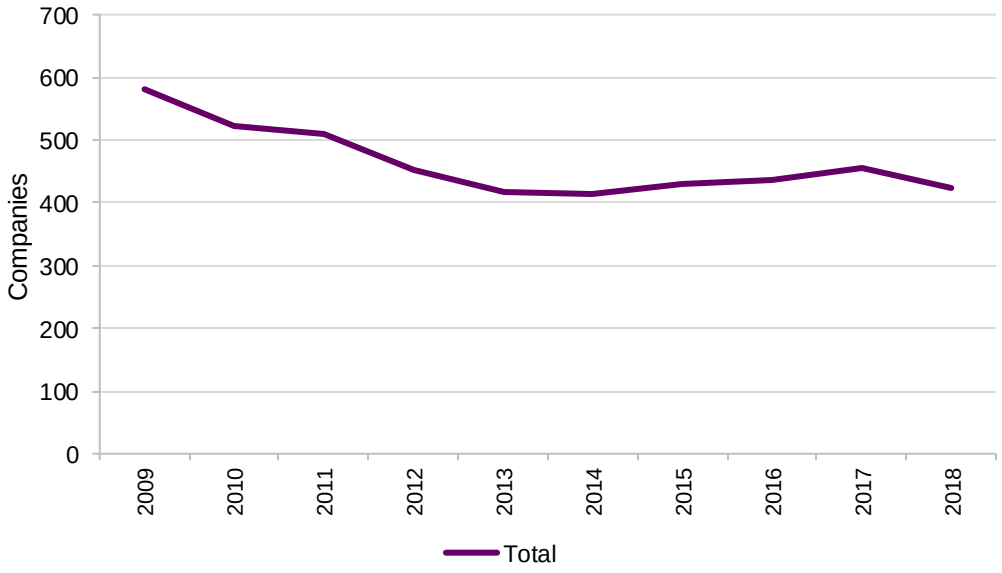
Source: ONS (2018) Nominal and real regional gross value added (balanced) by industry

1.2.5 Competitor comparison: aquaculture in Norway

Aquaculture is an important industry for Norway. It accounts for over half the Atlantic salmon produced globally[19], and exports approximately 95% of its total production.[20] Many of Norway's top aquaculture companies such as Marine Harvest (now Mowi) and AKVA Group either operate in the UK, or own UK companies.

The Norwegian aquaculture sector has realised significant growth in recent years. Its business base has decreased by over 25% in the period 2009-18, but the evidence indicates that there has been consolidation in the industry, similar to the consolidation that has taken place in the Scottish finfish aquaculture sector. In 2018, the business base stood at 425, with finfish production accounting for over half of businesses (52%). Smolt production accounted for almost 38%, and shellfish production almost 11%. Shellfish production has seen the biggest proportionate (-76%) and real-term (-89) decrease over this period.

Figure A1.21: Norwegian aquaculture business base, 2009-18



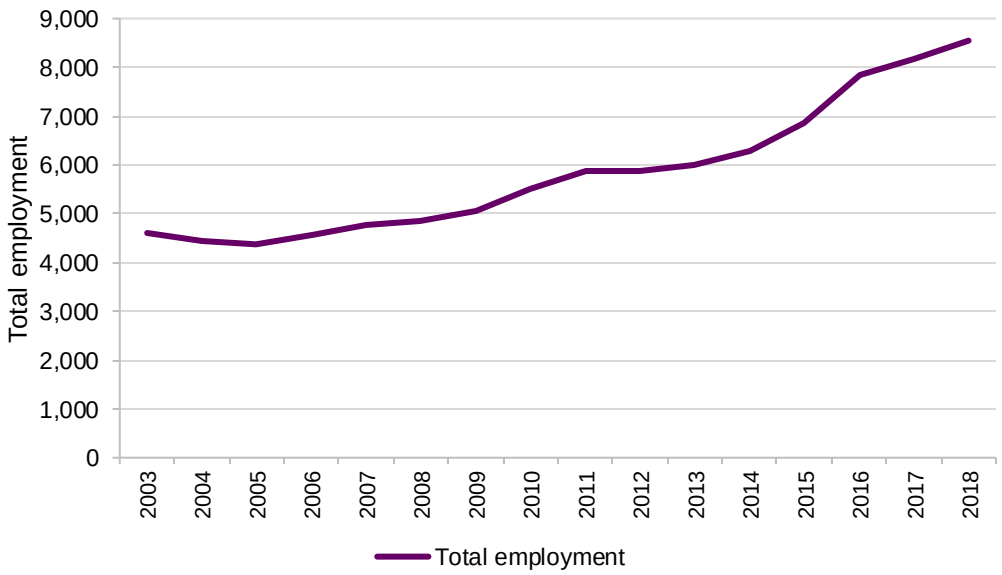
Directorate of Fisheries, Norway, 2019

[19] Ibid., p.22

[20] EY (2018) The Norwegian Aquaculture Analysis 2017

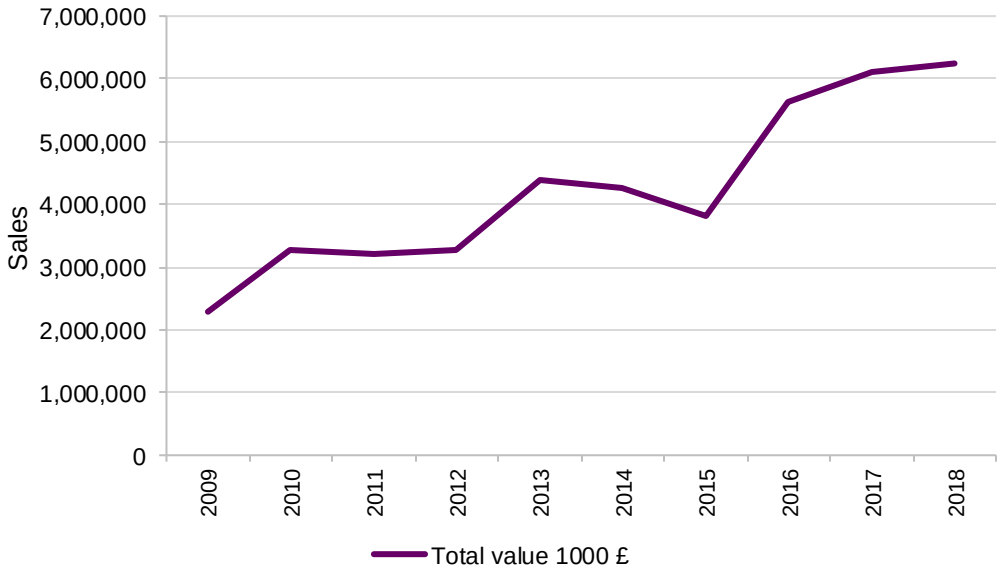
Over the same period, employment in Norwegian aquaculture has grown by 68% to over 8,500, and total sales have grown from around £2.29bn (Kr 22.4bn) in 2009 to £6.25bn (Kr 67.8bn) in 2018, an increase of over 272%.[21]

Figure A1.22: Norwegian aquaculture employment, 2009-18



Directorate of Fisheries, Norway, 2019

Figure A1.23: Norwegian aquaculture sales, 2009-18



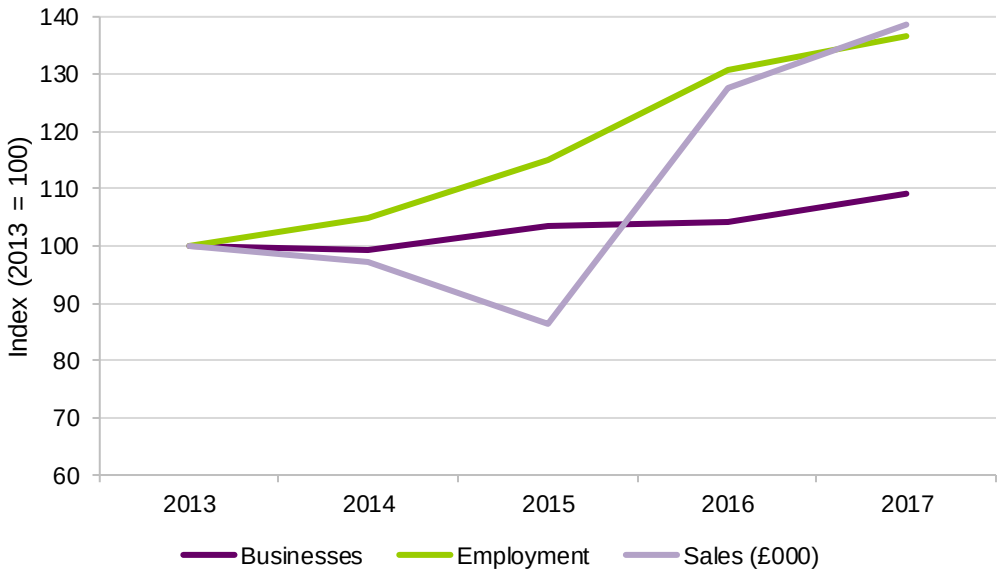
Directorate of Fisheries, Norway, 2019

For comparison with Aquaculture in the UK, over the period 2013-17, employment in Norwegian aquaculture grew by 37%, and sales by 39%. This is significantly

[21] Directorate of Fisheries, Norway (2019) Statistics for Aquaculture, at: https://www.fiskeridir.no/English/Aquaculture/ Statistics/Total

stronger performance, which has allowed Norway to grow its global market share to around 54%.[22]

Figure A1.24: Indexed business base, employment and sales performance in Norwegian aquaculture, 2013-17



Directorate of Fisheries, Norway, 2019

[22] EY (2019) The Norwegian Aquaculture Analysis 2018

1.3 Seafood processing

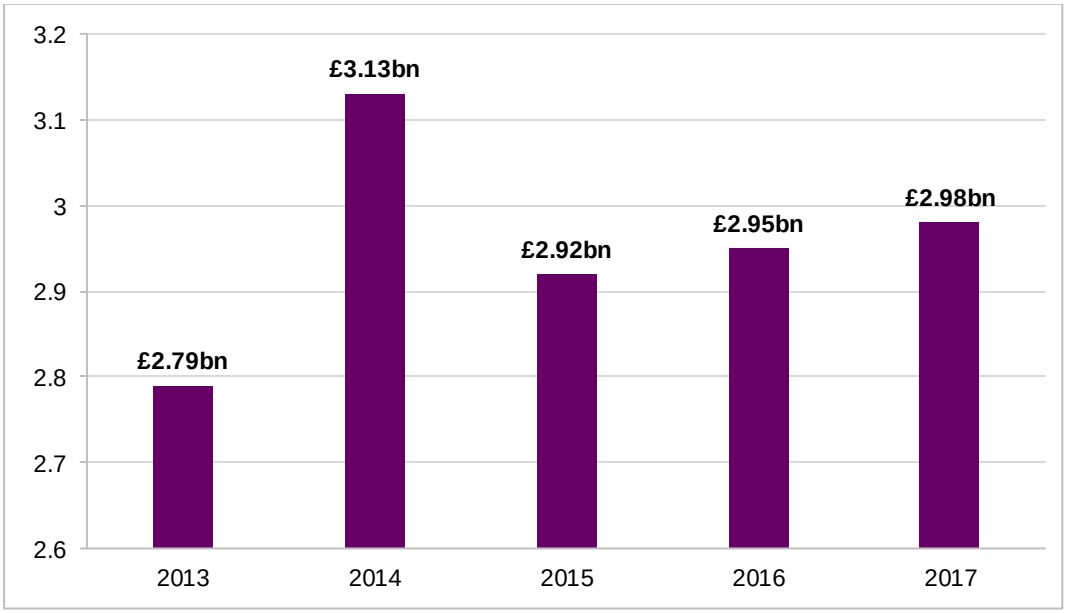
1.3.1 Economic value and distribution of impacts

The turnover of the seafood processing industry in the UK is currently estimated at £2.98bn for 2017. The seafood processing sector reached a high of £3.13bn turnover in 2014, growth of 12.2% from the previous year. It should be noted that this is in contrast to a decline in commercial capture fishing in 2014, though seafood processing serves both commercial capture fishing and aquaculture; further processing growth may also be linked to any growth in caught fish imports.

Between 2014 and 2015, the sector witnessed a decline of 6.7%, and since then as seen steady growth of just over 1% each year. Over the past five years as a whole, the UK seafood processing industry as seen turnover growth of 6.8%.

Marine Scotland figures show that the turnover for seafood processing was valued at just over £1.6bn in 2016, approximately 27.3% of the wider food manufacturing sector in Scotland[23], with particular concentrations in the central belt and in Aberdeen City and Shire. This represents a significant proportion of the overall UK seafood processing value. Figures from ONS are comparable with data gathered by non-profit organisation Seafish, who found a non-significant change in seafood processing sector turnover since 2010 with decreases in operating profits driven by an increase labour and energy costs.[24]

Figure A1.25: Seafood processing - UK turnover (£bn)



Source: ONS, UK Non-Financial Business Economy Annual Business Survey: 2018

According to latest figures, the wider manufacture of food products sector[25] (covering meat, seafood, fruit and vegetables, oils and fats, diary, starch products, baked

[23] Marine Scotland: Scotland's Marine Economic Statistics (2018)

[24] https://www.seafish.org/article/processing-sector-statistics

[25] Cannot split 10.2: Processing and preserving of fish, crustaceans and molluscs from data.

goods, and animal feeds) in the UK was valued at £7.4bn in 2016. England accounts for a significantly large share of the sector, equating to 81.5%, due to strong seafood clusters based at Grimsby in North East Lincolnshire and Heathrow in London. This is followed by Scotland (7.9%), Northern Ireland (5.5%), and Wales (5.1%).

Table A1.14: Turnover, £ millions – manufacture of food products by country

Date	UK	England	Scotland	Wales	Northern Ireland
2012	75,238	60,455	5,736	3,815	5,233
2013	75,319	60,744	5,809	4,215	4,551
2014	75,958	62,268	6,054	3,373	4,264
2015	74,051	60,287	5,587	3,924	4,252
2016	74,233	60,536	5,861	3,752	4,084
2012-2016 (%)	**-1.3%**	**0.1%**	**2.2%**	**-1.7%**	**-22.0%**

Source: ONS, Nominal and real regional gross value added (balanced) by industry (2018). Only SIC07 code 2-digit sector up to 2016 available

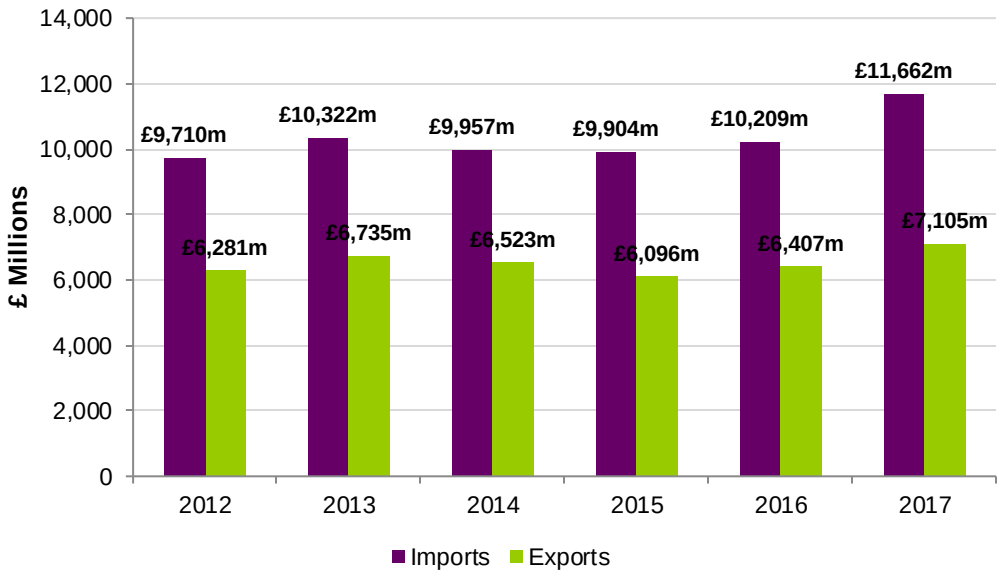
After a peak of just under £7.6bn in 2014, the turnover for the manufacture of food products has declined by 2.3%, with an overall decline of 1.3% over the 2012-2016 period. The most significant decreases in turnover are in Northern Ireland and Wales, who each saw the sector shrink by 22.0% and 1.7%. Each of the Scottish and English sectors grew by 2.2% and 0.1% respectively.

1.3.2 Trade[26]

UK imports of manufactured food products were valued at more than £11.6bn for 2017, an increase of approximately 20% since 2012. Exports of manufactured food products from the UK were valued at over £7.1bn for 2017, also witnessing an increase since 2012 by 13%.

[26] Trade data is only available for the wider 10. Manufacture of food products sector. This includes the processing and preserving of meat and meat products; fish, crustaceans and molluscs; fruit and vegetables and the manufacture of vegetable and animal oils/fats; dairy products; starch products, baked goods; and prepared animal feeds.

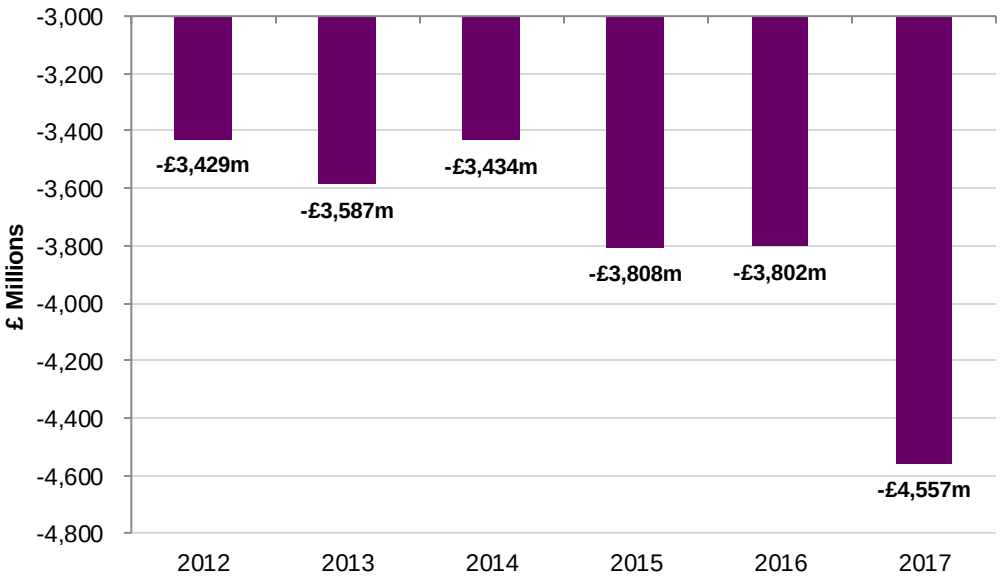
Figure A1.26: Manufacture of food products – UK imports and exports (£m)



Source: ONS, UK Trade in Goods by Industry, Country, and Commodity (2019)

Net exports for the manufacture of food products in 2017 were minus £4.6bn. Despite a fall of 11% in the trade deficit from the previous year in 2015, overall between 2012 and 2017 the deficit has grown significantly by 33%.

Figure A1.27: Manufacture of Food Products: Net Exports (£m)



Source: ONS, UK Trade in Goods by Industry, Country, and Commodity (2019)

Despite data limitations, latest figures from Scottish Salmon report that Scottish salmon exports have reached an all-time high valued at approximately £600m for 2017, a 35% increase from the previous year[27]. The increase in export value has been stimulated by an increased price of salmon, as well as export tonnage increasing by 26% between 2017 and 2016.

1.3.3 Business base and employment

[27] http://scottishsalmon.co.uk/salmon-exports-reach-record-600m/

As of 2017, there was 305 UK businesses operating in the seafood processing industry, with 52.5% based in England and a further 37.7% based in Scotland. Since 2012, the UK seafood processing sector has shrunk by 10.6% accounting for 35 businesses. The decline in the UK sector was driven by a loss of 25 Scottish seafood processing businesses, accounting for a decline of 18.6%. More than half of seafood processing businesses are classed as micro businesses, employing between zero and nine employees, with a further 30% being small-sized businesses.

Table A1.15: Business Base – Seafood Processing by Country

Date	UK	England	Scotland	Wales	Northern Ireland
2012	340	170	140	10	20
2013	320	160	130	10	20
2014	325	165	130	10	20
2015	315	160	125	15	15
2016	315	165	125	15	15
2017	305	160	115	10	15
2012-2017 (%)	**-10.3%**	**-5.9%**	**-18.6%**	**0%**	**-25.0%**

Source: UK Business Counts 2018

The number of seafood processing businesses is widely spread throughout turnover size bands. Fifty UK seafood processing businesses turnover £100,000 - £199,999, accounting for 19.7% of the business base. This is followed by the £2m – £4.9m band (16.4%); £10m - £49m (11.5%); £500,000 - £999,000 (11.5%); and £1m – £4.9m (9.8%).

The seafood processing sector in the UK employs just over 16,000 employees, growing by approximately 12.4% between 2012 and 2017. This Figure A1.is predominantly from employees situated in England and Scotland, who account for approximately 96.1% of the sector employment base. Over the 2012-2017 period, the English seafood processing sector employment grew by 23% equating to approximately 1,500 new employees. The Scottish sector remained fairly stagnant, peaking in 2015 before falling to 2012 levels in 2017. Moreover, seafood processing in Northern Ireland has almost doubled between 2012 and 2017, accounting for an additional 284 employees.

Over the 2012-2017 period, the English seafood processing sector employment grew by 23% equating to approximately 1,500 new employees. The Scottish sector remained fairly stagnant, peaking in 2015 before falling to 2012 levels in 2017. Moreover, seafood processing in Northern Ireland has almost doubled between 2012 and 2017, accounting for an additional 284 employees.

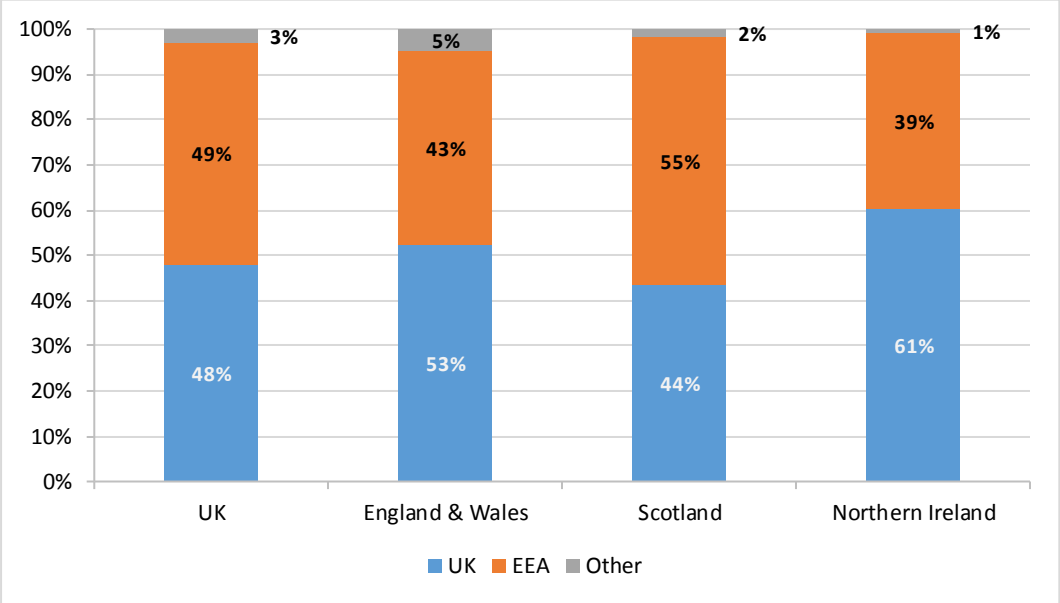
Table A1.16: Employment base – seafood processing by country

Date	UK	England	Scotland	Wales	Northern Ireland
2012	14,340	6,500	7,500	50	290
2013	14,334	6,500	7,500	50	284
2014	14,389	6,500	7,500	80	309
2015	15,476	7,000	8,000	80	396
2016	15,143	7,000	7,500	130	513
2017	16,124	8,000	7,500	50	574
2012-2017 (%)	**12.4%**	**23.0%**	**0%**	**0%**	**97.9%**

Source: ONS, UK Non-Financial Business Economy Annual Business Survey: 2018; Annual Business Inquiry (2013-2017)[28]

According to the Seafish 2018 Seafood Processing Labour Report[29] the majority of employees in Seafood processing across the UK were non-UK nationals. This is highest in Scotland at around 57%. Seafish evidence shows that the majority of UK resident workers in the seafood processing sector were more likely to be highly skilled compared to European Economic Area (EEA) workers.

Figure A1.28: Nationality of the seafood processing sector workforce, 2017



Source: Seafish (2018) UK seafood processing sector labour report 2018
Figures may not sum due to rounding

1.3.4 GVA and labour productivity

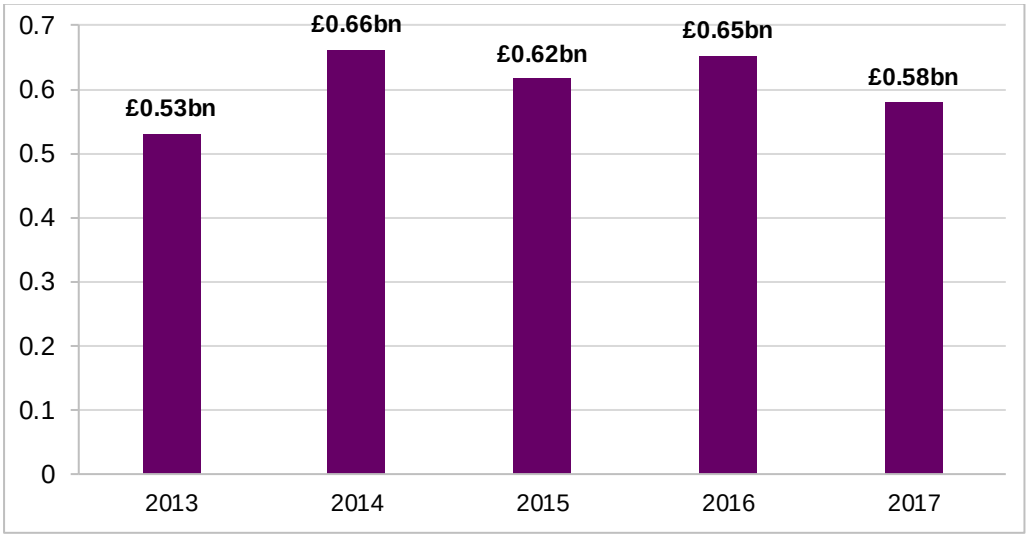
According to latest figures from the Office of National Statistics, the UK seafood processing sector currently accounts for £0.58bn GVA representing around 2.6% of GVA in the wider manufacture of food products sector. Over the past five years,

[28] The Annual Business Inquiry sample is designed at an industry section level, so large year on year changes may occur when broken down by SIC3 level

[29] https://www.seafish.org/media/2018_seafood_processing_sector_labour_report.pdf

GVA in this sector has fluctuated between £0.53bn and £0.66bn, witnessing an overall increase of 9.2% for the five year period.

Figure A1.29: Seafood processing - UK GVA (£bn)



Source: ONS, UK Non-Financial Business Economy Annual Business Survey: 2018

The GVA for the wider manufacture of food products sector for 2017 was estimated at just over £22bn, growing by approximately 24.8% since 2012. England holds for a large majority of GVA in this sector, accounting for 81.7% followed by Scotland (7.8%); Northern Ireland (5.3%) and Wales (5.2%).

GVA for Scotland's seafood processing sector was valued at £391m for 2016 and accounts for just under one-quarter of GVA in the wider food manufacturing sector[30] and just less than 60% of the UK seafood processing sector.

Table A1.17: GVA, £ millions – manufacture of food products by country

Date	UK	England	Scotland	Wales	Northern Ireland
2012	17,758	14,890	1,268	936	663
2013	19,052	15,773	1,406	1,012	862
2014	19,922	16,599	1,449	967	907
2015	20,869	17,106	1,524	1,037	1,202
2016	20,896	17,140	1,578	1,059	1,118
2017	22,160	18,111	1,726	1,148	1,175
2012-2017 (%)	**24.8%**	**21.6%**	**36.1%**	**22.6%**	**77.2%**

Source: ONS GVA Statistics (2018)

GVA per worker is set out below. Growth in GVA per worker has increased over the period 2012-17, with the growth rate highest in Scotland at 36.1%.

[30] Marine Scotland: Scotland's Marine Economic Statistics (2018)

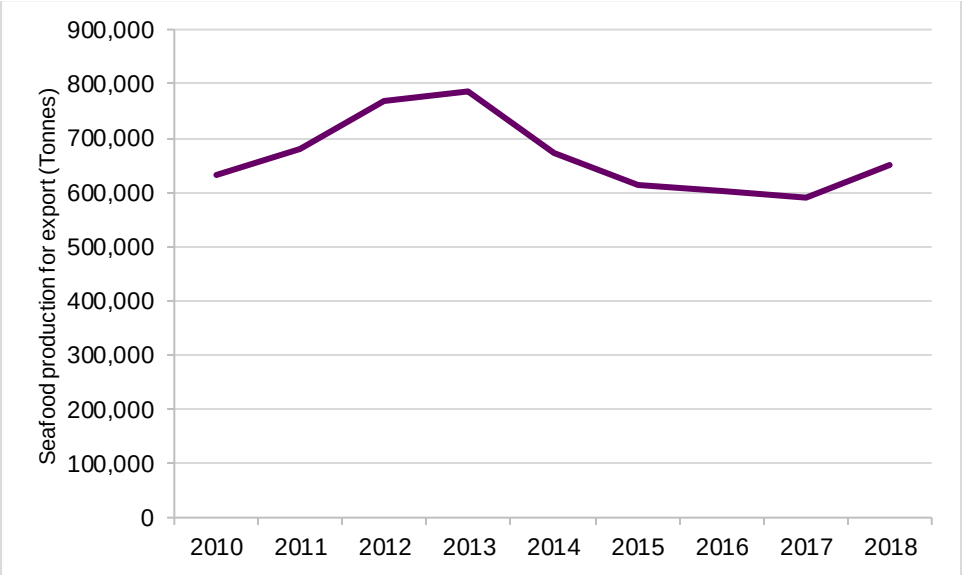
Table A1.18: GVA per worker, £ – manufacture of food products by country

Date	UK	England	Scotland	Wales	Northern Ireland
2012	n/a	£53,369	£38,424	£49,263	n/a
2013	n/a	£55,344	£43,262	£49,366	n/a
2014	n/a	£57,337	£42,000	£48,350	n/a
2015	n/a	£57,020	£45,493	£46,089	n/a
2016	n/a	£54,326	£48,554	£57,243	n/a
2017	n/a	£58,423	£52,303	£53,395	£59,167
2012-2017 (%)	**n/a**	**9.5%**	**36.1%**	**8.4%**	**n/a**

Source: ONS GVA Statistics, Annual Business Survey (2018)
Only SIC07 code 2-digit sector up to 2016 available

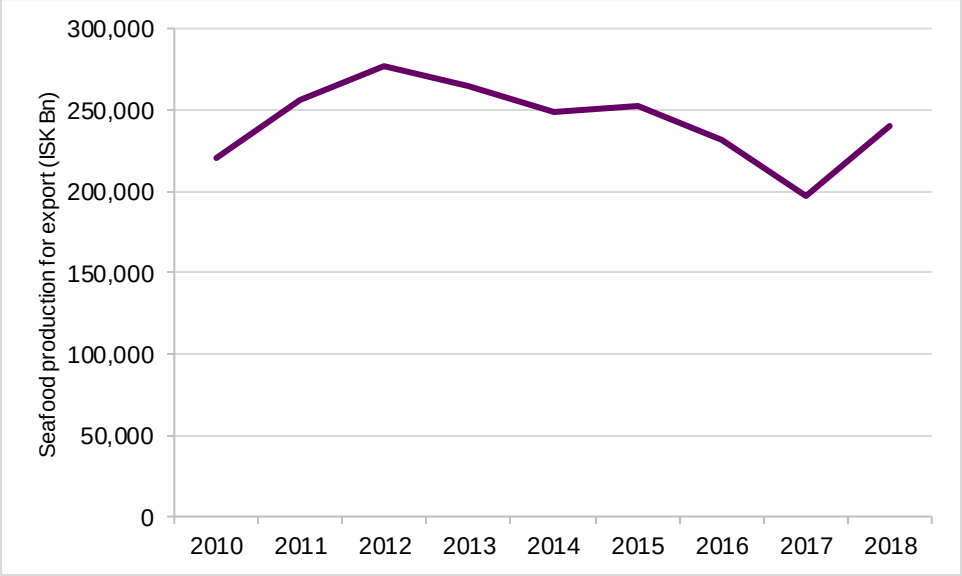
1.3.5 Competitor comparison: Iceland and Norway

Figure A1.30: Seafood processing for export in Iceland, volume, 2010-18



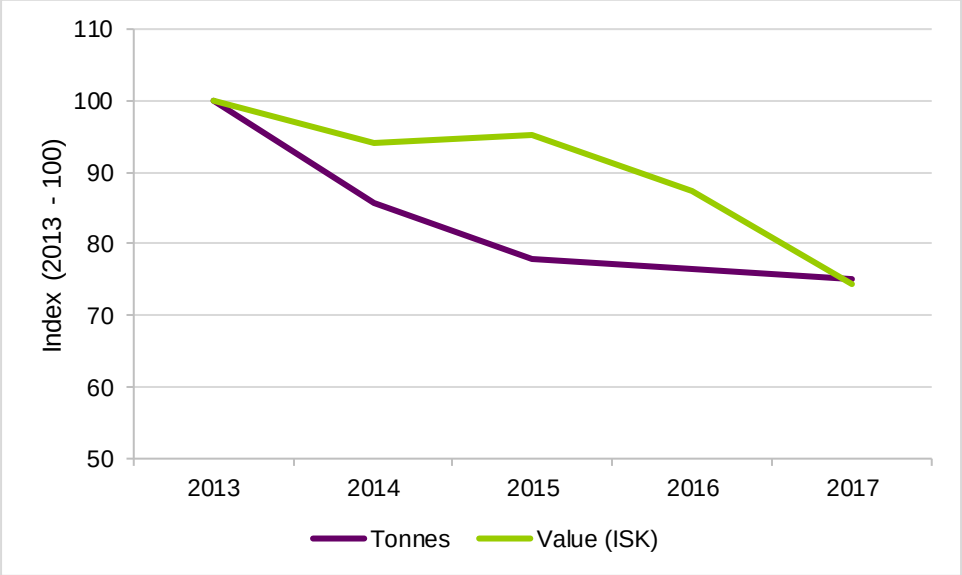
Source: Statistics Iceland, 2019

Figure A1.31: Seafood processing for export in Iceland, value, 2010-18



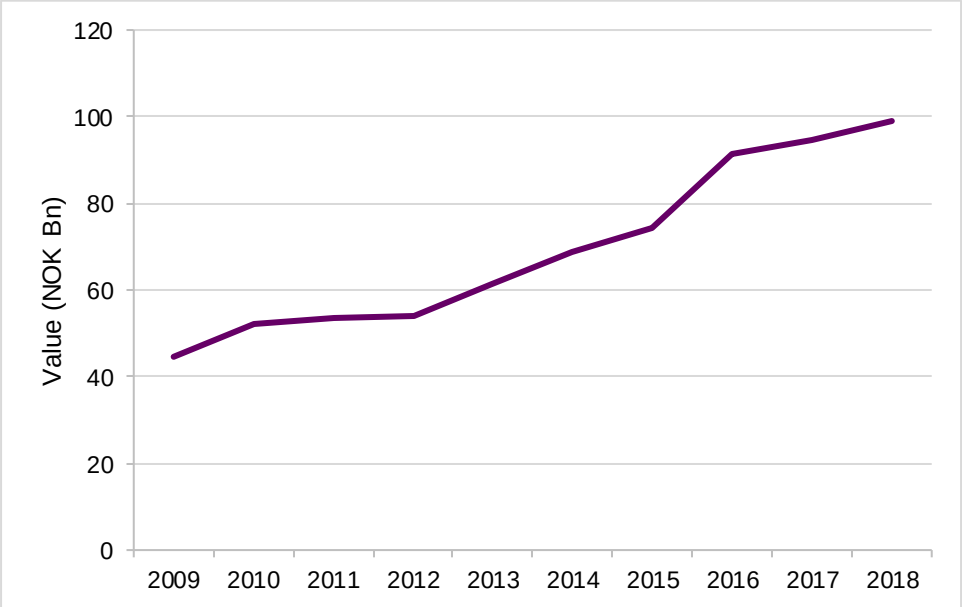
Source: Statistics Iceland, 2019

Figure A1.32: Seafood processing for export in Iceland, indexed, 2013-17



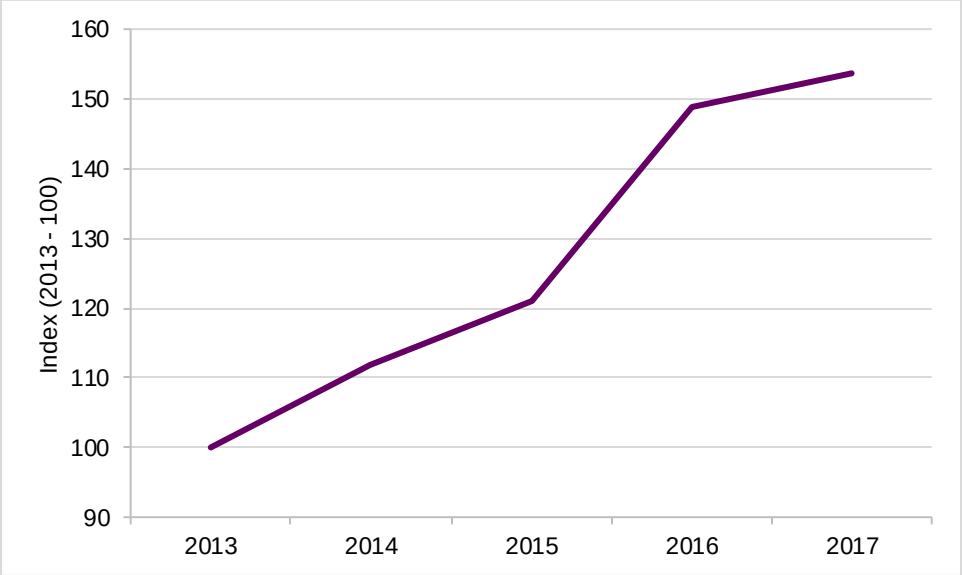
Source: Statistics Iceland, 2019

Figure A1.33: Seafood processing in Norway, value, 2010-18



Source: Norwegian Seafood Council, 2019

Figure A1.34: Value of seafood processing in Norway, indexed, 2013-17



Source: Norwegian Seafood Council, 2019

1.4 Commercial seaweed harvesting

1.4.1 Economic value and distribution of impacts

Seaweed harvesting is very much a nascent sector, and so estimates around the scale and economic value of the sector are limited. It was previously estimated by Viking Fish Farms in 2012 that the UK macroalgae industry has an economic value of £1-1.3m.[31] Harvesting has historically been concentrated in the Outer Hebrides in Scotland, which was estimated to account for 5,500 of 6,000 wet tonnes harvested in the UK.[32] Other areas for harvesting were Orkney and Shetland Islands, Northern Ireland and South Wales (specifically for food such as laverbread). More recent estimates have put total UK harvest at 20-30,000 wet tonnes, with an expansion in harvesting in South West England a contributing factor for this increase in tonnage.[33]

At a regional level, Marine Biopolymers Ltd has estimated that its plans for kelp harvesting off the west coast of Scotland have a potential value of £300m.[34]

Research commissioned by HIE has underlined that whilst Scottish seaweed harvesting in itself may be of a relatively low value, it could enable a very high value (in the range of £100-£500m after ten years) manufacturing and pharmaceutical industry.[35]

1.4.2 Trade

[31] Cefas (2016) Seaweed in the UK and abroad – status, products, limitations, gaps and Cefas role

[32] Ibid.

[33] Ibid.

[34] https://www.bbc.co.uk/news/uk-scotland-46252427

[35] HIE (2018) Wild Seaweed Harvesting as a diversification opportunity for fishermen

Globally, 95% of seaweed production is from Asian Aquaculture. Despite having the natural resource, the UK does not have a long history of seaweed farming, although small-scale harvesting for food, feed and fertilisers has been carried out for hundreds of years. In recent years, with an increasing recognition of the potential uses of seaweed, e.g. in algal biofuel technologies, interest in expanding harvesting has grown. This expansion is likely to be based upon farming as wild harvesting is close to capacity at locations with current activity.[36] However, there are a number of social and environmental sensitivities around commercial harvesting. For example, Marine Scotland is currently considering the need for further regulation or policy for wild seaweed harvesting following on from the publication of its Wild Seaweed Harvesting Strategic Environmental Assessment (SEA).[37] Currently small-scale cultivation projects are seen as 'low risk,' and an expansion of the industry will need a more complete understanding of the scale dependent changes in order to balance environmental risks with the benefits that seaweed cultivation projects can offer.[38]

Of the 27 seaweed related businesses identified in the UK in 2016, 16 were using UK harvested seaweed and 11 were using seaweed harvested elsewhere.[39]

1.4.3 Business base and employment

It was estimated by Viking Fish Farms in 2012 that the UK macroalgae industry constituted 15 SMEs. A report from CEFAS in 2016 updated this and estimated that there is 27 seaweed related businesses operating in the UK, of which 16 use seaweed harvested in the UK. Of these 16 companies, eight produce seaweeds for food or condiments. The next most common uses cosmetics and nutraceuticals, followed by animal feed production and fertilizers Of the eleven using seaweed from outside the UK, four focused on cosmeceuticals production, three on chemical production from seaweeds (e.g. hydrocolloids), two on animal feed/supplements and two on human food. There was limited information on staff numbers, however what is available indicates that most of the 27 businesses were micro (0-9 employees) or small (10-49 employees) sized. Just three were medium sized, with 50-249 employees.

By country, the majority of the sixteen businesses that use UK seaweed are based and harvest their seaweed in Scotland, particularly in and around the islands, two are in Wales, two are on the south-west coast of England, one is in Essex and one is based in Northern Ireland. Those on the south-west coast of England are, as of 2019, looking at cultivation on the south-east coast due to wild harvest supply issues. Two additional companies have set up on the east coast of England with cultivation as their main business.

[36] Cefas (2016) Seaweed in the UK and abroad – status, products, limitations, gaps and Cefas role

[37] https://www.gov.scot/publications/wild-seaweed-harvesting-strategic-environmental-assessment-environmental-report/

[38] https://www.frontiersin.org/articles/10.3389/fmars.2019.00107/full

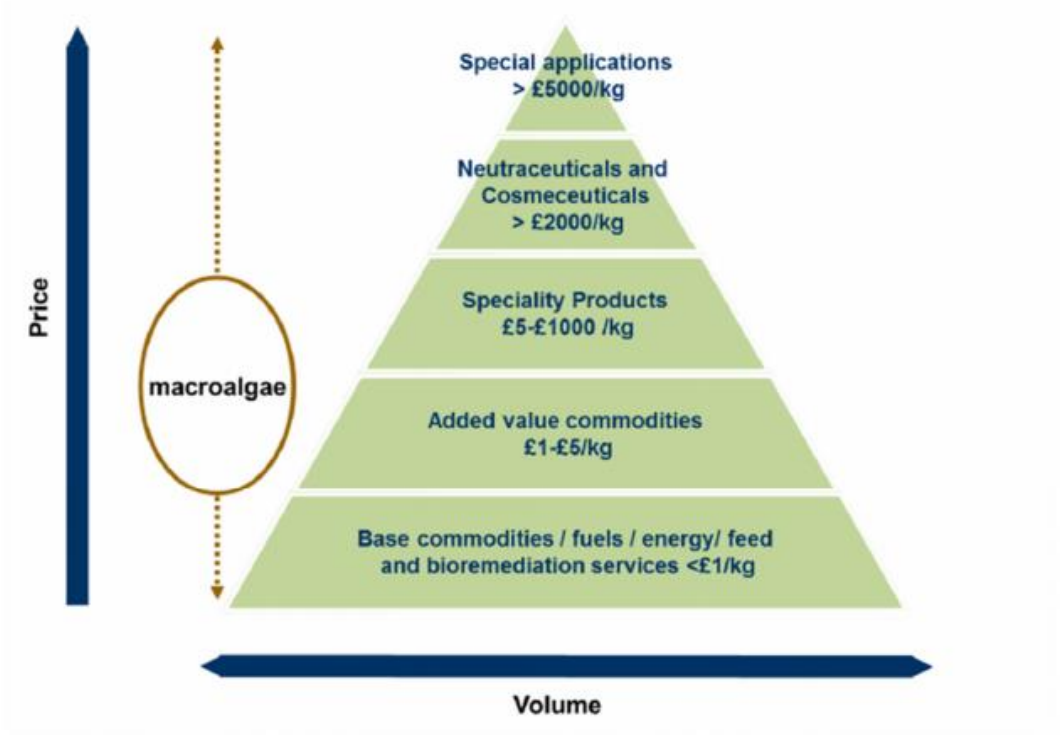
[39] Ibid.

Seaweed farming, as opposed to wild harvest, in the UK is currently at a pre-commercial stage with pilot farms having been established in Northern Ireland (Queen's University Belfast), Scotland (SAMS) and formerly Wales (Swansea University).[40] Two small commercial farms are run by NewWave foods in Scotland and The Cornish Seaweed Company in England.

1.4.4 Sector productivity

The value, and hence productivity, associated with seaweed production varies considerably by the type of products being produced. As shown at Figure A1.15, the economical return for biomass is estimated at <£1/kg compared with >£5,000/kg for certain special applications. Currently the UK is at the stage of producing added value commodities and speciality products, with values between £1-£1,000/kg.

Figure A1.35: Pricing of products from macroalgae and current capacity for macroalgae production in the UK.



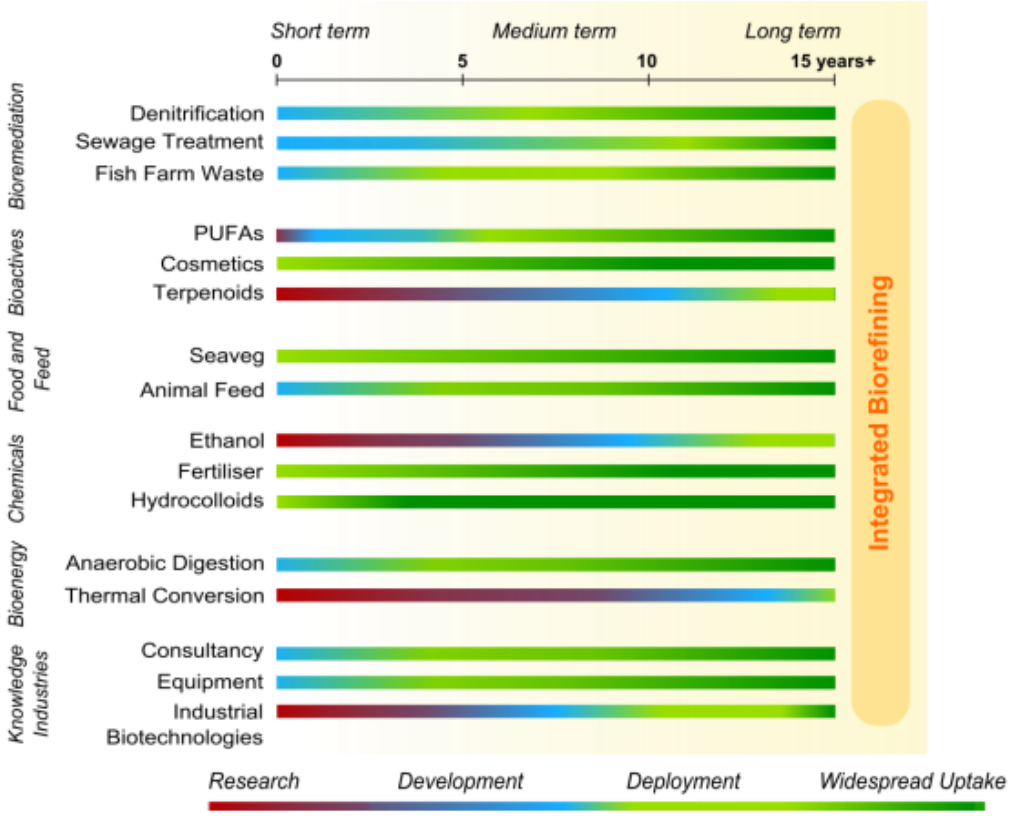
Source: Cefas, (2016) Seaweed in the UK and abroad – status, products, limitations, gaps and Cefas role

The timescale for the UK achieving the production of different seaweed products is shown at Figure A1.16 (although it should be considered that this is somewhat out of date as it was produced in 2013). It indicates that uses for cosmetics, fertiliser, sea vegetables and hydrocolliods are already deployed and wide-spread usage can be expected in the near future. Uses in industrial biotechnologies, thermal conversion, ethanol and terpenoids are still at the research stage with deployment expected in

[40] Ibid.

10-15 years. These current areas of research can be expected to lead to seaweed uses with higher value and productivity.

Figure A1.36: Timescale to commercialisation, different uses of seaweed algal biomass in the UK

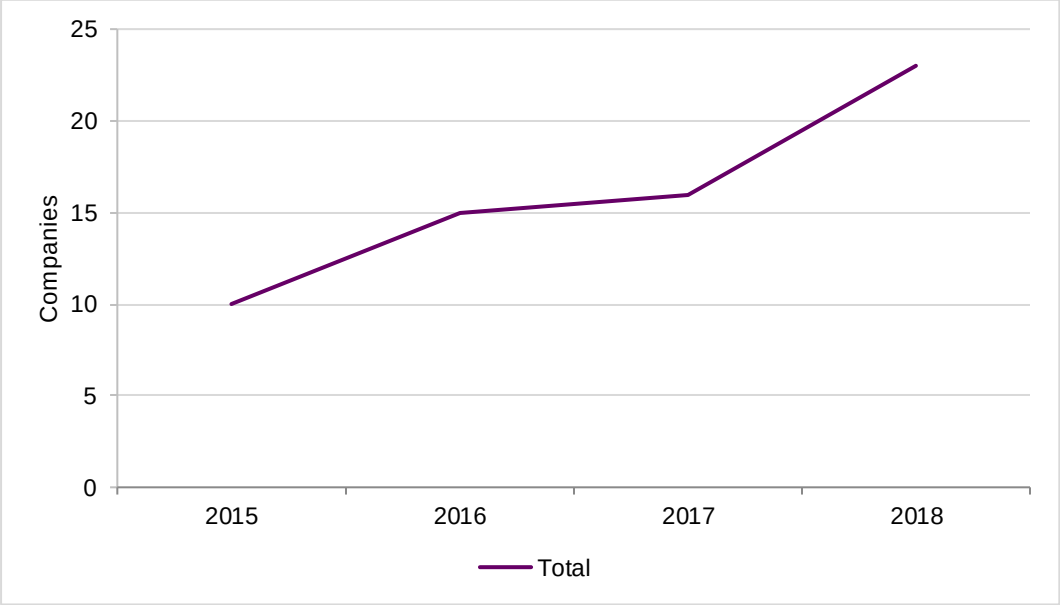


Source: Adapt/Innovate UK, NERC (2013)

1.4.5 Competitor comparison: Seaweed harvesting in Norway

The Norwegian seaweed harvesting sector has undergone significant growth in recent years. Its businesses base has grown from 10 companies in 2015 to 23 in 2018 (Figure 2.9), an increase of 130% over the period, albeit within the context of small business numbers.

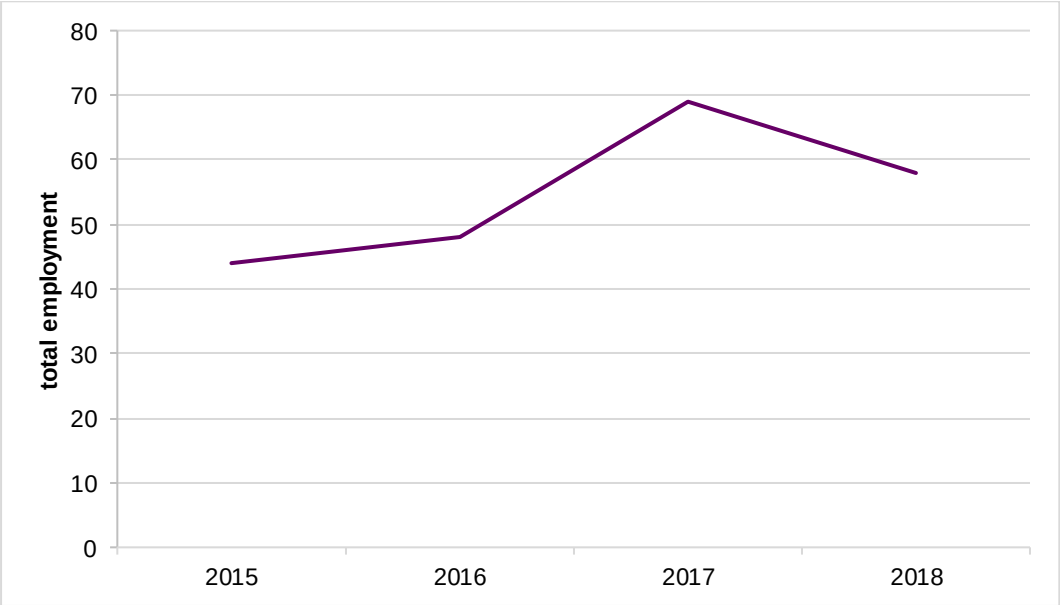
Figure A1.37: Norwegian seaweed harvesting business base, 2015-2018



Directorate of Fisheries, Norway, 2019

Employment in Norwegian seaweed harvesting has grown overall over the same period, by 32%, as shown in Figure 2.10. However, following a peak of 69 total employees in 2017, seaweed harvesting employment fell to 58 in 2018, a decrease of 19%.

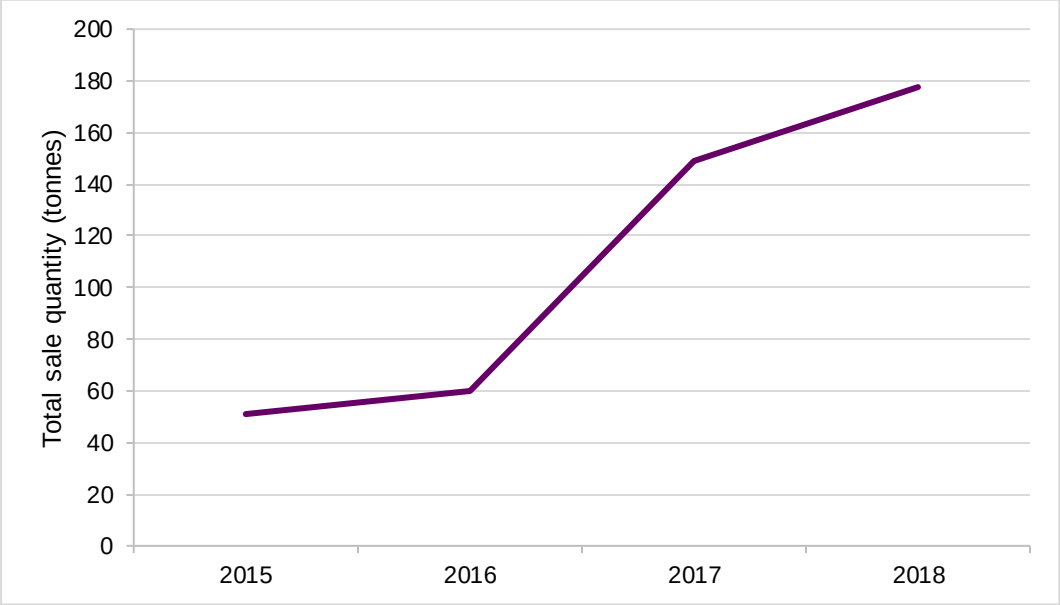
Figure A1.38: Norwegian seaweed harvesting employment, 2015-2018



Directorate of Fisheries, Norway, 2019

Overall tonnage and value of seaweed harvested has increased over the period 2015 to 2018, as shown in Figures 2.11 and 2.12. Harvesting tonnage increased by 248%, rising from 51 tonnes to 178 tonnes. This has been largely a result of an increase in Sea Belt algae, with tonnage growing from 33 tonnes in 2016 to 140 tonnes in 2017.

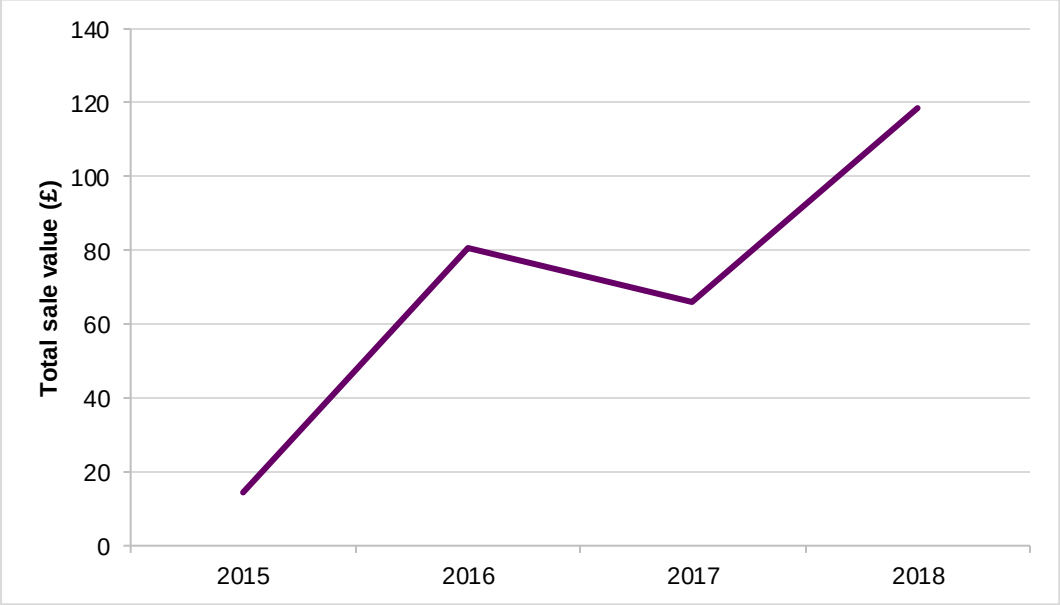
Figure A1.39: Norwegian seaweed harvesting quantity (tonnes), 2015-2018



Directorate of Fisheries, Norway, 2019

The value of seaweed harvested grew at a significantly higher rate between 2015 and 2018, increasing 722% from around £14,000 to almost £119,000.

Figure A1.40: Norwegian seaweed harvesting value (1000 £), 2015-2018



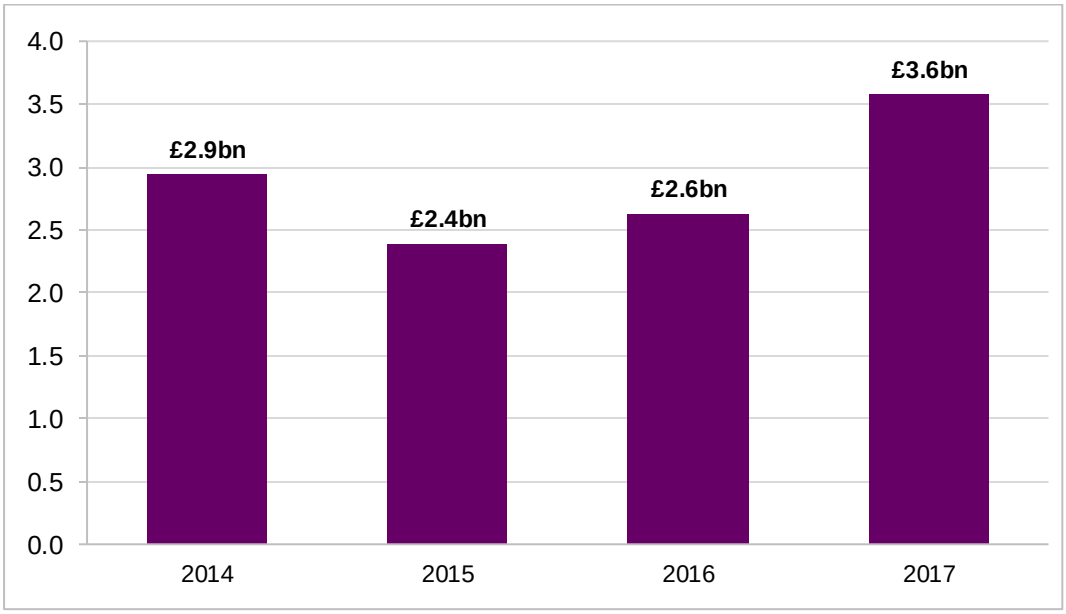
Directorate of Fisheries, Norway, 2019

1.5 Offshore Renewables

1.5.1 Economic value and distribution of impacts

CEBR's report for Maritime UK, "The Economic Contribution of the UK Marine Industry" estimates that the UK marine renewable sector had a total (including indirect and induced) turnover impact of £4.7bn in 2015.[41] More recently, the ONS analysis from the Low Carbon and Renewable Energy Economy Survey provides a 2017 turnover estimate for the offshore wind sector (but not the wave and tidal sectors, due to their relatively small contributions to the low carbon energy sector as a whole). The offshore wind sector is estimated to have directly turned over more than £3.5bn in 2017. This turnover represents 29% of the total £12.3bn directly generated by the UK's low carbon electricity sector. With multiplier effects included this estimate reaches £6.9bn, a £1.8bn increase from the 2014.[42]

Figure A1.22: Offshore wind – UK turnover (£bn)



Source: ONS, Low carbon and renewable energy economy, UK: 2017

The majority turnover within the UK offshore wind sector is generated within England (91%), with the other significant share of turnover accrued within Scotland (9%).

Table A1.19: Turnover, £000s – Offshore wind by country

Date	UK	England	Scotland	Wales	Northern Ireland
2014	2,938,000	2,496,000	95,000	341,500	6,000
2015	2,388,000	2,208,000	n/a	117,000	n/a
2016	2,628,500	2,224,500	300,500	67,000	36,000
2017	3,573,000	3,235,000	304,000	26,000	8,000

Source: ONS, Low carbon and renewable energy economy, UK: 2017

[41] Cebr (2017) The economic contribution of the UK marine industry.

[42] ONS, Low carbon and renewable energy economy, UK: 2017

The multiplier effects of the turnover generated in England are found to be higher than across the other nations in the UK.

Table A1.20: Offshore wind multipliers, 2017

Geography	Turnover
UK	**1.94**
England	1.96
Scotland	1.68
Wales	1.92
Northern Ireland	1.47

Source: ONS, Low carbon and renewable energy economy, UK: 2017

When the indirect turnover generated by the offshore wind sector is included, the estimated total turnover impact of the industry in England in 2017 reached £6.4bn, whilst the Scottish was more than half a billion.

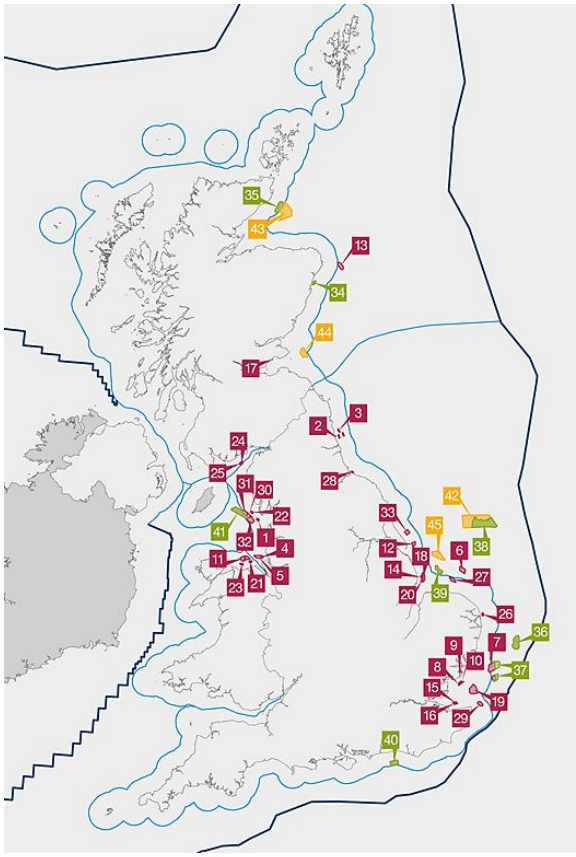
Table A1.21: Direct and indirect turnover, 2017 – offshore wind by country

Geography	Turnover (£ thousands)		
	Direct	Indirect	Total activity
England	3,235,000	3,121,000	6,356,000
Scotland	304,000	206,500	511,000
Wales	26,000	24,000	50,000
Northern Ireland	8,000	3,500	11,500
UK	**3,573,000**	**3,355,500**	**6,928,500**

Source: ONS, Low carbon and renewable energy economy, UK: 2017

The map below shows the location of the UK's offshore wind farms as of the 31 December 2017 are shown on the map below. The sites that are operational (coloured red) are concentrated close to the South East coast of England and the North West Coast of England / North Coast of Wales. Some of the sites under construction (in green) are in similar regions to operational sites, however when the sites in which have secured Government support and a Contract for Difference (in yellow) are also considered, there a shift northwards along the East Coast of England and Scotland.

Figure A1.23: UK offshore wind project pipeline – 31st December 2017



Source: The Crown Estate, Offshore Wind Operational Report, Jan – Dec 2017

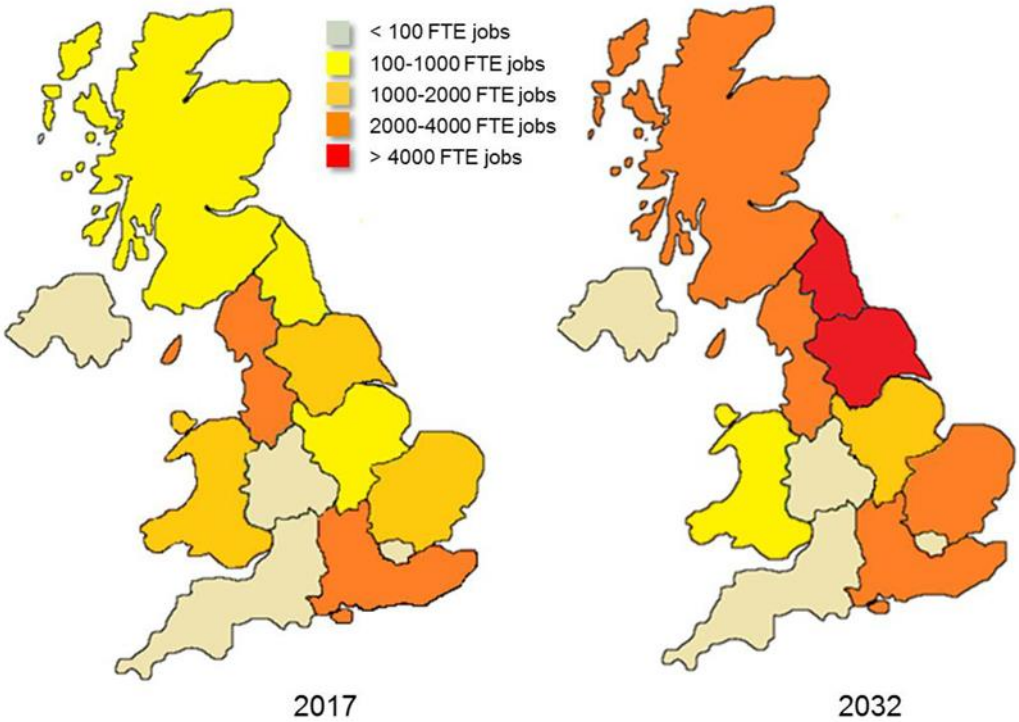
The location of the wind farms unsurprisingly has an effect on the regional distribution of the benefits. Analysis by Cambridge Econometrics suggests that currently the regions of the UK with the highest direct employment from the offshore sector are the North West and South East with between 2,000 and 4,000 direct FTE Jobs. However their projections suggest that by 2032 employment will be highest in the North East, and Yorkshire and Humber (>4,000 FTEs).[43] The North East's offshore sector has been named as one of four regions set to become part of a new £250m Offshore Wind Growth Partnership, expected to drive investment in areas such as advanced manufacturing, floating wind and larger turbines as well as create new, high-skilled jobs in the region[44] The world's biggest offshore windfarm, Hornsea, is located off the Yorkshire coast and is expected to be fully operational by 2020 with additional Hornsea projects either in the construction or development phase (up to Hornsea 4).[45]

[43] Source: Cambridge Econometrics (June 2017) Future UK Employment in the Offshore Wind Industry

[44] https://www.chroniclelive.co.uk/business/business-news/north-east-play-leading-role-15939570

[45] https://orsted.co.uk/en/Generating-energy/Offshore-wind/Our-wind-farms

Figure A1.24: Offshore wind direct FTEs – Regional Breakdown



Source: Cambridge Econometrics Future UK Employment in the Offshore Wind Industry

The wave and tidal energy sectors' regional distribution contrasts that of the offshore wind sector, with clusters and key assets in Cornwall, the Solent, Wales and the Highlands and Islands.[46] The European Marine Energy Centre in Orkney has generated £194m of GVA for the UK economy and created 3,801 job years on the islands. In the South West, cutting edge facilities have generated over £170m of investment in the last decade and created more than 400 marine energy jobs in the region.[47] Two tidal turbines equipped with a range of sensors were redeployed to Strangford Lough in Northern Ireland as part of the third phase of the Tidal Turbine Testing research project. SeaGen at the Strangford Lough tidal facility has the capacity to supply power to 1,500 homes.[48] The MeyGen site just north of Scotland is the largest tidal stream project in the world, and the only commercial multi-turbine array to commenced construction, with MeyGen Phase 1C expected to commence in 2019, creating 5,300 full-time roles while repurposing jobs from the oil and gas sector. It is expected to place Scotland at the forefront of an estimate 25GW global export market over the coming decades.[49]

Looking to the future, the Beatrice Offshore Windfarm Ltd is expected to be fully operational by summer 2019, following a three-year construction period. It is Scotland's largest offshore wind farm with £2.6bn in investment, and is located

[46] Renewables UK (Feb2017), Ocean Energy Race: The UK's Inside Track

[47] Regensw; Marine Energy Pembrokeshire; HIE (June 2016), Marine Energy - Key Steps to Maintain a Great British Success Story

[48] https://www.power-technology.com/projects/strangford-lough/

[49] https://simecatlantis.com/projects/meygen/

approximately 13km from the Caithness coast. It is expected to create around 90 full-time jobs over the course of its 25 year lifespan, while powering 450,000 homes with an installed capacity of 588MW and 84 turbines.

1.5.2 Trade

The offshore wind sector exports just under half a billion pounds of goods and services. The estimates of these exports from the ONS's Low Carbon and Renewable Energy Economy Survey have fluctuated over recent years having fallen from 2014 to 2016 but increasing by over 125% between 2016 and 2017.

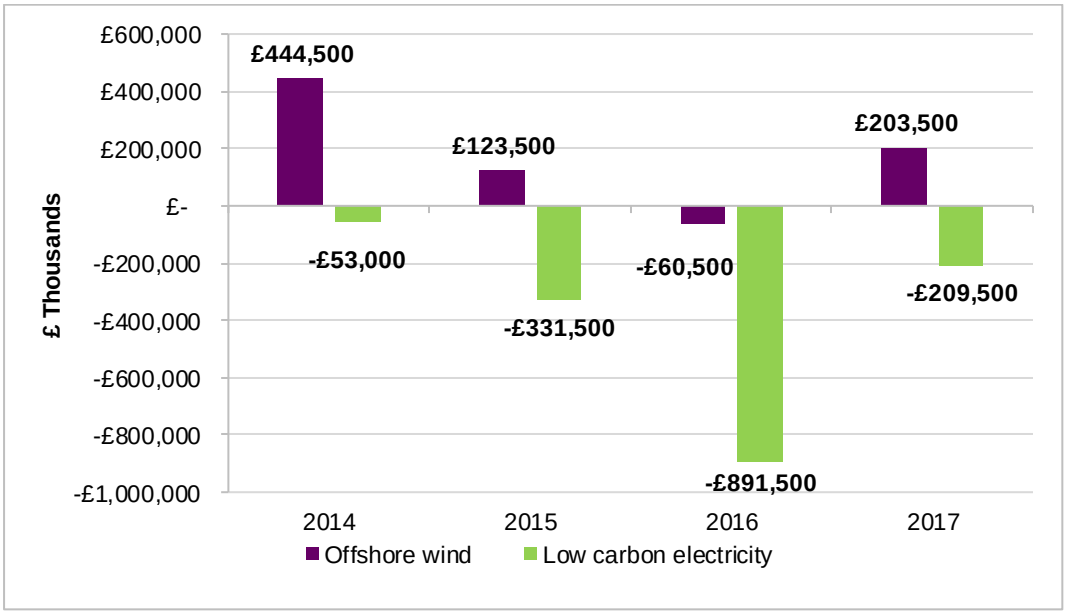
Table A1.22: Export (£000s) – Offshore wind

Date	UK	England	Scotland	Wales	Northern Ireland
2014	638,500	528,500	15,500	94,500	<500
2015	221,500	183,000	n/a	n/a	0
2016	209,000	181,500	27,500	<500	0
2017	472,000	402,500	57,000	12,500	<500

Source: ONS, Low carbon and renewable energy economy, UK: 2017

Unlike the low carbon energy sector as a whole, the UK the offshore wind was a net exporter in 2017. Annual imports of the sector estimated to be £268.5m in 2017 up from £194.0m in 2014. UK energy production peaked in 1999 and there has since been a significant rise in imports. Concurrently, UK demand for low carbon energy has increased since 2000 across wind, solar and hydro, with wind supply energy increasing by 34% in 2017 and capacity increasing by 23% upon 2016.[50]

Figure A1.25: Net exports



Source: ONS

50 https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/728374/ UK_Energy_in_Brief_2018.pdf

Renewables UK intelligence shows that marine renewable energy technology is exported to every continent with the exception of Antarctica. The most frequent destinations of wind, wave and tidal exports were found to be:

- Germany
- USA
- Denmark
- Ireland
- Australia
- Canada
- Sweden
- France
- Singapore
- Taiwan

The typical contract values for exporting companies surveyed were between £1m and £5m.[51] Exports of UK expertise are growing too, with the launch, for instance, of the UK-China Hub for Offshore Wind in Shanghai in 2017.[52] This is expected to facilitate the sharing and promotion of UK expertise in the sector internationally.

1.5.3 Business base and employment

Estimates for the number of businesses in the offshore wind sector are available from the data gathered by the ONS's Low Carbon and Renewable Energy Survey. The results of the survey suggest that the offshore wind sector constitutes roughly 10% (2,500) of the approximately 23,000 UK low carbon electricity production businesses. The majority of these businesses are operating in England (2,000), with Scotland the only other nation with a significant number of active companies (500).

Table A1.23: Business base – offshore wind

Date	UK	England	Scotland	Wales	Northern Ireland
2014	2,000	1,500	500	<500	<500
2015	1,000	1,000	<500	n/a	n/a
2016	2,000	1,500	<500	<500	<500
2017	2,500	2,000	500	<500	<500

Source: ONS, Low carbon and renewable energy economy, UK: 2017

ONS data show that the offshore wind sector contributes a greater proportion of the UK's low carbon electricity production employment than businesses, employing 22% (7,200) of the estimated 32,200 full-time equivalent (FTE) jobs in the wider sector.

[51] Renewables UK (April 2017), Export Nation, A year in UK Wind, Wave and Tidal Exports

[52] Renewables UK (April 2017), Export Nation, A year in UK Wind, Wave and Tidal Exports

The majority of these roles are in England (5,100), although a quarter are in Scotland (1,900). The employment estimates for offshore wind employment between 2014 and 2017 have been variable, falling by 3,200 between 2014 and 2015 before more than doubling between 2015 and 2017.

Table A1.24: Full-time equivalent employment – offshore wind

Date	UK	England	Scotland	Wales	Northern Ireland
2014	6,300	5,300	700	300	<100
2015	3,100	2,400	400	n/a	n/a
2016	5,500	3,600	1,100	500	300
2017	7,200	5,100	1,900	<100	<100

Source: ONS, Low carbon and renewable energy economy, UK: 2017

ONS Low Carbon and Renewable Energy Sector data also estimates the direct and indirect employment generated by the offshore wind sector. These multipliers estimate an additional 6,300 indirect FTEs employed due to the offshore wind sectors, bringing the total employment due to the sector in the UK to 13,500 FTEs.

Table A1.25: Direct and indirect employment, 2017 – offshore wind

Geography	Employees (full-time equivalents)			
	Direct	Multiplier	Indirect	Total activity
UK	**7,200**	**1.87**	**6,300**	**13,500**
England	5,100	1.92	4,700	9,900
Scotland	1,900	1.74	1,400	3,400
Wales	100	2.11	100	200
Northern Ireland	100	1.46	0	100

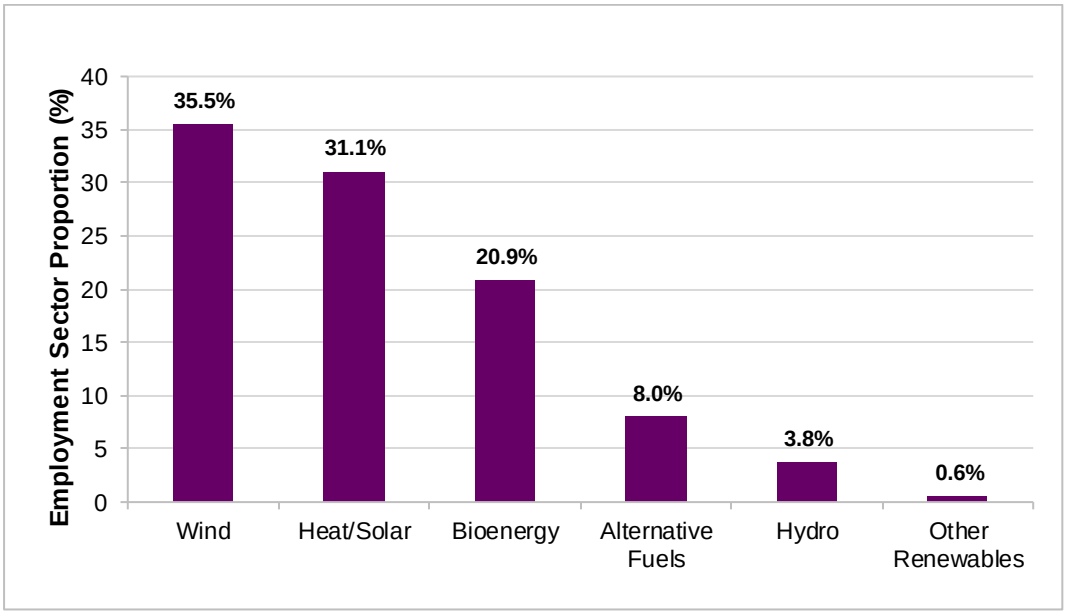
Source: ONS, Low carbon and renewable energy economy, UK: 2017

One recent estimate puts the employment supported by wave and tidal energy at 1,700.[53] Cebr produced an estimate for the 2015 employment impact of the Marine Renewable energy sector across the UK. They reported that the direct employment of the sector was 10,100. When they accounted for the indirect and induced employment due to the UK's offshore renewables energy sector the overall Figure A1.grew to 20,700.[54]

[53] Regensw; Marine Energy Pembrokeshire; HIE (June 2016), Marine Energy - Key Steps to Maintain a Great British Success Story

[54] Cebr (2017) The economic contribution of the UK marine industry.

Figure A1.26: Renewable employment, 2017



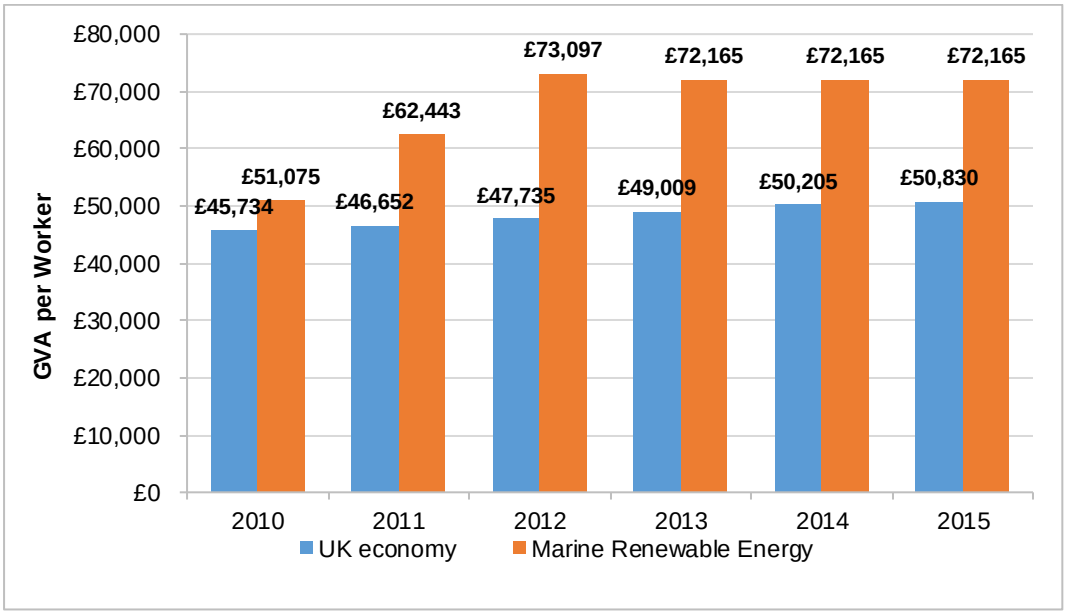
Source: ONS, Low carbon and renewable energy economy, UK: 2017

ONS figures from 2017 show a percentage breakdown of renewable energy group employment by sector, with wind and heat/solar amounting for around 36% and 31% respectively in the UK.

1.5.4 GVA and Labour Productivity

Cebr estimated that marine renewable energy had a direct GVA impact in the UK of £730m in 2015. In addition to these direct impacts the sector was estimated to have annual indirect GVA benefits of £511m stimulated in supply chains and induce a further £256m in the wider economy when direct and indirect employees spend their earnings. Analysis of labour productivity calculated that the GVA per worker in offshore renewables was consistently above that of the UK economy average, raising from approximately £51,000 per worker in 2010 to over £72,000 in 2015.

Figure A1.27: Labour productivity

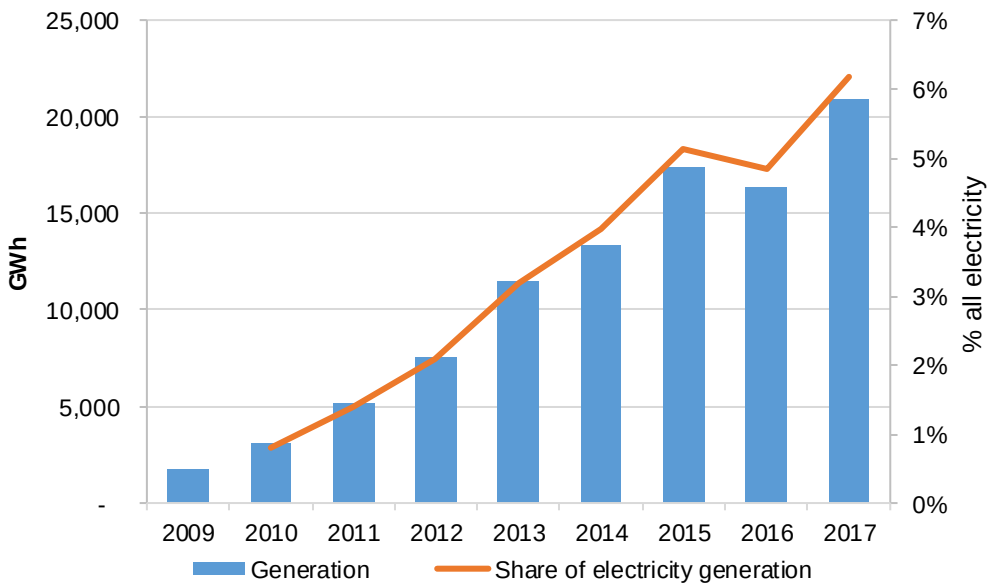


Source: Cebr, The economic contribution of the UK maritime industry

1.5.5 Environmental and sustainability characteristics

The past decade has been revolutionary for the scale of marine renewable infrastructure. Between 2009 and 2017 the cumulative capacity of the UK offshore renewables increased by 638%, from less than 1,000MW to over 7,000MW. 2017 was the first year that the offshore renewables sector produced over 6% of the UK's annual electricity.

Figure A1.28: Electricity generated by offshore renewables



Source: BEIS, Renewable electricity capacity and generation

The UK's natural assets and success to present mean offshore renewables are set to grow strongly. There were 36 UK offshore wind farms in 2017 generating electricity, with 1,762 wind turbines operational on the seabed, with the number of turbines set

to increase by 50% in the next 5 years.[55] Alongside this the UK has 50% of Europe's tidal energy[56] and 35% of its wave energy.[57]

1.5.6 Barriers to future developments

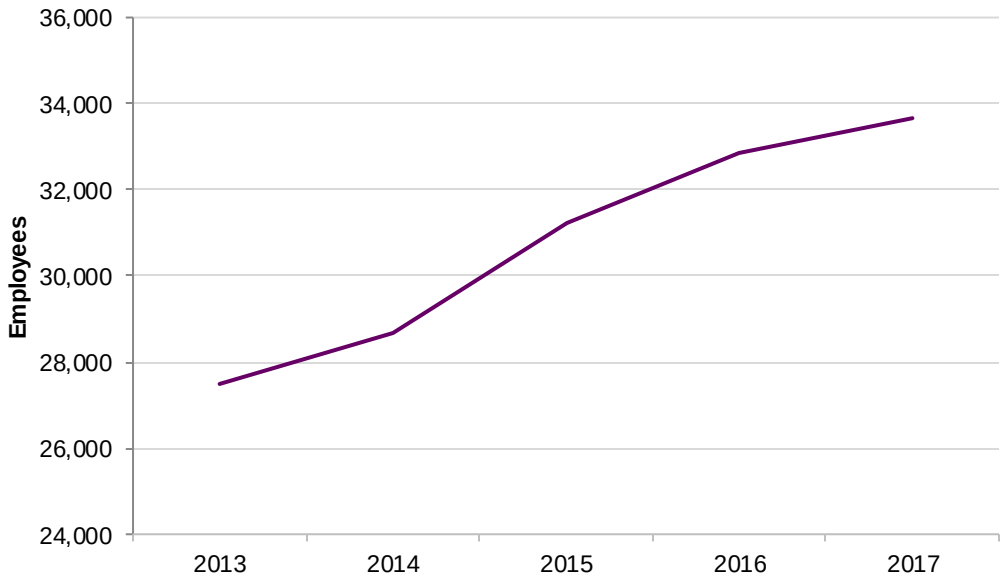
Timing is a significant barrier to future marine renewable energy developments, especially if the 2050 UK emissions target is to be met (a reduction in emissions to less than 100 g CO2/kWh. This may require a large-scale rollout of low-carbon generation over the next decade, with strain put on existing renewable technologies.[58]

High learning rates and global deployment would be required to establish a successful integration of marine energy into the UK energy system in the long-term, however uncertainty exists over whether learning rates of above 15% and a globally installed capacity of more than 150 GW by 2050 will materialise.

Other barriers to future development include marine technologies competing with alternative technology options that are more cost-effective, challenges around integrating low-carbon technologies into the existing UK generation system (given decentralisation and intermittency), and commitment from UK government to provide ongoing, sustained support for the development of the marine energy sector for the foreseeable future.

1.5.7 Competitor comparison: Denmark

Figure A1.29: Number of people employed by Wind Denmark, offshore and onshore, 2013-2017



Source: Industry Statistics, Wind Denmark 2014-2018

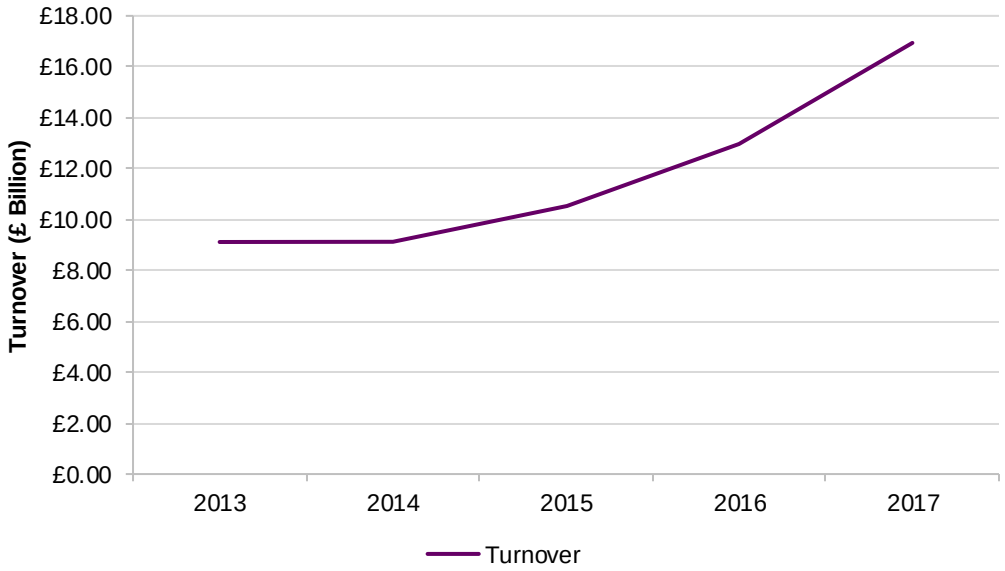
[55] The Crown Estate, Offshore Wind Operational Report, Jan – Dec 2017

[56] UK GOV (2013), Wave and tidal energy part of the UK's energy mix

[57] Andrew Thomas et al. (2013) Tidal and marine energy in the UK – identifying the future challenges for supply chain development

[58] Zeyringer, M, Fais, B, Keppo, I & Price, J (2018) 'The potential of marine energy technologies in the UK – Evaluation from a systems perspective', *Renewable Energy*, Vol. 115, pp.1281-1293

Figure A1.30: Total revenue in Denmark's offshore and onshore wind turbine industry, 2013-2017



Source: Industry Statistics, Wind Denmark 2014-2018

Table A1.26: Number of offshore wind turbines connected, Denmark, 2013-2018[59]

	2013	2014	2015	2016	2017	2018
Farms	1	12	13	13	16	14
Turbines connected	97	513	513	517	506	514
MW connected to grid	350	1,271	1,271	1,271	1,266	1,329

Source: WindEurope, 2013-2018

Table A1.27: Primary[60] renewable[61] energy production in Denmark, 1990-2018

Year (1990-2010)	**1990**	**2000**	**2005**	**2010**
Renewable Energy (PJ)	45.46	76.02	105.58	131.31
Years (2015-2018)	**2015**	**2016**	**2017**	**2018***
Renewable Energy (PJ)	159.16	158.59	170.57	174.64

Source: Danish Energy Agency, 2018

Table A1.28: Observed renewable energy consumption in Denmark, 1990-2018

Year (1990-2010)	**1990**	**2000**	**2005**	**2010**
Renewable Energy (PJ)	45.46	78.51	121.88	167.94
Years (2015-2018)	**2015**	**2016**	**2017**	**2018***
Renewable Energy (PJ)	210.04	217.51	244.16	244.82

Source: Danish Energy Agency, 2018

[59] https://windeurope.org/about-wind/statistics/offshore/

[60] Primary renewable energy is energy that is harvested directly from natural resources, including energy from wind, tides, coal and oil.

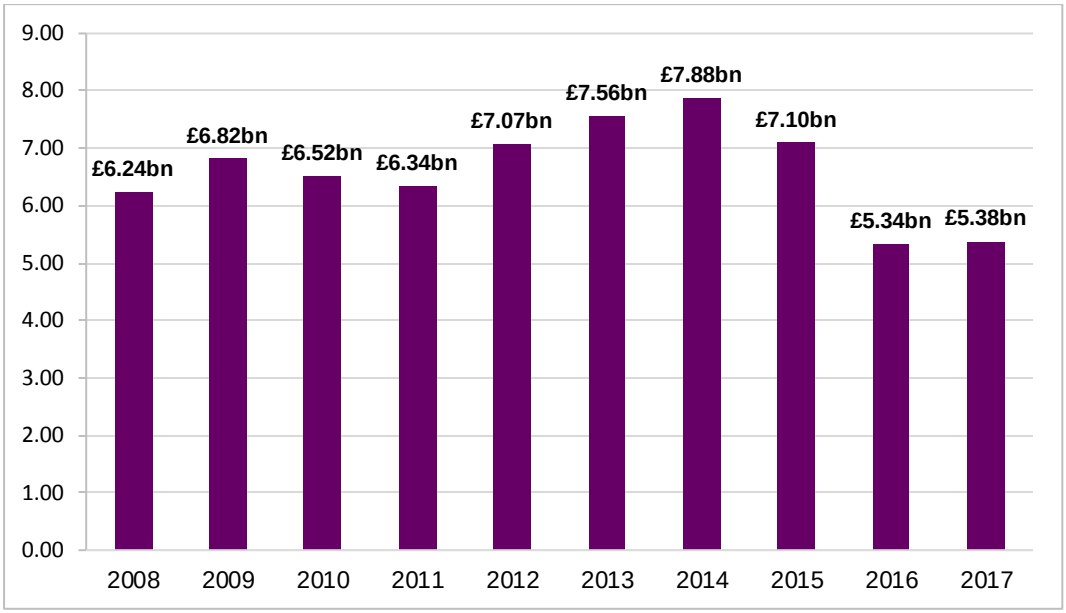
[61] Renewable energy in this instance accounts for wind, wood, waste/renewable, straw, biogas, and heat pumps

1.6 Oil & gas decommissioning

1.6.1 Economic value and distribution of impacts

Decommissioning is part of the natural lifecycle of oil and gas assets. In the UK, the total turnover of businesses providing support activities for petroleum and natural gas extraction, which includes those involved in oil and gas decommissioning, is estimated at £5.38bn in 2017. This is a drop of around 32% from its £7.88bn peak in 2014, when oil prices began to fall rapidly.

Figure A1.31: Support activities for petroleum and natural gas extraction - UK turnover £ billion



Source: ONS UK Non-Financial Business Economy Annual Business Survey 2018

Oil and Gas UK report that oil and gas decommissioning activity has been steadily increasing since 2004, with UK annual decommissioning expenditure increasing from £1.1bn in 2014 to £1.8bn in 2017[62]. Whereas total annual expenditure on the UKCS (UK Continental Shelf) fell by almost 50% from around £30bn in 2014 to £15bn in 2017. During this period of challenging market conditions, decommissioning activity represented the only increasing area of expenditure in the basin.

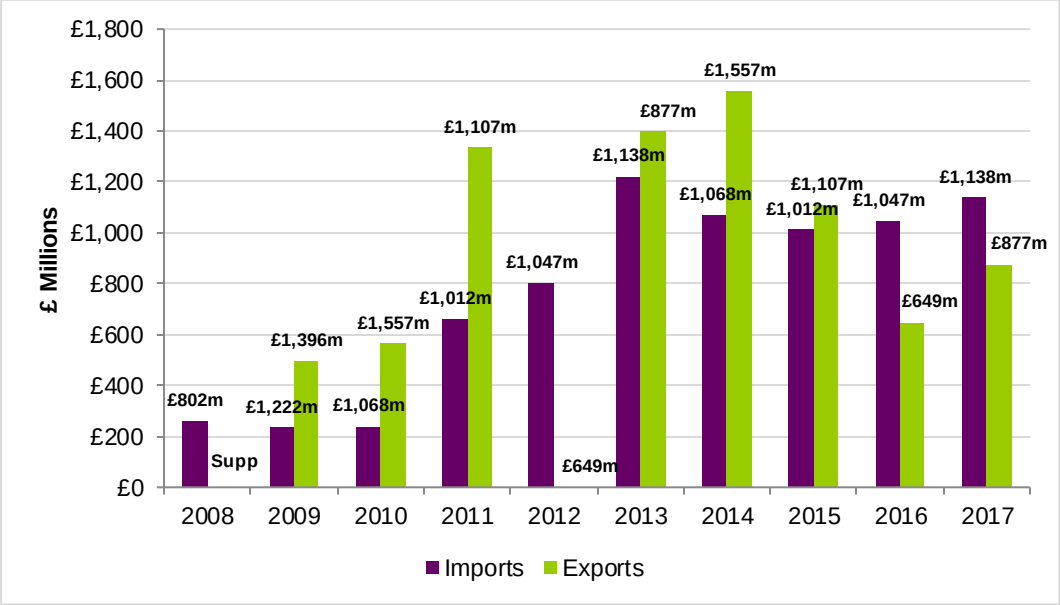
However, with the industry striving to increase efficiencies and reduce expenditure on decommissioning by 35 per cent, decommissioning still accounts for just a small proportion of overall expenditure on oil and gas in the UKCS (8% in 2017).

1.6.2 Trade

The import and export figures are not available for the 'Support activities for petroleum and natural gas extraction' sub-sector so figures for the whole 'Mining support service activities' sector have been used.

[62] Oil and Gas UK Business Outlook, 2018 – see https://cld.bz/c41vNPt/6/

Figure A1.32: Mining support service activities, import and export values (UK) £m



Source: ONS, UK Trade in Goods by industry, country and commodity, 2008-2016

1.6.3 Business base and employment

Business base

As shown in Table A1.29, data from UK Business Counts indicates that in 2018 there were 210 businesses involved in support activities for oil and gas extraction in the UK. These are almost evenly distributed between England and Scotland, with no businesses currently registered in Wales or Northern Ireland since 2016. Overall, the number of businesses has declined since 2013 and particularly in Scotland which has seen a 45% reduction in the number of businesses involved in oil and gas decommissioning since 2013.

Table A1.29: Business base, Support activities for petroleum and natural gas extraction by country

Date	UK	England	Scotland	Wales	Northern Ireland
2013	325	125	190	5	5
2014	230	95	130	0	5
2015	235	105	120	5	10
2016	245	110	130	5	5
2017	210	95	110	0	0
2018	210	100	105	0	0

Source: ONS, UK Business Counts: 2018

Employment: Size of workforce

The support activities for oil and gas extraction sector employed around 20,000 people in 2017 with the vast majority of these in Scotland (employees in this sector

make up around 0.7% of all employees in Scotland).[63] The employment figures for this sector in Northern Ireland are not available but are likely be similar to Wales.

Employee numbers in England have reduced steadily, with an almost two-thirds decline in employees from 2,750 in 2013 to 1,000 in 2017. Employee numbers in Scotland have also been declining since they peaked at 22,500 in 2014 – dropping by a quarter between 2014 and 2016. The 2017 figure does, however, show an increase in employment in Scotland between 2016 and 2017 back up to a similar level to that seen in 2013.

Table A1.30: Size of workforce – Support activities for petroleum and natural gas extraction by country

Date	England	Scotland	Wales	Northern Ireland
2013	2,750	18,000	125	-
2014	2,750	22,500	125	-
2015	1,750	20,500	150	-
2016	1,875	16,500	150	-
2017	1,000	18,500	75	-

Source: ONS Business Register and Employment Survey 2018
- Figures are undisclosed

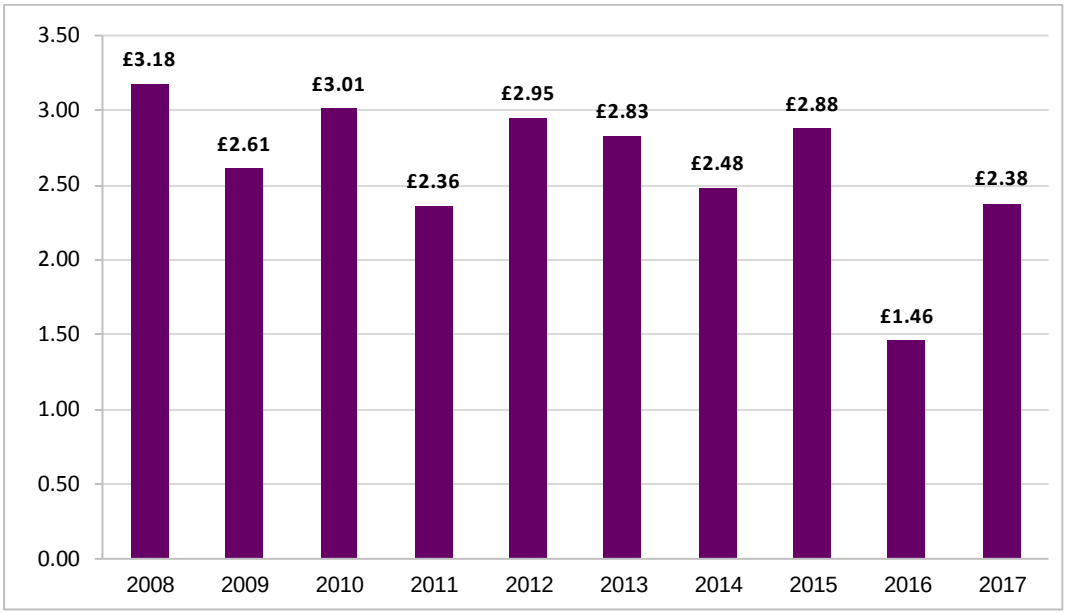
Around two-thirds of businesses in the sector are micro-sized with less than ten employees. Whilst England and Scotland currently have a similar number of businesses in the sector, and equal numbers of micro, small and medium-sized businesses, Scotland dominates the sector due to due to a small number of large businesses employing a significant number of people.

1.6.4 Sector GVA

The approximate UK GVA for the wider petroleum and natural gas extraction sector at basic prices has fluctuated over the years since 2008. Most recent figures place it at £2.38bn, up from £1.46bn in 2016 when it fell significantly, but a 25% reduction on its ten year peak of £3.18bn in 2008. This reflects the downturn in the oil and gas industry in 2016, with the sector only now showing signs of recovery.

[63] The employment figures for this sector in Northern Ireland are not available due to data suppression, but are anticipated to be similar to Wales. For Mining and Quarrying as a whole the 2017 employment figure in Northern Ireland is 1,850 (OpenData NI, 2019).

Figure A1.33: Support activities for petroleum and natural gas extraction – UK GVA £bn



Source: ONS UK Non-Financial Business Economy Annual Business Survey 2018

1.6.5 GVA per worker

Table A1.31 shows GVA per worker for the support activities for petroleum and natural gas extraction sector in Great Britain excluding Northern Ireland.

Approximate GVA per worker in the support activities for petroleum and natural gas extraction sector was £121,481 in 2017, whereas the UK average per worker across all sectors in 2017 was £54,330[64].

Table A1.31: GVA at current prices for the Support activities for petroleum and natural gas extraction sector per worker, 2013-2017

Year	GVA per worker (GB; excl. NI)
2013	£135,329
2014	£97,773
2015	£128,616
2016	£78,704
2017	£121,481

Source: ONS UK Non-Financial Business Economy Annual Business Survey 2018, and ONS Business Register and Employment Survey 2018

1.6.6 Sector forecast and global position

Over the years of rising oil prices (2003-2014) there was reduced impetus for the oil and gas sector as a whole to operate on a low-cost model. However, the rapid fall in oil prices since late 2014 has made these inefficient operational models unsustainable. The sector is now committed to operational improvements and efficiencies to cut expenditure by 35% over the coming years. Meeting these cost

[64] ONS Regional and Subregional Productivity February 2019 release

reduction targets is considered key to the UK positioning itself as a decommissioning expert on a world scale.

Wood Mackenzie[65] calculated that the UK accounted for 16% of the estimated 472 fields that ceased production in 2013-17. They forecast that globally the UK will have the highest decommissioning expenditure from 2018-2027 (33% of the $82bn forecast to be spent by the top 12 global markets over the 10 year period) – partly due the complexities of offshore, deep water decommissioning but primarily due to the maturity of the basin. The UK forecast is significantly more than the second (USA 15%) and third highest (Norway 11%).

Oil and Gas UK[66] research found that the UK is expecting to spend £15.3bn on decommissioning over the next decade. This expenditure is forecast to be divided between these areas:

- 48% in the Central North Sea
- 30% in the Northern North Sea
- 15% in the Southern North Sea and Irish Sea
- 7% West of Shetland

Forecast expenditure expected to be split amongst the following decommissioning activities:

- 49% on well decommissioning
- 17% on operator costs – project management and running platforms and facilities after production ceases
- 13% on topsides and substructure removals
- 12% on subsea infrastructure removal

Offshore oil and gas decommissioning in the USA has seen an average of 130 platforms removed annually from the Outer Continental Shelf over the last decade (with approximately 3,700 platforms still active). In the Gulf of Mexico, over 4,000 platforms have been decommissioned since the 1980s, with future decommissioning activity expected to happen in deeper waters. Regulations in the USA allow for the disposal of platforms at sea in the Rigs to Reef programme, with 470 platforms across the USA converted into artificial reefs in 2015.

1.6.7 Re-use opportunities

There is growing interest in applying circular economy principles to oil and gas decommissioning. Zero Waste Scotland has identified a number of ways oil and gas infrastructure could be reused and reconditioned, allowing for potential economic

[65] Wood Mackenzie, US$32bn of decommissioning worldwide over the next five years: is the industry ready?,2017

[66] Oil & Gas UK, Decommissioning Insight, 2018

benefits.[67] In accordance with high value reuse opportunities, two main re-use approaches for decommissioned materials were identified: re-use of components and equipment reconditioning and re-use in other industries. Component re-use might incorporate steel sections from jacket and topside, pipelines and anchor chains and cables, while equipment reconditioning and re-use could consider opportunities around vessels and tanks, accommodation blocks and winches.

1.6.8 Societal and environmental consequences

As part of the decommissioning process, operators are required to evaluate the environmental and societal consequences of different decommissioning strategies. There is a particular focus on the impact of existing oil and gas infrastructure on commercial fisheries. Interactions between oil and gas infrastructure and commercial fishing vessels can lead to unwanted consequences for the latter, including damage and/or loss of gear, loss of fishing time, spoilt catches, and potential injuries/fatalities[68]. Between 2007 and 2015 a total of 1,590 pipeline-fishing incidents were reported by UK vessels to the Marine Accident Investigation Board (MAIB), with almost all incidents reported to have resulted in a financial loss (99.6%). Of the reported incidents, 66% had location data, with the majority of incidents reported in the northern North Sea where the majority of UK mobile demersal fishing in concentrated. Oil and gas-related debris accounted for 24% of claims, whereas wires (18%) and pipelines and protective coverings (13%) also accounted for significant number of claims. There has been a reduction in the number of incidents reported, from under 150 per year in 1989, to fewer than 10 per year in 2013, largely due to improved communication, infrastructure mapping and technological innovation (GPS). The "FishSafe" unit was introduced in 2001 and likely contributed to increased awareness of offshore oil and gas infrastructure locations among fishers.

1.6.9 Competitor comparison: Oil & gas decommissioning in Norway

67 https://www.zerowastescotland.org.uk/sites/default/files/North%20Sea%20Oil%20and%20Gas%20Rig%20Decommissioning%20%26%20Re-use%20Opportunity%20Report.pdf

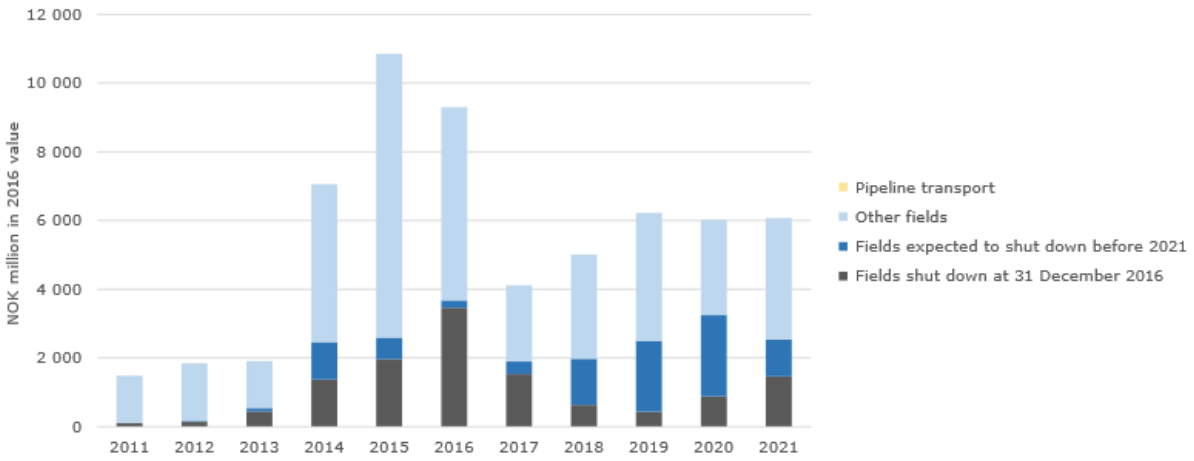
68 Rouse, S., Hayes, P and Wilding, T.A. (2018) "Commercial fisheries loses arising from interactions with offshore pipelines and other oil and gas infrastructure and activities", *ICES Journal of Marine Science*

Table A1.32: Change in estimate lifetime for selected Norwegian oil and gas fields, 1980-2050

Field	Latest year of reported production in:		
	1992-1995	2002	2018
Veslefrikk	2007	2014	2025
Varg	2003	2006	2016
Statfjord	2007	2020	2025
Gullfaks	2004	2016	2042
Ekofisk	2025	2028	2050
Draugen	2007	2016	2035
Brage	2005	2008	2030

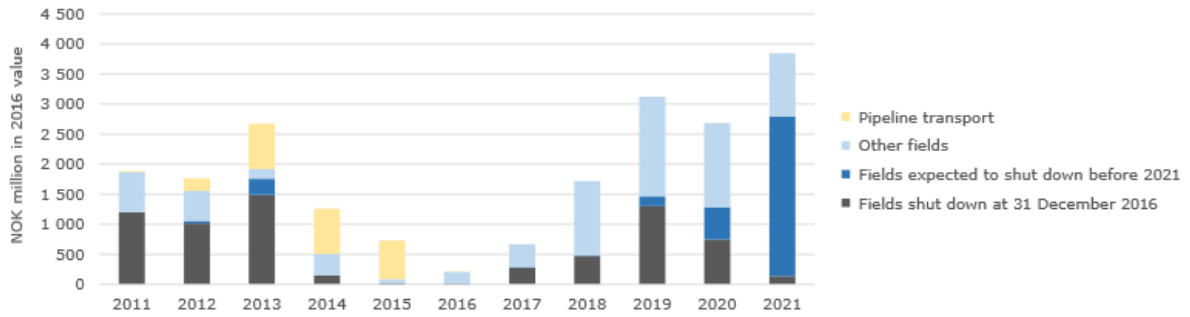
Source: Norwegian Petroleum Directorate, 2018

Figure A1.34: Field shut-down costs, 2011-2021[69]



Source: Norwegian Petroleum Directorate, 2016

Figure A1.35: Field disposal costs, 2011-2021



Source: Norwegian Petroleum Directorate, 2016

[69] https://www.npd.no/en/facts/publications/reports2/resource-report/resource-report-2017/cessation/decommissioning-costs/

1.7 Marine tourism

1.7.1 Output, GVA and labour productivity

The total economic contribution of the marine tourism sector is difficult to define using standard datasets. Therefore intelligence available on the overall economic contribution of the sector comes from specific reports relating to the sector. The Coastal Communities Fund Annual Report 2016, estimated the GVA output of the marine tourism sector was approximately £4-5bn per year.[70] British Marine found that the "Leisure Marine" sector alone (leisure boating activities) generated £3.0bn of revenue in the UK in 2015/16, with the hire, charter and passenger boat and the moorings and marinas sectors worth £351m and £222m respectively. This economic activity in the Leisure Marine supports an overall annual GVA impact £1.1bn per year.[71]

For England and Wales the economic impact statistics are more readily available at a coastal tourism sector level. In England there more than 17 million domestic overnight trips and 144 million day trips made to the coast a year.[72] The total spend generated by domestic coastal tourism in England and Wales is approximately £8bn, and the sector contributes £3.6bn in GVA a year.[73]

Marine tourism and recreation were estimated to generate turnover in the Scottish economy of £3.7bn in 2015.[74] Examples of successful industries include dolphin watching in the Moray Firth, which generates at least £4m for the local economy each year[75] and cruise passenger numbers, which have grown strongly in Orkney, rising from 36,000 in 2011 over 95,000 in 2016 with a projected annual growth rate of 3.5%. The Sailing Tourism in Scotland report estimated the sector's economic value to be around £130m in 2015, projected to increase to potentially £167m by 2020, exceeding its initial £145m target.[76] Scottish marine tourism alone had a turnover of £1.0bn in 2016, increasing by over a third from £746m in 2009, leading to a GVA contribution to the Scottish economy of £554m. The GVA per worker (full-time and part-time) in the sector is £19,864 compared with £14,616 in 2014.[77] With respect to Scotland's assets, the growth in economic value of marine tourism is also projected to rise from £360m in 2015 to around £450m in 2020 supported by Scotland's National Marine Tourism Strategy 'Awakening the Giant,' which is set to provide

[70] Big Lottery Fund (Nov 2016), Coastal Communities Fund Annual Progress Report 2016

[71] https://www.ybw.com/news-from-yachting-boating-world/uk-leisure-marine-industry-grows-for-fifth-consecutive-year-46296

[72] Visit England, Domestic Tourism to the seaside in England 2014

[73] National Coastal Tourism Academy (Jan 2017), Coastal Visitor Economy. Vision, Strategy and Action Plan

[74] Scottish Government, Scottish Marine Recreation & Tourism Survey 2015

[75] Foresight (2018), Future of the Sea

[76] https://www.sailscotland.co.uk/news/posts/2017/sailing-tourism-to-grow-by-37m/

[77] Scottish Government (Oct 2018), Scotland's Marine Economic Statistics

authentic experiences through new cruise routes and themed journeys among others.[78]

Tourism as a whole had a turnover of £926m in Northern Ireland in 2017, up from £641m in 2011.[79] Coastal tourism represents a significant proportion of the Northern Irish total, with Causeway Coast and Glens (the local government district covering most of the North Coast) accounting for £194m (21% of N.I.) of spend, the second most behind Belfast. Three of the six most visited attractions in Northern Ireland are on the coast, recording a combined 2,000,000 visitors in 2017 (Giant's Causeway: 1,012,000; Carrick-a-Rede Rope Bridge: 434,000; Kinnego Marina: 430,000). Meanwhile, Northern Ireland's Maritime history is the premise of the second most popular attraction Titanic Belfast, with 760,000 visitors a year.

Table A1.33: Summary of GVA and Turnover Estimates

Geography	Turnover	GVA	Sector
England and Wales[4]	£8.0bn	£3.6bn	Domestic Coastal Tourism
Scotland[7]	£1.0bn	£554m	Marine Tourism
Northern Ireland[8]	£926m	-	Total Tourism
UK[1]	**-**	**£4-5bn**	**Marine Tourism**

Source: National Coastal Tourism Academy; Scottish Government; North Ireland Statistics and Research Agency; Big Lottery Fund

1.7.2 Business base and employment

The data for the number of businesses in the UK marine tourism sector is not available however some estimates for the employment contribution of the sector across the four nations exist. Beatty, Fothergill and Gore (2014) concluded that coastal tourism in England and Wales directly supported 212,000 jobs in 2010-2012 (up from 207,000 in 2006-08), and that the number indirectly support could be as high as 600,000.[80] There is a more recent figure for marine tourism employment in Scotland, in 2016 an estimated 27,900 jobs were in the sector, up 15% from 2008.[81] For Northern Ireland there is a lack of specific figures, although the visitor economy has whole supported more than 61,000 jobs in 2017.[82]

1.7.3 Trade

Tourism exports can be defined as overseas spend plus fares. The UK tourism industry as a whole in 2013 this figure was £22.3bn, and imports (UK outbound tourism) were £33.5bn.[83] Marine leisure exports for 2015 were estimated at £882m,

[78] http://www.hie.co.uk/growth-sectors/tourism/marine-tourism-strategy/deafult.html

[79] Northern Ireland Statistics and Research Agency, Annual Tourism Statistics Publications

[80] Beatty, Fothergill and Gore (July 2014), The Seaside Tourist Industry in England and Wales Employment, economic output, location and trends

[81] Scottish Government (Oct 2018), Scotland's Marine Economic Statistics

[82] http://www.irishnews.com/business/2018/06/08/news/record-year-for-tourism-in-northern-ireland-as-trips-bed-nights-and-spend-all-increase-1350501/

[83] Deloitte (Nov 2013), Tourism Jobs and Growth, The Economic Contribution of the tourism economy UK.

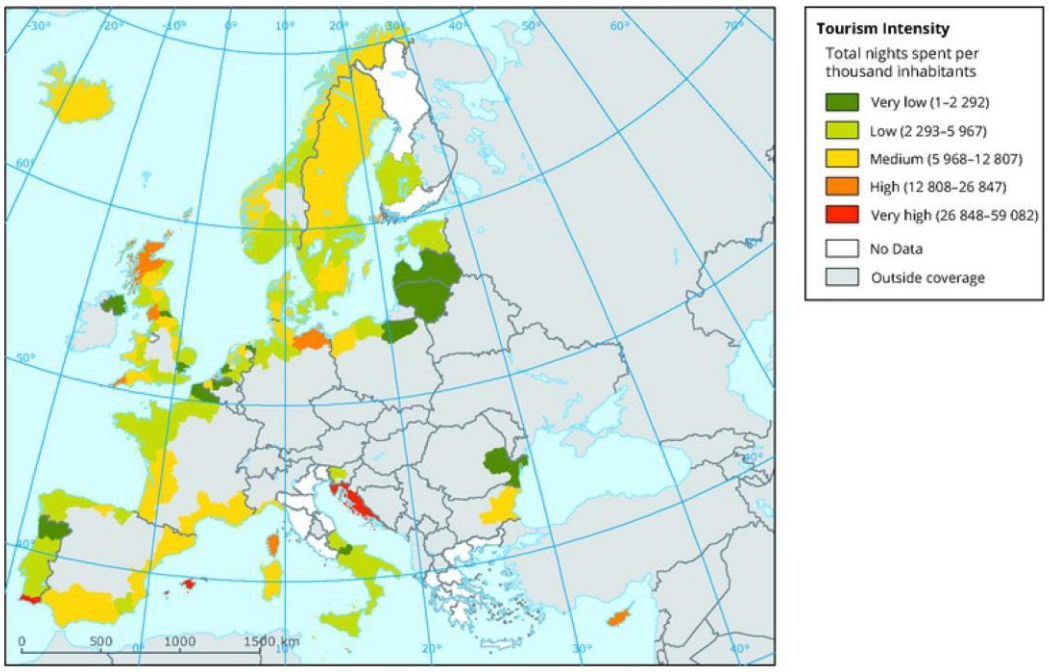
the two largest markets being the Eurozone £392m (44.6%) and North America £157m (17.8%). With sailing and boating alone generating over £101m of visitor expenditure and supporting 2,730 jobs in Scotland, marine tourism is one of Scottish tourism's sleeping giants.[84] In 2017, international visitor numbers to the UK were estimated to be around 39.21 million, a 4.3% increase upon the previous year with 4-5% increases each year since 2013.[85] Average spend per visit declined slightly year upon year between 2014 and 2016, however it increased by 4.3% in 2017 with total expenditure up 8.7% to £24.51bn.

1.7.4 Economic value and geographic distribution of impacts

Tourism is a key employer in many of the UK's coastal areas. The as shown in the map below, in the Highland and Islands, Cumbria and Cornwall tourism intensity is higher than the coast of mainland Spain and France.

Figure A1.36: Tourism intensity in coastal areas, 2012

Tourism intensity in coastal areas, 2012



Source: European Environment Agency

In England and Wales at a regional level coastal tourism has the largest employment impact in the South West, where nearly a third of the England and Wales total are employed. The South West and South East are the locations for growth in employment with the employment numbers and in the North West and Wales falling since 2006/08.

[84] https://www.sailscotland.co.uk/media/2843/awakening-the-giant.pdf

[85] https://www.visitbritain.org/inbound-tourism-trends

Table A1.34: Average year-round employment directly supported by seaside tourism

Region	2006/08	2010/12
South West	61,000	68,000
South East	46,000	49,000
North West	29,000	25,000
East of England	23,000	23,000
Wales	20,000	19,000
Yorkshire and Humber	14,000	14,000
North East	7,000	7,000
East Midlands	6,000	7,000
England and Wales	207,000	212,000

Source: Beatty, Fothergill and Gore (2014)

Appendix 2: Literature review of constraints and challenges

1.8 Introduction

This appendix sets out a literature review of the key market failures and constraints facing the marine economy's key sectors. These are:

- Aquaculture (including finfish and shellfish cultivation)
- Commercial capture fishing (including sea fisheries and key inland fisheries)
- Seafood processing (NB this is considered within aquaculture and fisheries)
- Commercial seaweed harvesting and growing
- Offshore renewable energy (including wave, tidal and offshore wind)
- Oil and gas decommissioning
- Marine tourism

It uses a capitals framework to set out the key challenges facing the marine economy. The findings of this literature review informed the approach to the primary research, and provides context for the findings.

1.9 Aquaculture

1.9.1 Overview

UK aquaculture covers farmed finfish (predominantly salmon, and rainbow trout), shellfish (mussels, oysters, and other species) and seaweed which, while small, is growing in relevance as a foodstuff and a source for pharmaceutical and biofuel materials. Salmon constitutes the largest product by a significant margin at over 85% of total production by volume and 95% of total value[86]. Almost all of the salmon production takes place in Scotland, while rainbow trout and shellfish are more evenly spread by each UK country.[87]

1.9.2 Human capital

There has been net growth in jobs in UK aquaculture, but with stasis in some areas and large growth in others. Both full and part time employees in UK aquaculture production in 2012 were as follows[88]:

[86] p.1, https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/405469/ Aquaculture_Statistics_UK_2012.pdf

[87] Dependent on whether the Welsh mussel industry is treated as aquaculture; this view assumes so.

[88] NB: Figures from 2016: https://www.seafish.org/media/publications/FINALISED_Aquaculture_in_EWNI_FINALISED__-_Sept_2016.pdf and http://www.hie.co.uk/common/handlers/download-document.ashx?id=b76bda3c-a01b-462f-9f74-4773bfb1cfe4. P. 8, https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/405469/Aquaculture_Statistics_UK_2012.pdf. 2012 data presented for consistency.

Table A2.1: Aquaculture employment, UK, 2012

	Finfish employees	Shellfish employees
England	823	258
Wales	100	34
Scotland	1540	358
Northern Ireland	63	55
TOTAL	**2,526**	**705**

Source: Seafish; HIE (2016 data)

Scottish finfish production employees in 2017 stand at around 1,900[89], reflecting growth in the salmon sector over 5 years. In 2016 Seafish estimated around 1,000 production jobs across England, Wales and Northern Ireland (lower than stated in 2012). In total around 3,900 employees are estimated to be involved in aquaculture production across the UK.

However, these jobs are only in production – the impact of this production through the value chain is far greater in terms of processing, engineering services, transport and feed. 'The Value of Aquaculture to Scotland' (2017) states that production jobs in Scottish finfish aquaculture comprise around 18% of employment across the value chain (which includes suppliers, processors, transporters beyond the production site itself), and 15% of jobs including supply chain and induced jobs generated by that economic activity (including jobs in shops, housing etc. that are not directly related to the sector)[90]: it is estimated that for every job in aquaculture production, a further four are supported in other sectors. This brings the total number of UK jobs in the supply chain to over 12,000, and over 15,000 in total (including the 12,000 direct and indirect jobs) benefiting from aquaculture business spreading across the economy.[91]

Training and education in aquaculture are available in the UK and again with more in Scotland in line with the industry structure. However, leading institutions like Stirling University have effectively globalised their knowledge and skills position beyond national aquaculture production.[92]

Although Scotland's aquaculture-related education is internationally renowned, there remains a limited supply of courses and qualifications that are specific to aquaculture. In addition, training provided by aquaculture employers is not always transferable or recognised by other employers. Compounding all of this, the pipeline of entrants from formal education is currently insufficient to meet demand. There is a challenge in ensuring industry-relevant skills and a demand for more courses and aquaculture learning opportunities overall, and a need for more vocational or

[89] https://www.gov.scot/publications/scottish-fish-farm-production-survey-2017/pages/2/

[90] Pg.55-58, http://www.hie.co.uk/common/handlers/download-document.ashx?id=b76bda3c-a01b-462f-9f74-4773bfb1cfe4

[91] It is worth noting here, however, that these wider supported FTE jobs are estimates, and as such there is a degree of uncertainty, since wider impacts can prove problematic to accurately measure

[92] https://www.seafish.org/article/careers-and-training-in-aquaculture

practical aspects to courses. This is not just in terms of volume, but also in geographical reach of the education provided.[93]

The growth and growth aspirations of the sector is driving a particular need for skills in production although there is also demand, albeit less acute, in other areas such as processing and the wider supply chain. Engineering and boat skills are key demands across the sector and there is currently a shortage, due to competition with other sectors. Consolidation in the sector is also driving demand for management and wider business skills. Demand for technical and technological skills is expected to increase as the industry develops and adopts more sophisticated and innovative techniques and technology, particularly for fish welfare and environmental stewardship.[94]

A number of factors can make it hard to attract people in to the industry and it has competition from other sectors. This is compounded by lack of awareness and misperceptions amongst potential employees of the career opportunities in aquaculture, particularly in relation to emerging opportunities around digital and technical skills. Coupled with this, a key challenge for the remote areas that aquaculture is often located in is retaining and attracting talent. Local infrastructure is crucial so that there are not only jobs, but that areas are attractive as places to live, work and learn.[95]

Brexit is also impacting on the supply of much needed international workers, especially in processing. Brexit will also potentially negatively impact the supply of international students who come to Scotland to study, and then stay and work in the sector. There is also a significant gender imbalance within the aquaculture sector workforce and education pipeline which also impacts on the available workforce. [96]

1.9.3 Natural resources/physical capital

Aquaculture relies on the use of natural capital including marine space, freshwater lakes and lochs, and rivers. This puts it in contact with wild species and water users.

A 2018 Scottish Parliament Committee enquiry into the environmental impact of Scottish salmon found that 'the status quo is not an option' and calls for improvement in data, monitoring and research, an independent assessment of the environmental impacts of growth forecasts, and application of the precautionary principle for new sites.[97] Increased use of onshore Recirculation Aquaculture Systems (RAS) is being considered by different companies (and already operating in high value areas of the

[93] ekosgen/Imani Development for HIE (2018) Skills Review for the Aquaculture Sector

[94] Ibid.

[95] Ibid.

[96] Ibid.

[97] P. 66, https://www.parliament.scot/S5_Environment/Inquiries/20180305_GD_to_Rec_salmon_farming.pdf

industry like halibut production[98] and longer smolt production) though this has different water use, waste and site requirements.

A Seafish report (2016)[99] highlights that aquaculture can be wellbeing-enhancing and provide tourism opportunities. Loch Fyne Oysters[100] is an example of where production, retail and hospitality offerings through integrated supply chain, including Scottish operations in Argyll and Bute with oyster production in Morecambe Bay, Cumbria. Whilst there may be an opportunity to capitalise on this in locations where aquaculture production sites exit, there should be cognisance of potential environmental impacts arising from aquaculture operations, and any possible resulting impact on wellbeing if environments are degraded.

Management of sites at a portfolio level (many sites across a given geography) can be important for risk mitigation: in salmon production it is considered preferable that a loch or lake system does not have competing management systems that may adversely interact with each other. This approach is formalised in disease management areas[101] and farm management agreement (FMA) approach in Scotland[102]. Equally, distance can be an advantage for ensuring supply: in 2013, the Scottish Shellfish Marketing Group drawing mussel supplies from Shetland and across the West Coast of Scotland was able to mitigate the impact of a Shetland an algal bloom by drawing on suppliers from other areas.[103]

Climate change and the environment

The impact of climate change and the associated changes to environmental parameters are an ongoing concern for aquaculture and require monitoring and management. Climate change affects the temperature of water which has consequences for the spread of sea lice and the development of algal blooms. These pose a considerable risk to the sector and the emergence of new pathogens under changing climatic conditions are also of concern and require constant monitoring.

Although it is low carbon, aquaculture can lead to some environmental impacts through its use of chemical treatments on sites, residue from feed, accumulation of waste, as well as the potential impact of diseases. Despite a significant investment and effort from industry to address these issues, the real or perceived negative environmental impacts of Finfish farming and the wider impacts on fish stocks remain a concern and are reflected in the recent Scottish Parliament inquiry, and there is a

[98] https://www.gighahalibut.co.uk/tag/otter-ferry-seafish/

[99] P. 77 https://www.seafish.org/media/publications/FINALISED_Aquaculture_in_EWNI_FINALISED__-_Sept_2016.pdf

[100] www.lochfyne.com

[101] https://www2.gov.scot/Topics/marine/Fish-Shellfish/FHI/managementagreement

[102] P. 9, http://thecodeofgoodpractice.co.uk/wp-content/uploads/2015/02/cogp-explanatory-contextual-feb-15.pdf

[103] During research for the Assessment of the Benefits to Scotland of Aquaculture, https://www2.gov.scot/Resource/0045/00450799.pdf

call for more data to be made available[104]. It attracts largely negative media coverage which may be detrimental to its development. The Finfish industry needs to continue to focus on the low carbon footprint of production in comparison to most meat sources[105]. Raising awareness about these positive environmental credentials, and its proactivity on addressing issues, would help to counter some of the negative perceptions of the sector. It could potentially be incorporated in SEPA's Environmental Impact Assessments (EIA), though currently EIA's focus on site-level impacts

In an effort to manage local impacts, industry has highlighted that improved efficiency, particularly in terms of waste management should be addressed[106] as it is a key area for growth and can also help to improve the environmental footprint of the sector. Industry has also highlighted that clear standards and protocols should be adopted in terms of biosecurity and health issues.[107, 108,109]

Disease

Sea lice are the overriding issue for the industry and needs to be addressed in the immediate future (by 2021) to ensure production targets are met and the future of the sector is secure. Reduced production and productivity through mortalities and lower quality/size of harvested fish[110,111] as a result of sea lice has been a serious problem for the Scottish salmon industry, though this is being actively addressed by individual companies and through sector initiatives (e.g. through the Scottish Aquaculture Innovation Centre[112]). Effective management of sea lice is a major priority for salmon producers[113,114] and Scotland has invested around £30 million annually over the last five years to improve sea lice control.[115] Its investments in biological and engineering solutions will help to reduce the use of medicinal treatments with their associated negative environmental impacts, and which are likely to be curtailed in future. These

[104] https://www.parliament.scot/S5_Environment/Inquiries/20180305_GD_to_Rec_salmon_farming.pdf

[105] https://klimamarin.no/wp-content/uploads/2014/04/Klimamarin-2014-Catarina-Martins-Salmon-farming-the-challenge-and-the-opportunity-from-a-carbon-footprint-perspective.pdf

[106] http://www.sarf.org.uk/cms-assets/documents/152955-102338.sarf082.pdf

[107] https://www2.gov.scot/Topics/marine/Fish-Shellfish/FHI/healthpractice

[108] Cook, E. J., Davidson, K., Fox, C. & Black, K. (2013) Monitoring and eradication of invasive and non-native species in aquaculture units. SARF087, Scottish Aquaculture Research Forum.39 pp.

[109] Callaway, R. et al. (2012) Climate change and marine aquaculture in the UK. Aquatic Conservation: Marine and Freshwater Ecosystems 22:389-421

[110] Steve Westbrook and Imani Development (2017), 'The value of aquaculture to Scotland', at: http://www.hie.co.uk/regional-information/economic-reports-and-research/archive/value-of-aquaculture-2017.html

[111] Imani Development, SRSL/HIE, SAIC (2017) *Scottish aquaculture: a view towards 2030*

[112] https://www.scottishaquaculture.com/projects/health-and-welfare/

[113] Steve Westbrook and Imani Development (2017), 'The value of aquaculture to Scotland', at: http://www.hie.co.uk/regional-information/economic-reports-and-research/archive/value-of-aquaculture-2017.html

[114] Imani Development, SRSL/HIE, SAIC (2017) *Scottish aquaculture: a view towards 2030*

[115] Food and Drink Scotland (2017) aquaculture Growth to 2030: A strategic plan for farming Scotland's seas

approaches include the mechanical removal of sea lice using 'cleaner fish' such as wrasse. Funding is available to assess the effectiveness of this method and to improve efficacy and fish welfare.[116,117]

In addition to sea lice, there are other diseases that can disrupt production of farmed fish. Prevention of diseases affecting e.g. gill health[118] are key and increased monitoring and reporting is required in the short term (up to 2021). If diseases are not contained it will lead to increased costs of production, and the persistence of negative perceptions of the industry. If the issue of sea lice and other diseases are solved or largely addressed, it will have a positive impact on the entire industry, including planning and environmental impact.[119]

The succession of diseases over the longer term is also an important issue and requires constant monitoring throughout the sector. The market failure here is one of an incomplete market, where the aquaculture sector is failing to adequately address disease. Support needs to be given to develop the fish health and veterinary science skills necessary, to ensure adequate resources are available to develop technology and techniques to effectively manage diseases for both Finfish and Shellfish.

1.9.4 Infrastructure capital

The majority of aquaculture *production-level* infrastructure (hatcheries, farms, well boats, feed barges) is sited on the Scottish West Coast in the Highlands and Islands region, including (more broadly) Argyll and Bute, the Western Isles, Orkney Isles and Shetland Isles. Shetland is proportionately large in production capacity by population, comprising around 25% of all salmon production and 75% of all shellfish production in Scotland.[120]

The supply routes for these activities rely on rural infrastructure including the network of ferry services to large island groups and to individual islands. These commercial volumes are thought to be consistent and complementary with the public service obligations to provide such routes.[121] It also makes use of harbours and ports, with some evidence that it is providing business for smaller facilities (Imani consultation for private salmon client, 2018). It is estimated that the creation of a new salmon production site (including planning and construction of fish pens) is between £3-4m, and will provide volume-based extra demand for transport services, feed, processing, animal health products and hatchery supply services. A number of these services are

[116] Steve Westbrook and Imani Development (2017), 'The value of aquaculture to Scotland', at: http://www.hie.co.uk/regional-information/economic-reports-and-research/archive/value-of-aquaculture-2017.html

[117] SAIC News release: Scottish aquaculture Innovation Centre to fund industry-changing research on sea lice control. [online] Available at: http://scottishaquaculture.com/wp-content/uploads/2015/04/SAIC.project-announcement-Mar-2015.pdf [Accessed 15 August 2017].

[118] https://www.bbc.co.uk/news/uk-scotland-46823104

[119] Imani Development, SRSL/HIE, SAIC (2017) *Scottish aquaculture: a view towards 2030*

[120] P. 48, http://www.hie.co.uk/common/handlers/download-document.ashx?id=b76bda3c-a01b-462f-9f74-4773bfb1cfe4

[121] Alexander et al (2014): https://www2.gov.scot/Resource/0045/00450799.pdf

based across Scotland, notably in the Central Belt as well as the Highlands. Grimsby in South Humberside processes Scottish and non-Scottish product to supply major retailers.

Across the UK, trout production is established in freshwater sites. The British Trout Association states that 'trout is farmed widely in the UK, but particularly in central and southern Scotland, south England and North Yorkshire. The main facility needed is a clean river for adequate water supply, in an accessible spot. […] A farm on a river will consist of ponds, tanks or raceways with the water supplied by gravity. Often a location with a weir is utilised. Cage farming is an alternative method involving the siting of net cages in deep freshwater lakes. The Scottish lochs provide the best location for this method of farming in Britain.'[122]

Supply of trout ova from hatcheries, and processing, reflect the salmon and other finfish sectors, with on-sale to processors, smokeries and retailers. Dawnfresh in Scotland has sought to scale up trout production in the cage (pen) method stated, in a similar manner to Scottish salmon production, with similar logistical and infrastructural approaches.

Shellfish production requires lower levels of physical infrastructure investment. From Shetland production sites, ferry services connect producers with processing facilities in Bellshill near Glasgow. Vertically integrated production by Loch Fyne Oysters takes product from the West Coast through processing and distribution channels.

1.9.5 Financial capital

The GVA contribution of salmon aquaculture is estimated to be around £620m across the value chain. Aquaculture across England, Wales and Northern Ireland is estimated at between £75m and £100m[123] with a total estimated at around £700m in GVA and up to direct, indirect and induced 15,000 jobs.

However, access to finance is a cross-cutting issue and a considerable challenge for the industry. For the smaller shellfish sector, there is a lack of understanding of its asset structure (value of licenses, income, equipment) amongst banks, and this inhibits access to funding to fuel growth and innovation. Ownership and financing is different in the larger multinational salmon sector. Some stakeholders note that the salmon industry's boom and bust in the 1990s has deterred UK banks unduly, now that the industry has consolidated and matured. The industry's assets have not been seen as viable collateral for loans, which means that loan finance has been more limited than in countries such as Norway, where equipment and licence are accepted by banks in the loan process. Norwegian and Canadian multinational ownership now means that internal company financing is the norm where businesses in Scotland must demonstrate competitiveness within an international portfolio of production. Scottish banks are now beginning to finance production (for example, expansion of

[122] British Trout Association: http://britishtrout.co.uk/trout/farming-trout/

[123] Aggregation of data from HIE 2017 (Scotland) and Seafish 2016 (England, Wales and Northern Ireland) reports.

Scottish Sea Farms operations). The opportunity stretches through the supply chain into manufacturing and services, as a single salmon site requires up to £4 million in capital investment, of which a significant proportion is spent in Scotland.[124]

There is an immediate requirement to educate Scottish financial institutions to open up more financing options by 2021.[125] This is already happening for finfish as industry/industry bodies and larger producers are working together to achieve this, so the focus should be on helping shellfish producers (and arguably also smaller finfish producers) access finance.

1.9.6 Technological capital

R&D and innovation in the sector has included an increase in automation at farm, well boat, and processing levels. Processes such as feeding are now much more mechanised to minimise cost and impact. Monitoring of fish in pens also makes greater use of digital technology, e.g. cameras and remote sensing of environmental conditions such as oxygen levels.

In terms of future offshore development, ongoing research and investment is needed in developing large-scale technology for offshore equipment (such as cages) to help identify and realise further opportunities for production.

Innovation in the salmon sector is moving in this direction, leading to new methods of production including on-shoring of some processes, and moving to more exposed sites. These could require new methods including more robust equipment, remote management and monitoring and new logistics approaches for power, communications, delivery, waste management, etc. Activity therefore ranges from innovation in cage design, to offshore renewable power generation, to remote cameras and sensors to monitor higher rates of wear and tear. More exposed sites using existing technology will be the norm before 2030, but new offshore models are under development and will require a potentially large shift in skills and technology beyond 2030.[126]

The *Scottish aquaculture: a view towards 2030* report identifies a need to review technological innovation pathways for the sector in order to address the innovation constraints and provide a roadmap for the sector going forward. Required actions to overcome these constraints could include the promotion of Scottish entrepreneurs, the encouragement of cross-sector partnerships (e.g. with oil & gas), and addressing access to markets, particularly for aquaculture SMEs.

Processing of aquaculture products is expected to move to more technology-based solutions and away from labour, though volume growth is still expected to give net growth in jobs to 2030 and beyond. These jobs will reflect technological changes,

[124] Imani Development, SRSL/HIE, SAIC (2017) *Scottish aquaculture: a view towards 2030*

[125] Ibid.

[126] ekosgen/Imani Development for Highlands and Islands Enterprise (2018) MAXiMAR: Maximising the Marine Economy in the Highlands and Islands

e.g. there may be a faster rate of growth of Remote Operating Vehicle (ROV) operators, while farm jobs may grow at a slower rate.

1.9.7 Social and political capital

The salmon sector has faced increasing criticism in media coverage and campaigning, relating to environmental impacts, mortality rates and management of sea lice. An inquiry report was published in March 2018[127]: while calls for a moratorium on growing the sector were rejected due to a lack of evidence, the 'social licence' for expanding salmon production (the acceptability of having coastal sites) is under threat. The Scottish Salmon Producers' Organisation (SSPO) has developed a Community Engagement Charter[128] (2016).

The Scottish Government 'supports the [Scottish] Aquaculture Industry Leadership Group as it seeks to deliver the industry's growth strategy by 2030. The strategy aims to:

- **double** the economic contribution of the sector from £1.8 billion in 2016, to £3.6 billion by 2030
- **double** the number of jobs to 18,000 by 2030'[129]

In 2018 the UK government commissioned the MAXIMAR Science Innovation Audit[130] with research coordinated by Highlands and Islands Enterprise (HIE). The audit sets out the science and innovation potential within aquaculture as a key pillar of the wider marine economy (in the Highlands and Islands and across the wider UK).

1.10 Commercial capture fishing

1.10.1 Overview

Fisheries production can be split into: inshore fishing, which tends to be nearer to shore within the 12 nautical mile limit and smaller scale; and offshore fishing, which tends to be higher volume, using larger boats.

The two subsectors have different characteristics: inshore fishing tends to be more skipper-owned, occasionally organised within a co-operative model for onshore logistics and marketing, and occasionally in a larger company-owned fleet with employed skippers (this latter model may increase in future with traceability requirements). Inshore fishing tends to involve non-quota species (with the exception of nephrops, and inshore fishers can attain quota rights). Offshore boats are more

[127] https://www.parliament.scot/S5_Environment/Inquiries/20180305_GD_to_Rec_salmon_farming.pdf

[128] http://scottishsalmon.co.uk/wp-content/uploads/2016/09/community_charter_2016_digital.pdf

[129] https://www2.gov.scot/Topics/marine/Fish-Shellfish

[130] ekosgen/Imani Development for Highlands and Islands Enterprise (2018) MAXiMAR: Maximising the Marine Economy in the Highlands and Islands

expensive, physically larger, concentrated in ownership and tend to be subject to quotas[131]. Much of this current system would be subject to change under Brexit.

In 2017, the UK fishing industry had 6,148 fishing vessels, 43 vessels fewer than in the previous year. The fleet in 2017 comprised 4,834 10 metre and under vessels and 1,314 over 10 metre vessels.[132]

Selected key facts[133],[134]

- The Scottish and Northern Irish fleets caught mainly pelagic fish, e.g. herring and mackerel [the previous year]. The English landed mainly demersal species (e.g. cod and plaice) and the Welsh caught mostly shellfish, such as Whelks.
- The UK fishing fleet remained seventh largest in the EU in terms of vessel numbers, with the second largest capacity and fourth largest engine power.
- UK fleet landings abroad rose to 290 thousand tonnes compared with 256 thousand tonnes in 2016, almost entirely down to increases in blue whiting and mackerel. Much of this was landed in Norway, followed by Netherlands.
- Scottish vessels accounted for 64 per cent of the quantity of landings by the UK fleet while English vessels accounted for 28 per cent.
- Brixham had the highest quantity and value of UK fleet landings in England – 15 thousand tonnes (of mainly high value shellfish) with a value of £41 million.

1.10.2 Human capital

Around 11,700 fishermen were active in the UK. Approximately 2,000 were part-time.[135] However, research suggests that official datasets are unlikely to reflect the true number of people engaged in a commercial fishing industry. This is due to the high levels of self-employment and casual crew members.[136]

[131] http://researchbriefings.files.parliament.uk/documents/CBP-8457/CBP-8457.pdf

[132] https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/742793/UK_Sea_Fisheries_Statistics_2017.pdf

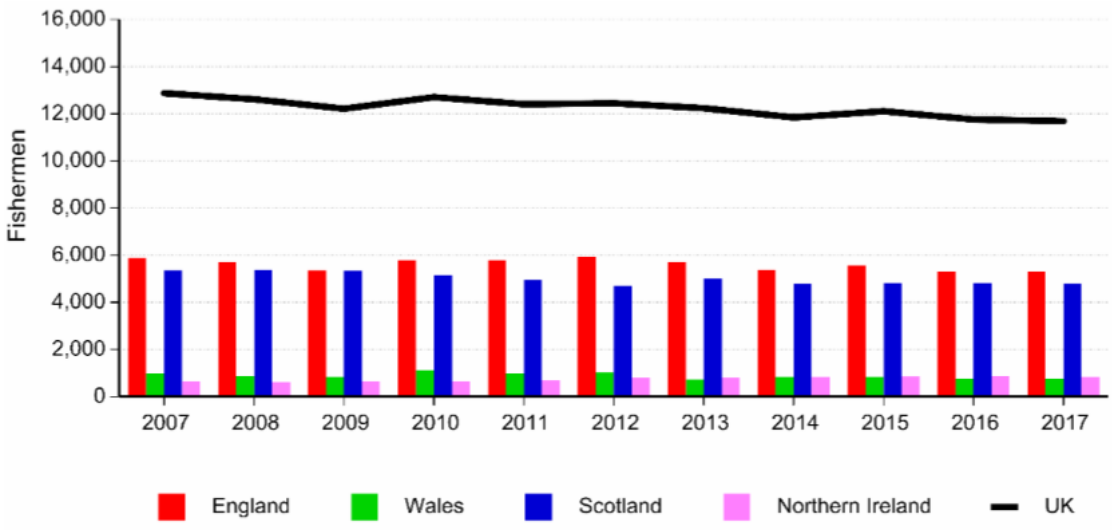
[133] https://www.gov.uk/government/news/fishing-industry-in-2017-statistics-published

[134] https://www.seafish.org/media/1801581/welsh_industry_dashboard_a1_aw.pdf

[135] https://www.gov.uk/government/news/fishing-industry-in-2017-statistics-published

[136] Seafarers UK (2018) Fishing for a Future: An Analysis of Need, Challenges and Opportunities in UK Fishing Communities

Figure A2.1: Number of Fishermen in the UK, 2007-2017



Source: MMO (2018) Fishing Industry Statistics, 2017

While the financial value of offshore fishing is greater, proponents of inshore fishing highlight the relatively high impact it has on employment, degree of self-employment, and high GVA going to fishers. Research by the New Economics Foundation[137] identifies that the UK fishing industry has an economic value of less than 0.05% of GDP, but many of the port and harbour towns that it supports rely on the industry as the main sustaining economic driver – not just on the towns themselves, but their rural hinterlands also.

Recruitment and retention of workers in the fishing industry is a real challenge, with many new entrants having strong family connections with the industry. Whilst better education and improved social mobility have contributed to reducing familial recruitment, there are a lack of pathways encouraging recruitment into the fishing industry.[138]

In the seafood sector, 'the free movement of workers has provided a welcome supply of labour, particularly in capture and seafood processing activities, where employment opportunities can be temporary, in comparatively low wage/skill occupations and in relatively remote locations'.[139] Changes over the course of the Brexit process (from uncertainty to regulatory change) are likely to have a significant impact on the fishing value chain.

1.10.3 Natural resources/physical capital

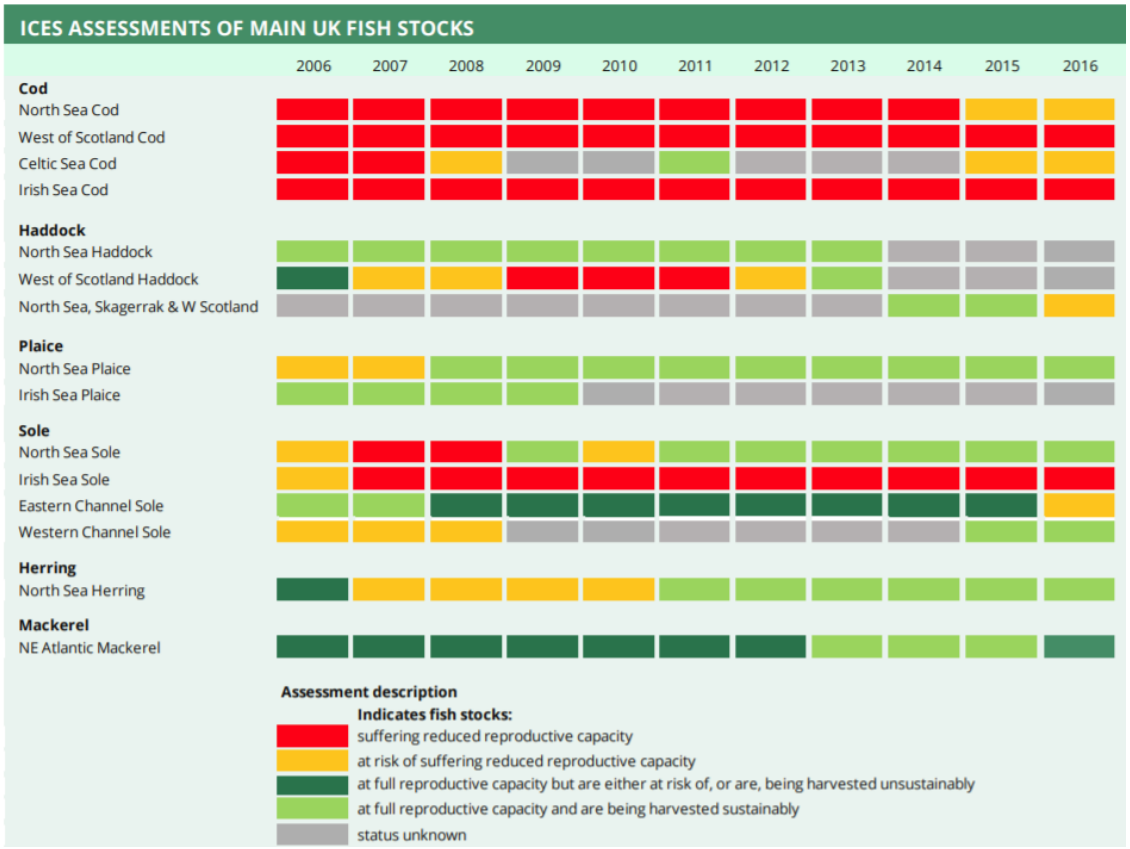
[137] New Economics Foundation (2017) Who Gets to Fish? The Allocation of Fishing Opportunities in EU Member States

[138] Seafarers UK (2018) Fishing for a Future: An Analysis of Need, Challenges and Opportunities in UK Fishing Communities

[139] Section 2.2.4 https://www.seafish.org/media/1653731/overview_-_brexit_and_the_uk_seafood_industry_1.3.pdf

Since fish stocks and the marine resource are considered public assets, the management of stocks and application of quotas is of intense focus, not least due to likely changes as the UK exits the EU. However, there are also many species and fishing activities that are not subject to quota but remain subject to regulations.

Figure A2.2: Main UK Fish Stocks, 2006-16



Source: UK Sea Fisheries Statistics, House of Commons Briefing Paper, Number 2788, 5 December 2017

It is important to note that conservation measures in the management of fish stocks have been effective, allowing for example increases in Total Allowable Catch (TAC) for some species.[140] There is a general improvement in stock status, somewhat at odds with the concerns for many years about over-fishing.

The majority of the fish asset is caught by offshore fishing: 74% of the quantity landed by the UK fleet was caught by vessels over 24 metres in length which accounted for 4 per cent of the total number of UK vessels. These vessels tend to catch lower value pelagic fish.[141] In contrast, the smaller vessels in the UK's fishing fleet – which make up more than three quarters of the total number – have access to under 2% of the UK pool of fishing quota allocated by MMO.[142]

[140] https://publications.parliament.uk/pa/cm201719/cmselect/cmniaf/878/87804.htm#footnote-372

[141] https://www.gov.uk/government/news/fishing-industry-in-2017-statistics-published

[142] New Economics Foundation (2017) Who Gets to Fish? The Allocation of Fishing Opportunities in EU Member States

While offshore boat ownership is relatively concentrated, the financing of inshore boats is more diverse, though is proving a barrier to succession in the sector (SIFIDS 2019), often due to poor provision of financing models (some local best practice exists where fishermen's organisations have partnered with banks as in the Western Isles). Meanwhile, the increase in demands for traceability in the supply chain and for control of existing supplies is a key factor in causing a rationalisation of vessel ownership within seafood companies (for example Macduff Shellfish[143]) and within associations such as Orkney Fisherman's Society[144].

1.10.4 Infrastructure capital

The offshore fisheries sector is dominated in Scotland by the North East of Scotland, with fleets based in Peterhead and Fraserburgh. Peterhead was the port with the highest UK fleet landings – 151 thousand tonnes with a value of £167 million.[145]

Processing and export infrastructure has traditionally been sited in port towns and cities, notably in the North East of Scotland and South Humberside. Shetland is a prominent fishing centre and transport of fish off the islands depends on adequate ferry services – to this end, the organisations in the 'Stewart Building' in Lerwick (various fishing, processing and shellfish representatives), along with the salmon sector, have dialogue with ferry operators. This has an impact on additional ferry services to Orkney so is relevant across the Northern Isles. Wales has Fishguard and Milford Haven (with processing capacity) port hubs in the South are just over an hour to the M4 motorway, with Holyhead in North Wales being 2 hours by road to Liverpool. Northern Ireland's fishing hubs are largely focused on the Eastern coast on the Irish Sea (Belfast, Portavogie, Kilkeel), all proximate to Belfast's port and transport infrastructure. Kilkeel is attracting investment to develop its port capacity.[146]

Recent research has identified a number of infrastructural challenges in many ports and harbours. These range from a need for dredging, to necessary equipment such as landing cranes, improved cold storage and buildings to provide rest and social facilities for fishermen, and also processing and marketing opportunities.[147]

Competition for marine space is relevant for fishing sectors, particularly the inshore fleet – marine planning processes vary by home nation. SIFIDS consultations with inshore fishers highlighted challenges with offshore renewables and marine protected areas. Marine Spatial Planning may have significant impacts on fishing in future as the resource as a public space is increasingly coordinated among users[148].

---

143 http://macduffshellfish.co.uk/

144 https://orkneycrab.co.uk/. OFS company accounts cite this as a call to secure supply through vessels.

145 https://www.gov.uk/government/news/fishing-industry-in-2017-statistics-published

146 https://www.belfasttelegraph.co.uk/business/northern-ireland/kilkeel-harbour-reels-in-major-port-investment-in-35m-boon-36672165.html

147 Seafarers UK (2018) Fishing for a Future: An Analysis of Need, Challenges and Opportunities in UK Fishing Communities

148 https://www.gov.uk/topic/planning-development/marine-planning

1.10.5 Financial capital

UK fishing effort by the over 10 metre fleet is 39 per cent lower than in 2002, however this does not proportionately relate to overall volume and value.[149] In 2017, UK vessels landed a value of £980 million (724 thousand tonnes of sea fish) into the UK and abroad. A summary of key landing ports is found below.

Figure A2.3: Landings by UK vessels into key ports, 2017

	Quantity ('000 tonnes)				Value (£ million)			
	Demersal	Pelagic	Shellfish	**Total**	Demersal	Pelagic	Shellfish	**Total**
England								
Brixham	4.7	1.6	8.7	**15.1**	15.6	0.5	24.6	**40.6**
Newlyn	6.5	3.9	3.2	**13.6**	19.4	1.6	8.9	**29.9**
Plymouth	1.3	6.5	2.9	**10.7**	4.5	3.3	8.1	**15.9**
Wales								
Fishguard	..	-	2.2	**2.2**	..	-	2.9	**2.9**
Milford Haven	0.5	..	1.0	**1.5**	1.5	..	2.0	**3.5**
Holyhead	..	..	1.3	**1.3**	..	..	2.0	**2.0**
Scotland								
Peterhead	48.2	98.6	4.1	**150.9**	86.9	66.2	13.6	**166.7**
Lerwick	9.7	29.7	0.3	**39.8**	18.6	21.6	1.0	**41.3**
Fraserburgh	8.7	11.5	6.3	**26.5**	15.0	9.6	21.4	**46.0**
Northern Ireland								
Belfast	-	6.2	..	**6.2**	-	3.8	..	**3.8**
Kilkeel	1.5	-	3.3	**4.8**	2.4	-	7.2	**9.6**
Portavogie	0.4	..	2.7	**3.1**	0.4	..	6.2	**6.6**

Source: Fisheries Administrations in the UK

Source: MMO (2018) Fishing Industry Statistics, 2017

The UK is a net importer of fish:

[149] P 7 https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/742793/UK_Sea_Fisheries_Statistics_2017.pdf

Figure A2.4: UK trade in fisheries product[150]

UK FISHING, GDP AND OVERSEAS TRADE

	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
GDP for Fishing												
Gross value added (£millior	439	465	481	468	472	582	489	506	529	615	610	682
Imports												
quantity (000s tonnes)	720	753	748	782	721	704	720	755	739	722	680	730
value (£ million)	1,696	1,921	1,994	2,210	2,177	2,255	2,559	2,570	2,757	2,738	2,672	3,073
Exports												
quantity (000s tonnes)	461	416	467	416	480	517	436	466	452	502	442	441
value (£ million)	939	942	982	1,009	1,166	1,346	1,464	1,344	1,460	1,566	1,337	1,640
Net imports												
quantity (000s tonnes)	259	338	281	366	241	187	284	289	287	220	238	290
value (£ million)	757	978	1,012	1,201	1,011	909	1,095	1,226	1,297	1,172	1,335	1,433

Notes: GDP for fishing includes landings abroad.
Imports are valued at cost, including insurance and freight terms whereas exports are valued at free on board terms.
Sources: Maff, *Sea Fisheries Statistical Tables*, various years
Defra, *United Kingdom Sea Fisheries Statistics 2004*
Marine Management Organisation, *UK Sea Fisheries Statistics (various years)*

Seafish collate UK Fleet Economic Performance data[151] provides a financial breakdown of the sector showing, for example, that inshore fishing (pots and traps vessels between 10-12m in length) can have high GVA over 50%) and Net Profit of 30% per year. Nevertheless, the decline in fishing activity (by employment) appears to have had relatively little effect on social outcomes measured in the social impact of multiple deprivation (SIMD), as efficiencies through technology/boat size have improved and coastal economies have diversified.[152]

However, this landing value does not capture the volume-dependent GVA of processing of fish products, further downstream GVA in hospitality and retail, and export value. Processing can take place locally by small-scale processors, but increasingly is to be found in large-scale capacity in South Humberside (Grimsby), Grampian, and 'Other Scotland' as main processing regions: up to 7,100 jobs (total fish processing employment in the UK is 11,586 but this includes over 4,000 farmed salmon processing jobs).[153]

Though fishermen often have fixed costs, the unpredictability of income from landings mean that their ability to access investment funds and the necessary capital to develop their businesses and make improvements to their vessels is often very limited. The risk averse nature of banks impacts commercial capture fishing in a

[150] UK Fisheries Statistics Briefing Paper: http://researchbriefings.files.parliament.uk/documents/SN02788/SN02788.pdf

[151] Accessed via https://www.seafish.org/article/industry-economics

[152] Jones, https://www.sciencedirect.com/science/article/pii/S0964569114001276

[153] https://www.seafish.org/media/publications/2016_Seafood_Processing_Industry_Report.pdf

similar fashion to aquaculture; as such the industry is constrained, and fishermen often rely on dated and worn out equipment.[154]

1.10.6 Technological capital

Fishing sector technological change has included changes in the physical feasibility of achieving tasks using labour (though this will vary between inshore, offshore and target species), but also in the management and monitoring of fisheries.

Tracking of vessels is mandatory above 15 metres, but now initiatives to track smaller vessels are gaining support, not just because of regulation and enforcement, but for inshore fishers to: demonstrate impacts where there is conflict between fishing sectors; provide data to support their case in marine planning; and with potential safety implications to identify adverse events at sea.[155]

Technological development is particularly important in relation to improving catch selectivity – this is an area where there has been limited uptake to some extent – particularly issues around Discard Ban are supposed to drive innovation. However, innovation is not just needed for enforcement of regulations but to support product traceability and collect data for scientific analyses more effectively. Various initiatives in this regard are being trialled through the SIFIDS programme, including interpretation of simple GPS data and 3D scanning of shellfish to measure e.g. size and sex of the catch.

1.10.7 Social and political capital

The prominence of fishing as a famous and culturally significant sector can be problematic, in that perceptions of many coastal regions are associated with the work of the sector.[156] Further, it is subject to quotas and international agreements, and as such it is a relatively politicised sector.

The UK's fishing industry is currently regulated at an EU level and managed in England by the Marine Management Organisation (MMO), Marine Scotland in Scotland, Natural Resources Wales in Wales and the Inshore and Environment Branch of the Department of Agriculture and Rural Affairs in Northern Ireland. These bodies are responsible for setting individual fishing vessel quotas, within the annual Total Allowable Catch (TAC) allocated by the EU.[157] The MMO provides statutory functions relating to UK fisheries management and collates fisheries data from home nation authorities.

Inshore fisheries have associations and formalised Groups that represent their interests. In England these are Inshore Fisheries and Conservation Authorities

[154] Seafarers UK (2018) Fishing for a Future: An Analysis of Need, Challenges and Opportunities in UK Fishing Communities

[155] Early findings from the EMFF-funded SIFIDS programme, to be completed (2019)

[156] See the EU-funded Pericles project covering cultural linkages: https://www.pericles-heritage.eu/about/

[157] https://researchbriefings.parliament.uk/ResearchBriefing/Summary/CDP-2017-0256

(IFCAs) with statutory seats for MMO, Environment Agency and Natural England, and serve as a platform to connect local authorities, businesses and other groups. In Scotland the Inshore Fisheries Groups (IFGs) have been created to act as a voice for inshore fishers to discuss and address policy and operational issues. Inshore fishing, in particular, still enjoys a strong association with heritage and, increasingly, local food provenance (SIFIDS, 2019)[158], though this still entails policy debate with offshore fishing fleets in terms of spatial conflicts and species caught by both sub-sectors (nephrops is a contentious example[159]). Scottish IFGs are currently consultative bodies but may have statutory responsibilities in future. In Wales, the IFGs have been superseded by the Welsh Marine Fisheries Advisory Group. In Northern Ireland the Inland Fisheries Group has responsibility.

The UK exiting the EU ('Brexit') is a key determinant of political and social outcomes for fisheries, not only as they relate to quotas but how the fleet and outcomes are organised more generally. A summary of policy context was prepared by ABPMer[160], but currently the implications of imminent political changes are not known: should the Common Fisheries Policy (CFP) no longer apply to UK fisheries, alternate models from Iceland and Faroe Islands have been explored (for example at the Fisheries Innovation Scotland conference, 2018) and may provide lessons for the way forward. There are some indications that the following scenarios may come about: catch quotas may remain the main management tool for constraining fishing mortality; fisheries may be managed on best available scientific advice; most science advice will continue to be sourced via ICES; some form of the Landings Obligation (Discard Ban) will be retained; UK will continue to deliver its international obligations in regard to marine habitat protection including OSPAR marine protected areas network. However, the main areas of uncertainty remain, *inter alia*: the mechanism by which UK will negotiate as a separate coastal state; overall splits of fishing opportunities between UK and other coastal states on principle of zonal attachment of stocks (changes to relative stability); potential tariffs on fisheries exports; access to labour; how elements of science will be funded e.g. data collection (via Data Collection Framework) currently funded under EMFF. It is also worth noting that any non-tariff measures such as certification may be potentially more disruptive than tariffs. Collectively these are key considerations given the current dependence on the EU as a key export market for UK commercial capture fishing.

Fisheries research and development of fishing infrastructure has been supported largely by the EU Structural Fund and EMFF – there are also routes like Fisheries Innovation Scotland. Consideration must be given to how such research and

[158] To be published

[159] The Scottish Creel Fishermen's Federation and Scottish Fishermen's Federation have debated the correct valuation of nephrops catches: see http://www.scottishcreelfishermensfederation.co.uk/report.htm and http://www.sff.co.uk/wp-content/uploads/2017/10/AS-nephrops-FINAL-report-171017-ISSUED.pdf

[160] http://www.abpmer.co.uk/media/1487/white-paper-brexit-where-next-for-uk-fisheries.pdf

common good investments can be funded and achieved after Brexit[161], and reports commissioned by fisheries associations and representative bodies, though these may be focused on making the case for members' interests.

Sustainability of the fishing industry has long been a major focus of stock management and quotas, but increasingly covers risks from sustainability certification and traceability, litter in the marine environment, and 'annual report cards' from Cefas's Marine Climate Change Impact Partnership (MCCIP)[162] on climate change impacts on the marine ecosystem including fisheries.

Succession planning is increasingly important: attracting new entrants into industry is a concern among inshore fishers: in recent SIFIDS work the average age of a respondent was 51, which is high for such a physically demanding profession. That is likely to reflect owners rather than employees, but equally they cited challenges attracting and retaining young crew, even though the wages were attractive. Financing of boats, and fishing having a big impact on family and social life, and it being a tough and often dangerous job, are all significant factors.

Safety at sea is a serious issue as fishing remains a dangerous industry. In interviews with fishers, it is a prominent theme. Safety is being tackled through improving training, but also legislative requirements e.g. sea going medicals for fishers recently made mandatory in Scotland. This is likely to remain a future issue and dealing with it will lead to some increased costs/obligations on the industry.

1.11 Commercial seaweed harvesting and growing

1.11.1 Overview

Commercial seaweed harvesting and growing is currently a very small sector in the UK, and in most areas still consists solely of hand cultivation. The majority of harvesting and cultivation currently takes place in Scotland, particularly in and around the islands. Despite its small size, the seaweed harvesting industry is of growing interest as the many properties and potential uses of seaweed are increasingly being recognised.

1.11.2 Human capital

As mentioned above, the Commercial seaweed harvesting industry in the UK is currently very small in size. The vast majority of the 16 UK seaweed related businesses using British-harvested seaweed in production have been identified as small- or micro-sized, meaning there is limited employment within the industry. This means that there are challenges around skills supply and development, particularly if the industry is to grow and become more technologically advanced. Areas that have been identified as having a particular shortage include technical know-how and skills in seaweed farming; and greater knowledge transfer between academia and the

[161] Further discussion is given in the 'Future of fisheries management consultation - https://www.gov.scot/publications/national-discussion-paper-future-fisheries-management-scotland/pages/0/

[162] http://www.mccip.org.uk/about-mccip/

chemical and pharmaceutical industry in order that academic research currently being carried out can be taken into the commercial sphere. A lack of skills in algae strain development is seen to be a key inhibitor to sector development as commercialisation and industrial production levels require algal strains with higher growing rates or resistant to higher water temperatures.[163]

1.11.3 Natural resources/physical capital

The UK has the natural resources needed to grow commercial seaweed cultivation through its extensive coastline and high coast:area ratio relative to elsewhere in Europe.[164] However at this stage such natural resources are underutilised as commercial seaweed harvesting remains under-developed.

Scotland, and the Highlands and Islands in particular, has been identified as having a vast and underused natural resource in seaweed and microalgae. Recent research that mapped four kelp species in Scotland indicates a total biomass of 20m tonnes for Laminaria hyperborean, 2.5m tonnes for Saccharina latissimi, 0.19m tonnes for Saccorhiza polyschides and 0.16m tonnes for Laminaria digitate. It is particularly abundant in three Marine Scotland Atlas regions: West of the Outer Hebrides, the Minch and Inner Hebrides, and the north coast of Orkney. [165] The region also has the natural resources and conditions required to cultivate seaweed. Scotland's summer warm water temperatures seldom exceed 16 degrees and they are clear and rich in nutrients. These factors, combined with long daylight hours mean that the Highlands and Islands has excellent and high quality kelp growth.

The seaweed species in the UK have numerous uses. For example, brown seaweeds have several potential end uses including animal feed, human foods, horticulture, fertiliser, chemicals (mainly alginate), personal care products and biofuels. This demonstrates the versatility of the resource and the breadth of the market but it is also important to consider that each of these products/markets have potential limitations and individual factors to consider in their development. Other seaweed species will have other applications (as with agar from red seaweeds) and these species will likely have volumes of waste that can be used in lower value processes within a circular economy.[166] Currently in the UK there are 16 businesses using seaweeds harvested in the UK. Of these 16 companies, eight produce seaweeds for food or condiments. The next most common uses cosmetics and nutraceuticals, followed by animal feed production and fertilizers.[167]

Another important factor in terms of the physical assets and natural resources utilised for seaweed cultivation is issues around conflict with other uses of coastal areas. As with finfish and shellfish aquaculture, a licence is required for cultivation and

[163] Ibid.

[164] Evolution Bioscience, 2017, Marine Biotechnology Review

[165] https://scottishmarineinstitute.my.sharepoint.com/:w:/r/personal/sa02ca_sams_ac_uk/_layouts/15/Doc.aspx?sourcedoc=%7B615141e1-7af8-4381-8284-2434264d308d%7D&action=default

[166] ekosgen, 2018, MAXIMAR SIA

[167] Cefas, 2016, Seaweed in the UK and abroad – status, products, limitations, gaps and Cefas role

harvesting. Nevertheless, cultivation may be in conflict, for example, with marine tourism in shallow waters, cultivation can also impact on the marine environment, e.g. direct impact on corals, competition with other plants, loss of equipment and debris in the water. It is therefore important that potential sites for cultivation across the UK can be defined on the basis of sustainability and avoiding conflict with other marine sectors.[168]

Other constraining physical/natural factors include the seasonality of algal biomass. As a seasonal product, there are concerns around a variation in yields affecting prices, and the need to import when local seaweeds are out of season. This is viewed as having prevented an increase in seaweed production in the UK and elsewhere in Europe. It is felt that R&D in this area, and potentially contributions from seaweed aquaculture, could be a solution to this problem.[169]

1.11.4 Infrastructure capital

Licensing and management is a key issue for seaweed cultivation infrastructure. The Scottish Government's policy on statement on seaweed cultivation (And integrated multi-trophic aquaculture IIMTA)) was published in 2017, setting out support for small-medium sized farm cultivation.[170] However, large-scale cultivation is currently not supported due to a number of clear environmental risks demonstrated both by the Strategic Environmental Assessments (SEA) for seaweed[171] and its harvesting[172], as well as recent research by SAMS[173]: environmental changes associated with a developing seaweed aquaculture industry that are of greatest concern include facilitation of disease, alteration of population genetics and wider alterations to the local physiochemical environment. These negative externalities may be addressed through greater collaboration, and further research and development, e.g. to identify what harvesting and management practices to avoid, etc.

Regulation of seaweed cultivation and harvesting is made difficult by the fact that there is a limited body of information on the potential environmental impacts of seaweed farms and their management (e.g. control of nuisance species).[174] The afore mentioned issues around potential conflicts with other marine sectors, for both harvesting and farming, is also a factor that inhibits the development of licensing and regulation. In particular cultivation, faces potential conflicts with fisheries, tourism, fish farms, and offshore renewables.[175] Whilst hand harvesting does occur within the

[168] Cefas, 2016, Seaweed in the UK and abroad – status, products, limitations, gaps and Cefas role

[169] Ibid.

[170] Marine Scotland/Scottish Government (2017) Seaweed Cultivation Policy Statement

[171] Marine Scotland/Scottish Government (2012) Strategic Environmental Assessment (SEA) Scoping Report Seaweed Policy Statement

[172] Marine Scotland/Scottish Government (2016) Wild Seaweed Harvesting Strategic Environmental Assessment Environmental Report

[173] https://www.frontiersin.org/articles/10.3389/fmars.2019.00107/abstract

[174] Ibid.

[175] HIE, 2018, Wild Seaweed Harvesting as a diversification opportunity for fishermen

intertidal zone, and is licenced[176], large scale harvesting does not currently occur – and so there is not the infrastructure at present to support the growth of the industry. These conflicts have therefore already impacted upon the development of larger-scale industry growth in kelp; one marine biotechnology company in particular has faced difficulties in obtaining a license for industrial wild kelp harvesting off the west coast of Scotland.[177]

A lack of associated infrastructure capital is an important constraining factor for commercial seaweed harvesting and growing in the UK. For example, there is currently no Marine BioProcessing Centre, which means there is no way of accessing a dedicated pilot scale production facility demonstrating utility in the UK. This is felt to be a key inhibitor of the industry, and a major factor in current low levels of investment and activity.[178]

Other infrastructure issues relate to the seasonality challenges mentioned above. This means there is a need for storage facilities for excess seaweed, which are currently lacking in the UK.[179]

1.11.5 Financial capital

Access to finance is a major challenge for the industry, particularly for progressing research into commercial production. Set-up and scale-up costs are high, particularly for high-tech production methods, and these may well be potentially risky investments – which in turn may deter financing. Additionally, a lack of promotion and marketing, in tandem with a lack of information on productivity and yield can also inhibit funding opportunities. There is also a need for a continuity of funding within research and development in order that the UK can maintain its reputation for algae-related expertise.[180]

Whilst there are challenges, there are also existing opportunities for finance. For example, Marine biotechnology (a sector based around seaweed cultivation) has been identified as one of the five priority areas of Horizon 2020 and its strategic approach to R&D funding and innovation.

Other marine biotechnology funding opportunities include the Blue Bioeconomy Public-Private Partnership which highlights the challenge of there being a lack of synergies between different sectors (i.e. range of sectors that rely on the Blue Economy including food, cosmetics, and bioenergy) and lack of adequate investments. However, scale up in the sector is extremely expensive and to achieve the economic potential of marine biotechnology and commercialise the science will

[176] Companies licenced to hand-harvest include Cornish Seaweed Company (https://www.cornishseaweed.co.uk/), Hebridean Seaweed (http://www.hebrideanseaweed.co.uk/) and Mara (https://maraseaweed.com/)

[177] https://www.bbc.co.uk/news/uk-scotland-46252427

[178] Evolution Bioscience, 2017, Marine Biotechnology Review

[179] Cefas, 2016, Seaweed in the UK and abroad – status, products, limitations, gaps and Cefas role

[180] Ibid.

require significant funding and facilities that support it. The high level of investment and skills in the marine biotechnology sector, and with wider policy, licencing and regulatory considerations, suggests that strategic funding and support is required – this approach has been successfully demonstrated to achieve results in similar sectors, such as wave and tidal energy.[181]

1.11.6 Technological capital

Potential uses and technological developments for UK seaweed are listed below. However it is important to state that these are high growth opportunities, there are also other lower value harvesting purposes such as consumption, horticulture and fertiliser.

- **Health and life sciences**: the use of marine biotechnologies in pharmaceuticals (e.g. novel applications for new medicines) and biomaterials (e.g. wound dressings, dental biomaterials, and medical devices). Analysis from research and markets indicates that the increasing use of seaweeds across a variety of applications will be an important future driver. The marine resource is seen as an important source for new types of antibiotics.
- **Cosmetics**: both functional ingredients (e.g. preservatives, and sebum regulation) and raw materials (e.g. algae extracts and pigments) have potential for further development into new applications. There is also growing interest in the use of marine-derived enzymes in the cosmetic industry, for instance marine fish-derived collagen.
- **Foods and food-related products**: Food security is a growing issue and marine biotechnology is part of the solution. It has an important contributions to make to transforming food production for example through food supplements, ingredients, and packaging. The market for human food and supplement consumption is increasing although with slower uptake in the UK where it is not a traditional part of our diet. There is also significant potential around animal feeds, particularly for aquaculture fish feeds. Algae presents a potential opportunity to replace fish meal protein and fish oil in farmed fish diets whilst maintaining the nutritional profile of fish oil, as micro algae produces essential fatty acids DHA and EPA found in fish oil. However, exploiting this will require economies of scale to make sure it is price competitive against other marine derived supplies. It is an area that is still under development and so is currently difficult to quantify with any accuracy.
- **Aquaculture**: As well as the potential for feeds in aquaculture, there is significant potential to innovate to culture algae to help develop shellfish seed production, an emerging area in using gene based technologies and bacteriophage technology for fish vaccination for the treatment of aquatic disease and water treatment systems. Recirculation Aquaculture (RAS) is highly developed for salmonid production and biotech is playing an important role in maintaining homeostatis and remediation in RAS system, as well as in

[181] ekosgen, 2018, MAXIMAR SIA

waste water treatment. RAS technologies are being developed for other species in the SIA area, notably for vanomid prawns and for Siberian Sturgeon.

- **Energy**: development of clean, renewable energy processes, and industrial additives. Much of the recent growth of the sector has come from the use of marine algae and micro algae in biofuel production and this is likely to continue being an important future opportunity area (as identified by Highlands and Islands stakeholders). However, biofuels are still very much in development and face a number of challenges around scalability and economic viability of current models which need to be overcome in the short term.[182]

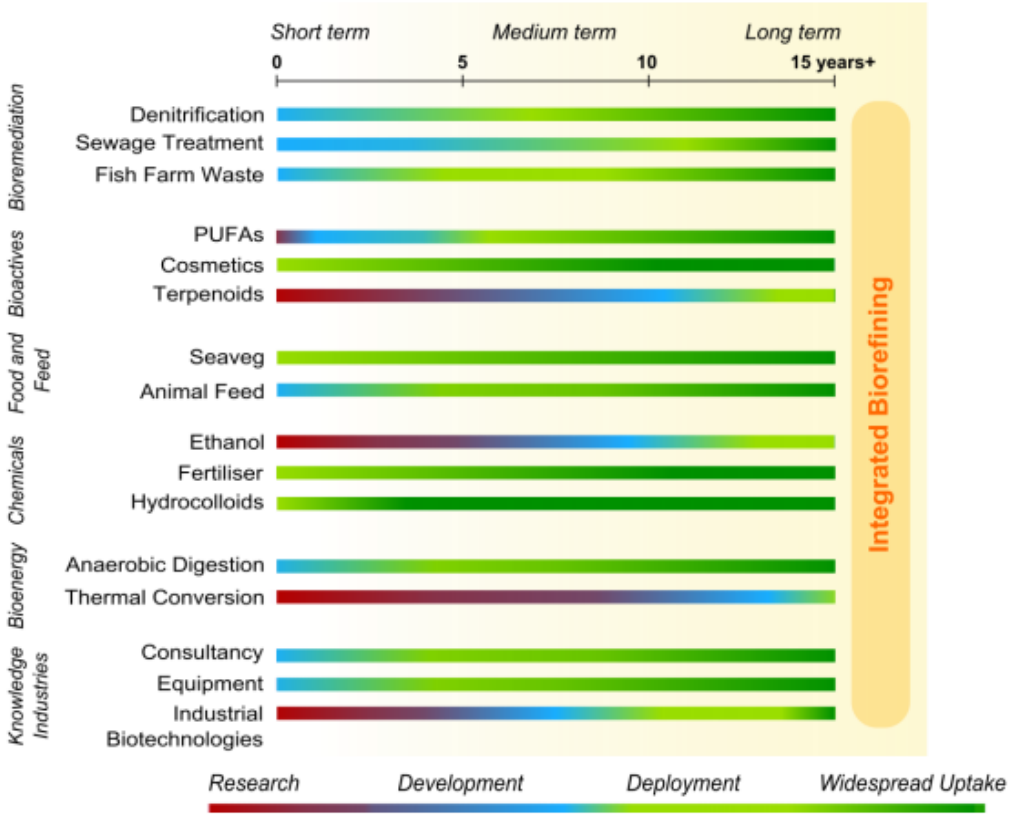
In the UK, and more widely in Europe, SAMS is a leader in seaweed cultivation. It holds a large stock of different seaweed species and has access to experimental farming facilities across two sites which focus on species including *Alaria esculenta*, *Saccharina latissima*, *Laminaria hyperborea*, *Palmaria palmata* and *Ulva* sp. This stock and associated research potential provides the opportunity to build on the knowledge base of what is available and further examine the potential of these species on a small scale, before commercial scale is required.[183]

The roadmap below gives some indication as to the stage the UK is at in developing different uses of seaweed. Although it is important to point out that it was produced in 2013 so is somewhat out of date. The roadmap shows that lower value products such as cosmetics, sea vegetables and fertiliser were already at the deployment stage, whilst higher value products such as industrial biotechnologies remained at the research stage.

[182] Ibid.

[183] Ibid.

Figure A2.5: Timescale to commercialisation of different uses of seaweed algal biomass, UK



Source: Adapt/Innovate UK, NERC (2013) [184]

1.11.7 Social and political capital

Social and political capital is a significant inhibitor for commercial seaweed harvesting and growing. Industrial harvesting is widely viewed as a threat to marine sustainability. For example, a proposal for large scale harvesting of kelp off the west coast of Scotland faced significant opposition both from the public and politicians. Whilst the project itself did not propose dredging, it was widely believed that this was the intention, with 14,000 people signing a petition against kelp dredging and David Attenborough giving his support. This also attracted political attention as MSPs proceeded to vote to ban the removal of entire kelp plants for commercial use. The vote does not ban mechanical harvesting in its entirety but it does mean that entire plants cannot be removed in such a way that they could not regrow.[185]

As well as concerns around sustainability, local coastal communities have also voiced concerns around the impact of cultivation on the wider marine economy and their jobs in areas such as fishing and wildlife tourism.[186] Social licence for seaweed cultivation has and is been investigated through projects such as Genialg.[187]

[184] P. 5, https://connect.innovateuk.org/documents/3312976/3726818/AB_SIG+Roadmap.pdf

[185] https://www.mcsuk.org/news/kelp-dredge-ban

[186] https://www.bbc.co.uk/news/uk-scotland-46252427

[187] https://genialgproject.eu/

These challenges underline the importance of better marketing and increasing public awareness in order to support the commercialisation of seaweed farming and cultivation.[188]

1.12 Offshore renewable energy

1.12.1 Overview

Offshore renewable energy comprises offshore wind, wave and tidal energy. The sector in the UK is currently at various stages of development across the different technologies. The level of maturity, scale and TRL status across the three technology types is considerably different. Whilst off-shore wind is a mature sector, tidal (and in the UK, it is tidal stream that is most relevant) is in the early stages of its development, and wave energy is several orders of magnitude behind tidal – it accounted for only a fraction of energy generated by wave and tidal devices in the UK.[189]

1.12.2 Human capital

There are an estimated 16,700 Marine energy jobs in the UK (15,000 offshore wind, 1,700 wave and tidal), and it is forecast that there will be significant growth to 28,000 wave and tidal jobs by 2040 and 27,000 offshore wind jobs by 2030.[190] Presently the UK constitutes more than 80% of the wave and tidal energy supply chain, and also has significant strengths within the offshore wind energy supply chain. In order to maintain its strong international position it is important that it continues to build strong expertise in blade optimisation, turbine reliability, system control, structural health/integrity monitoring, foundations, and operations and maintenance, through a vibrant domestic market.[191]

Whilst the UK does have such strengths, there remain challenges around skills supply. For example, in 2013 37% of wind and marine energy employers had hard to fill vacancies – due to applicants lacking necessary skills, experience and qualifications, in part because of fast growing skills demand. This is also part of a wider challenge in an undersupply of high level engineering skills.[192]

In particular the offshore wind industry has highlighted challenges around the supply of electrical engineers and coded welders and the need for qualifications with specific

[188] Cefas, 2016, Seaweed in the UK and abroad – status, products, limitations, gaps and Cefas role

[189] Government Office for Science (2018) Foresight: Future of the Sea – A Report from the Government Chief Scientific Adviser; from: Magagna, D. and Uihlein, A. (2015) Ocean Energy Development in Europe: Current Status and Future Perspectives. International Journal of Marine Energy 11, 84–104

[190] ORE Catapult, 2018, Marine Energy as Part of a Clean Growth Strategy; https://www.renewableuk.com/news/405601/RenewableUK-releases-new-global-offshore-wind-market-rankings.htm

[191] Highlands and Islands Enterprise (2018) MAXIMAR: Maximising the Marine Economy in the Highlands and Islands

[192] UKCES, 2015, Reviewing the requirement for high level STEM skills

elements on working offshore. They also raised concern around competition with the Oil and Gas sector, which is seen to offer higher wages.[193]

1.12.3 Natural resources/physical capital

The UK has some of the best wind, wave and tidal natural resources in the world – a significant asset that contributes to the drive for clean growth. Around 50% of Europe's tidal energy resource, and 35% of Europe's wave energy resource is in UK waters. The UK Government estimates that wave and tidal energy has the potential to meet up to 20% of the UK's current electricity demand.[194,195] The UK also has the largest offshore wind market in the world, with a portfolio of 35.2GW, accounting for around one third of the global market.[196] The world's largest offshore windfarm (Walney, with a capacity of 659 MW) was opened off the Cumbrian coast in 2018.[197] The Beatrice Offshore Windfarm is due to open at the end of 2019, and will be Scotland's largest windfarm, with a capacity of 588MW.[198]

In terms of the spread of resources across the UK, Scotland has around 25% of Europe's tidal stream generation potential, equivalent to approximately 10GW, and 10% of wave generation potential at around 15GW.[199] The waters around the Highlands and Islands have some of the strongest tidal streams such as at Pentland Firth and Sound of Islay, and some of the most powerful waves in the world. The European Marine Energy Centre (EMEC) in Orkney is ideally positioned to exploit the benefit of this resource. Cornwall is a growing location for marine energy technology and is looking to expand its offshore renewables related activity. There is a cluster around the Wave Hub grid connected test site off the north coast of Cornwall and Wave Hub continues to seek to attract device developers to its grid connected site. FaBTest in Falmouth allows for smaller and concept devices and components to be tested in the relatively sheltered bay. Wales also has access to a large tidal resource. To take advantage of this, Wave Hub is looking to develop a demonstrator site in South West Wales. Other pre-commercial demonstration sites include Morlais in North Wales, and Perpetuus Tidal Energy Centre (PTEC). The Welsh European Funding Office has secured EU funding of €100m to increase the number of wave and tidal devices being tested in Welsh waters.[200,201]

---

[193] http://www.windenergynetwork.co.uk/wp-content/uploads/2014/12/Chinn-Review-Supply-Chain.pdf

[194] RenewableUK (2017) Ocean Energy Race: The UK's Inside Track

[195] Government Office for Science (2018) Foresight: Future of the Sea – A Report from the Government Chief Scientific Adviser

[196] https://www.renewableuk.com/news/405601/RenewableUK-releases-new-global-offshore-wind-market-rankings.htm

[197] https://www.theguardian.com/environment/2018/sep/06/worlds-largest-offshore-windfarm-opens-cumbrian-coast-walney-extension-brexit

[198] https://www.beatricewind.com/

[199] HIE (2017) Marine Energy factsheet, May 2017

[200] RenewableUK (2017) ocean energy race: The UK's inside track

[201] University of Edinburgh (2017) Policy and Innovation Group UK Ocean Energy Review 2017

It should be noted that whilst the world class wave and tidal resources of the UK are an enabler, they can also be a challenge as their strength can damage equipment. This has resulted in the significant level of R&D in the UK, low TRL status of much of the technology, etc. Further, Marine Protected Areas (MPAs) and other environmental constraints can impact on the deployment of marine energy installations.

The UK is estimated to have the largest offshore wind capacity of anywhere in the world, accounting for around a third of installed global capacity.[202] Presently most offshore wind projects in the UK are based in England, with a particular cluster off the Cumbrian coast. There are three operational offshore wind projects in Wales and three in Scotland. Scotland, which is estimated to have 25% of Europe's offshore wind resources[203], also has 12 further projects that are at various stages between development and construction. A map of all offshore wind projects in the UK is available at the link provided in the following footnote.[204]

1.12.4 Infrastructure capital

Whilst there is an estimated supply chain of around 850 companies for the wave and tidal sector in the UK, in many cases much of the component manufacturing, e.g. turbines, remains outside of Scotland and also outside the UK. Recent research identified a lack of suppliers, as well as inadequate infrastructure in some cases could be a barrier to the development of the marine energy sector in Scotland.[205]

For offshore wind energy, there have been success in the developing the UK supply chain in particular areas such as operation and maintenance, array cables and substation manufacture. However there are also parts of the supply chain in which overseas suppliers dominate, such as towers, foundations and export cables.[206]

The most significant infrastructure inhibitor for offshore renewable energy will be the grid. Built to supply power from pit-head power stations to remote areas, the present grid configuration is no longer suitable for the demands placed on it by more dispersed energy sources. This is particularly as the majority of promising wave power sites are situated around remote island locations, with the greatest tidal energy resource found in channels between islands, or between Scottish islands and the mainland. For example, Shetland has a number of sites that would be suitable for tidal energy development, but the development of the industry on the island is currently prevented by the lack of an interconnector to the UK National Grid.[207]

---

[202] Government Office for Science (2018) Foresight: Future of the Sea – A Report from the Government Chief Scientific Adviser

[203] https://www.gov.scot/publications/sectoral-marine-plan-offshore-wind-energy-encompassing-deep-water-plan/pages/5/

[204] https://cdn.ymaws.com/www.renewableuk.com/resource/resmgr/luke/RUK18_Offshore_Timeline.pdf

[205] ekosgen/Scottish Enterprise (2016) Mid-Term Review of the Renewable Energy Investment Fund (REIF)

[206] http://www.windenergynetwork.co.uk/wp-content/uploads/2014/12/Chinn-Review-Supply-Chain.pdf

[207] Neill et al, 2017, The Wave and Tidal Resource of Scotland, Renewable Energy 114, pp.3-17

Unless there are grid upgrades from the resource-rich areas then the UK will fail to capitalise on the untapped energy sources.[208]

Offshore wind energy faces challenges in terms of grid connection. There is inevitably a need to send energy over a great distance, with increasing risk and cost of doing so – as well as energy loss. [209] Though many far-offshore sites have greater wind speeds, the transmission complexity is much higher. There are also challenges in terms of installation, operation and maintenance presented by sea depth and oceanographic conditions.[210]

Increasing port infrastructure is also of importance for supporting the development, manufacture, installation and ongoing operation and maintenance of marine energy projects.[211] This can give wider benefits to ports by increasing capacity for other uses and also potential providing electricity supply.[212]

1.12.5 Financial capital

Despite the UK's assets within marine energy and extensive developments within offshore wind energy, finance and funding remains a key challenge. For offshore wind energy, costs are higher than onshore wind and capital also faces greater risk as a result of higher and more unpredictable installation and operation and management costs. This has meant that offshore wind has not been commercially viable without government funding.[213] In 2015 it was estimated that in the UK capital costs for offshore wind were around £3m/MW installed, having doubled since 2010. This rise was due to an increase in material prices (and particularly steel) and also other factors such as supply chain bottle necks and moving into deeper waters. Operational offshore projects have achieved a stabilised cost of £140/MWh but there is a need to significantly lower this to around £100/MWh by 2020 if offshore wind is to compete with other energy supplies.[214] Recent evidence suggests that this is indeed happening: the 2017 CfD auction round achieved a 2021/22 administrative strike price of £105/MWh, and a clearing price of £74.75/MWh; this drops to £100/MWh and £57.50/MWh respectively for 2022/23.[215] It is expected that these prices could be pushed even lower in the upcoming 2019 CFD auction[216], with the levelised cost of electricity (LCOE) continuing to drop in recent years.[217] Some estimates suggest

[208] EMEC, 2018, Industrial Strategy Paper

[209] http://www.offshorewindindustry.com/news/challenges-offshore-wind-faces-way-to

[210] https://www.carbontrust.com/media/42162/ctc743-offshore-wind-power.pdf

[211] https://www.wavehub.co.uk/wave-hub-site/supply-chain-port-infrastructure

[212] https://marineenergy.biz/2015/04/21/ports-play-important-role-in-marine-energy-developments/

[213] Crabtree, C., Zappala, D., Hogg, S. 2015. Wind Energy: UK experience and offshore operational challenges. *Journal of Power and Energy* 229(7), pp.727-746.

[214] Ibid.

[215] https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/643560/_CFD_allocation_round_2_outcome_FINAL.pdf

[216] https://www.cfdallocationround.uk/

[217] https://www.irena.org/-/media/Files/IRENA/Agency/Publication/2018/Jan/IRENA_2017_Power_Costs_2018.pdf

that the LCOE for offshore wind may fall below that of onshore wind by 2028, assuming no change to planning restrictions.[218]

The UK's wave and tidal energy sector is expected to grow sharply, given the right support. Previous estimates by the Marine Energy Programme Board (MEPB) suggest that the wave and tidal market is expected to be worth £800m per year to the UK economy by 2035.[219] Analysis by the ORE Catapult suggests that tidal stream could generate a net cumulative benefit to the UK of £1.1bn by 2030, consisting of £1.5bn GVA from the domestic market and £900m GVA from exports, offset by £1.3bn of revenue support.

However, wave and tidal energy technology is still in its early stages of technology development. Many previous studies predicated estimates on there being a Renewable Obligation that would be paid to the generators, or that wave and tidal would be ring-fenced within Contracts for Difference (CfD). Recent rounds of the CfD auctions haven't specifically supported offshore renewables, making the route to market for wave and tidal energy in the UK more challenging. These market incentives are essential for the technology to break into the marketplace.[220]

This challenge has been compounded by competition within marine energy from offshore wind, a much more mature technology which has been supported by government, particularly through the Offshore Wind Capital Grants Scheme and CfD, and industry to scale up, and currently is more competitively priced.[221]

There are some substantial changes underway in terms of available funding in both the UK and European context. Wave and tidal energy researchers and developers have benefitted significantly from European funding sources, and the possible loss of access to Horizon 2020 is a threat to future funding revenue streams for research and innovation beyond the 2014-2020 programme period. Though the UK Government has committed in principle to matching its Horizon 2020 contribution, UKRI participant researchers and companies in Horizon 2020 are effective in securing a greater share of funding in return; as a result, there is likely to be a substantial funding gap. This is a significant concern.[222]

The recently announced Offshore Wind sector Deal[223] builds on the United Kingdom's global leadership in offshore wind, maximising the advantages for UK industry from the global shift to clean growth. It aims to do this by:

---

[218] https://www.owjonline.com/news/view,offshore-wind-could-become-uks-cheapest-form-of-renewable-energy_56591.htm

[219] Wave Hub (2014) wave and tidal *energy offers UK unprecedented opportunity for economic growth – latest findings*. at: https://www.wavehub.co.uk/latest-news/wave-and-tidal-energy-offers-uk-unprecedented-opportunity-for-economic-grow

[220] ekosgen (2018) MAXIMAR SIA

[221] Ibid.

[222] Ibid.

[223] https://www.gov.uk/government/publications/offshore-wind-sector-deal/offshore-wind-sector-deal

- Ensure forward visibility of regular CfD auctions
- Increasing UK expenditure content in the sector to 60%, including in capital expenditure (development, construction, installation)
- Increasing female representation in the sector
- Increasing exports to £2.6 billion by 2030
- Investing £250 million in the supply chain to support productivity and competitiveness

1.12.6 Technological capital

As has been noted, the UK is a world leader in Marine energy. For wave and tidal devices the Highlands and Islands has been a particularly successful testing environment. There have been more wave and tidal deployment in the region through EMEC on Orkney than in any other single location in the world. In total 18 companies from ten countries have tested 28 marine energy devices at EMEC over the last 14 years. As of 2017, there were seven leased wave and 17 leased tidal sites for commercial farms. Although to date development at these sites has been limited, their existence will enable the development of the sector. The region is therefore well-positioned to maximise these natural resources for electricity generation and supply chain growth.

Progress in the development and use of wave energy is approximately ten years behind tidal, and from 2008 to 2015 wave energy contributed only eight percent of the total electricity provided to the UK grid by wave and tidal systems – so a very small fraction of wave and tidal energy.[224] There is some question as to whether progress in wave energy has regressed, or is indeed no longer viable.[225] A number of studies question the viability of wave power in the UK.[226,227]

Wave, tidal and photovoltaics (PV) accounted for around 14% of UK energy generation in 2015 (much of this would have been PV).[228] There is therefore significant scope to increase wave and tidal energy's contribution in line with the government's estimate of it having the potential to meet 20% of all energy demand.

For offshore wind there has been far greater development of technologies and it is estimated that it will account for over 10% of UK electricity by 2020. UK Government ambition is that offshore wind accounts for a third of electricity generation in the UK

[224] Government Office for Science (2018) Foresight: Future of the Sea; from: Magagna, D. and Uihlein, A. (2015) Ocean Energy Development in Europe: Current Status and Future Perspectives. International Journal of Marine Energy 11, 84–104

[225] https://physicsworld.com/a/wave-energy-in-the-uk-is-it-dead/

[226] Hannon, M., van Diemen, R. & Skea, J. (2017) Examining the Effectiveness of Support for UK Wave Energy Innovation since 2000 : Lost at Sea or a New Wave of Innovation? At: https://doi.org/10.17868/62210

[227] https://www.eti.co.uk/news/eti-sets-out-priorities-for-marine-energy-if-it-is-to-compete-with-other-low-carbon-sources

[228] BEIS (2016) Digest of United Kingdom Energy Statistics

by 2030.[229] As mentioned, the UK accounts for the largest offshore wind market in the world.[230] However there still remain a number of technological challenges. These include issues around reliability and operating and maintenance costs, which can be particularly high due to the difficulty in reaching offshore wind farms and also the extreme environmental conditions facing offshore wind turbines.[231] Some work to address these challenges has already been undertaken with the increasing use of lightweight materials in construction and integration of risk modelling into the planning and development stages. Companies are also planning to standardise offshore wind substation design and apply environmental impact assessment and weather windows and service planning. Other key issues will be improving turbine access, tank testing and greater data sharing.[232]

Many of the developmental challenges are common across emerging energy technologies including the skills, funding and infrastructure challenges mentioned. Corrosion is also a major concern for many offshore energy developers.[233]

1.12.7 Social and political capital

In many ways offshore renewable energy has benefits over other forms of renewables, and particularly onshore wind energy, in terms of public perception as its distance from land helps to mitigate concerns around noise and visual impact.[234]

However there are still concerns around its impact on marine life and sustainability and conflicts with other marine sectors. In particular there are concerns around how the noise and disruption of constructing sites might impact on marine mammals by forcing them to leave their habitat.[235] Constructions such as tidal turbines also pose a risk of blade strike for diving marine animals[236] with other hazards to animals including floating structures and mooring lines.[237] Conflicts with other marine sectors include the formation of no fishing zones around devices and potentially an impact on marine tourism through the limitation of recreational activities in proximity to

[229] https://uk.reuters.com/article/uk-britain-windfarm/britain-targets-a-third-of-electricity-from-offshore-wind-by-2030-idUKKCN1QO008

[230] https://www.renewableuk.com/page/WindEnergy

[231] Crabtree, C., Zappala, D., Hogg, S. 2015. Wind Energy: UK experience and offshore operational challenges. *Journal of Power and Energy* 229(7), pp.727-746.; http://www.offshorewindindustry.com/news/challenges-offshore-wind-faces-way-to

[232] http://www.offshorewindindustry.com/news/challenges-offshore-wind-faces-way-to

[233] Government Office for Science (2018) Foresight: Future of the Sea; from: The Crown Estate (n.d.) Energy, Minerals and Infrastructure: Wave and Tidal. London: Crown Estate, https://www.thecrownestate.co.uk/energy-minerals-and-infrastructure/wave-and-tidal

[234] Crabtree, C., Zappala, D., Hogg, S. 2015. Wind Energy: UK experience and offshore operational challenges. *Journal of Power and Energy* 229(7), pp.727-746.; http://www.offshorewindindustry.com/news/challenges-offshore-wind-faces-way-to

[235] https://www.dw.com/en/how-do-offshore-wind-farms-affect-ocean-ecosystems/a-40969339

[236] https://wwwf.imperial.ac.uk/blog/climate-at-imperial/2015/05/27/how-do-marine-renewable-devices-affect-marine-life/

[237] http://www.alternative-energy-tutorials.com/energy-articles/environmental-impact-of-wave-energy.html

devices.[238] However, the exact impact of marine energy sites on the wider environment remains unclear. A number of projects to research the environmental impacts and uncertainties of ocean energy has recently started and this should help to address concerns.[239,240,241,242,243]

1.13 Oil and gas decommissioning[244]

1.13.1 Overview

Although still a relatively nascent sector, the oil and gas decommissioning market is growing, and an estimated £15.3bn is forecast to be spent on decommissioning on the UK continental shelf (UKCS) between 2018 and 2027[245]. In the UKCS alone, 74 topside structures, 71 substructures, up to 6,000km of pipelines and more almost 1,500 wells are due to be decommissioned over the next decade up to 2027.[246] Eventually, all of the infrastructure currently in the UKCS – 470 oil and gas installations from 58 licensed operators and up to 35,000km of pipelines – will need to be decommissioned[247]. The direct and indirect GVA impacts for Scotland from decommissioning could reach £11.3bn by 2025, supporting a peak of up to 22,775 jobs.[248]

The highest value areas of decommissioning are the activities that are undertaken below the surface – well plugging and abandonment, substructure removal and subsea infrastructure decommissioning. Combined, these three activities account for an estimated 70-80% of the £15.3bn forecast decommissioning expenditure over the next decade.

1.13.2 Human capital

Although an increasing number of UKCS decommissioning projects have now been carried out, experience is still a challenge for the UK workforce. There have been few large scale decommissioning projects to date, meaning a lack of continuity and

---

238 Ibid.

239 http://www.emec.org.uk/press-release-sea-wave-to-explore-environmental-impacts-of-wave-energy/

240 http://www.orjip.org.uk/projects

241 https://tethys.pnnl.gov/about-annex-iv

242 Environmental Interactions of Marine Renewable Energy Technologies (EIMR) conference series: https://www.uhi.ac.uk/en/research-enterprise/events-and-seminars/eimr/

243 https://www2.gov.scot/Topics/marine/marineenergy/mre/research

244 Our SIC code definition for oil and gas decommissioning is *09.1: Support activities for petroleum and natural gas extraction.* http://www.hi-energy.org.uk/Downloads/Oil/and/Gas/Factsheets/Offshore/Floating/Asset/Decommissioning/Market/Study.pdf

245 Oil & Gas Decommissioning Insight Report (2018) https://oilandgasuk.cld.bz/Decommissioning-Insight-2018

246 Ibid.

247 Offshore Petroleum Regulator for Environment and Decommissioning, Wendy Kennedy https://euoag.jrc.ec.europa.eu/files/attachments/04._wendy_kennedy.pdf

248 Ibid.

experience for UK contractors.[249] Scottish operators and main contractors are well experienced in project management and have strong asset knowledge[250], however there is a lack of asset knowledge amongst logistics and operations teams in Scotland currently, which may limit new entrants and potentially inhibit competition.[251]

Continuing to undertake more, and larger, decommissioning projects will enable operators and contractors to build experience and repetitive gains, meaning new efficiencies and ultimately a fall in decommissioning expenditure. Given that the UKCS is one of the earliest basins to begin large scale decommissioning, the UK faces an opportunity to build up experience and an early specialism in this sector.

There is also a skills gap in cost leadership for decommissioning. Cost leadership in decommissioning is essential to extend the productive life of the UKCS and encourage reinvestment in new opportunities.[252]

1.13.3 Natural resources/physical capital

There are significant environmental issues and implications of large-scale oil and gas decommissioning. The Convention for the Protection of the Marine Environment of the North-East Atlantic (OSPAR) view the re-use, recycling or disposal on land of disused offshore installations as the necessary course of action. The OSPAR 98/3 decision, which came about in 1998, means that the dumping of man-made structures offshore is prohibited. Prior to this decision, these structures could be disposed of at sea. As one of the 15 contracting parties to the OSPAR Convention, the UK is therefore obliged to implement this decision.

However, in some cases OSPAR state that leaving the structures in place may be appropriate, limiting the scale of the sector[253]. This is as a result of the significant debate and controversy over the environmental consequences of removing platforms and installations. Many scientists believe that the removal of platforms can cause more environmental harm than leaving them in place.[254] Such plans have received recent attention at the EU level over potential pollution risks.[255]

It is important to note that the 98/3 decision does not apply to pipelines. Individual countries set their own pipeline decommissioning policies. In the UK, buried pipelines and large pipelines are often left in place. The decision over whether to leave pipelines in place is based on the cost, the available technology, safety implications,

[249] Oil & Gas Decommissioning Action Plan, HIE and SE (2016) https://www.gov.scot/policies/oil-and-gas/oil-and-gas-decommissioning/

[250] Ibid.

[251] Ibid.

[252] Oil & Gas Decommissioning Insight Report (2018) https://oilandgasuk.cld.bz/Decommissioning-Insight-2018

[253] Ibid.

[254] Ecological best practice in decommissioning : a review of scientific research, Fortune and Paterson (2018) https://academic.oup.com/icesjms/advance-article/doi/10.1093/icesjms/fsy130/5107800

[255] https://www.theguardian.com/business/2019/sep/04/uk-facing-eu-outrage-over-timebomb-of-north-sea-oil-rigs

environmental consequences and the impact to society, including the fishing industry[256]. Similarly, some structures – particularly those over 10,000 tonnes, damaged structures or those made from concrete – can potentially be left in place[257]. These exemptions are included to the 98/3 ruling to account for the fact that the technology to remove such structures is limited, and a review of derogation criteria is conducted every three years to take into account any technological advancements that may assist with the removal of such structures. Therefore, in the future, it would be expected that fewer and fewer structures are left in place.

1.13.4 Infrastructure capital

A lack of suitable infrastructure is a significant challenge for the Scottish oil and gas decommissioning sector, and one that will need to be addressed for it to become competitive with European competitors.

Similar to the cruise market within Marine Tourism, many Scottish ports lack the infrastructure to take advantage of opportunities in decommissioning. The process requires deep water ports, and a significant laydown area for processing structures on land. Invergordon[258] and Aberdeen have recently invested significantly in this, and other ports (e.g. Stornoway) are looking to follow. Most recently, the Port of Dundee has announced its intention to invest in a deep water port facility to support decommissioning activity[259]. There is a need for Scottish ports to invest in infrastructure to be able to compete with ultra-deep water Norwegian ports[260].

Similarly, Scotland's 2016 Oil and Gas Decommissioning Action Plan[261] states that a challenge for the sector is competition from European ports and yards with deep water access and a range of complementary capabilities. The Plan states that links are needed between removal contractors and Scottish ports/yards[262].

Specifically, there is currently limited deep water infrastructure in Scotland to directly receive large topsides, modules or jackets. Currently, Heavy Lift Vessels (HLV) can be used for transferring cargo to barges in in sheltered water close to ports instead. However, this results in double handling of cargo, which increases risk, time and

[256] Guidance Notes: Decommissioning of Offshore Oil and Gas Installations and Pipelines, BEIS (2018) https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/760560/Decom_Guidance_Notes_November_2018.pdf

[257] Offshore Petroleum Regulator for Environment and Decommissioning, Wendy Kennedy https://euoag.jrc.ec.europa.eu/files/attachments/04._wendy_kennedy.pdf

[258] https://www.bbc.co.uk/news/uk-scotland-highlands-islands-46321896

[259] https://www.energyvoice.com/oilandgas/decom/195085/new-dundee-decommissioning-group-hopes-to-form-virtual-deep-water-port/

[260] Scottish Ports: Gateways for Growth (2018) https://www.britishports.org.uk/system/files/documents/scottish_ports_gateways_for_growth_2018.pdf

[261] Oil & Gas Decommissioning Action Plan, HIE and SE (2016) https://www.gov.scot/policies/oil-and-gas/oil-and-gas-decommissioning/

[262] Ibid.

cost[263]. In 2018, the Scottish Government commissioned a feasibility study to identify the most cost effective locations for an ultra-deep water port in the UK[264]. Two locations – Dales Voe in Shetland and Nigg Energy Park in Highland – were shortlisted, and Dales Voe has since been taken forward by the Scottish Government who has committed funding to the project as one of their key Programme for Government commitments.

1.13.5 Financial capital

In 2017, the Scottish Government announced the Decommissioning Challenge Fund (DCF). This was a £10.3 million fund in total, and was run over three calls between 2017 and 2019. The fund offered grants to 28 projects across four categories: feasibility studies, technical innovation, port infrastructure and capital equipment.[265] It provided opportunities for ports and the supply chains in Scotland to benefit from the decommissioning of North Sea infrastructure.[266] The DCF aimed to support:

- infrastructure upgrades and innovation in retrieval and transportation methods at ports and harbours
- supply chain projects to strengthen Scottish decommissioning capabilities and capacities
- projects to develop high quality and comprehensive investment-grade business proposals for decommissioning
- engineering scoping work at key sites to build business cases
- feasibility studies to help to attract private investment[267]

The estimates of decommissioning expenditure over the next decade are slowing down. This is partly as a result of re-phasing of projects over a longer timeframe, leading to a reduction in the expected workload over the ten year period.[268] Recovery of the oil price, the significant efficiency gains and improved investment conditions have improved the economic viability and productive life of assets, and subsequently pushed the cessation of production (and decommissioning) further into the future. This will have implications for the labour requirement for decommissioning in the short to medium term.

There has been significant financial instability in the oil and gas sector over the last decade, and this has had particular implications for the labour market in the North

[263] Ibid.

[264] https://www.gov.scot/publications/ultra-deep-water-feasibility-study-report/

[265] http://data.parliament.uk/writtenevidence/committeeevidence.svc/evidencedocument/scottish-affairs-committee/the-future-of-the-oil-and-gas-industry/written/86781.html

[266] Scottish Ports: Gateways for Growth (2018) https://www.britishports.org.uk/system/files/documents/scottish_ports_gateways_for_growth_2018.pdf

[267] https://www.gov.scot/policies/oil-and-gas/oil-and-gas-decommissioning/

[268] Oil & Gas Decommissioning Insight Report (2018) https://oilandgasuk.cld.bz/Decommissioning-Insight-2018

East of Scotland. The long period of rising oil prices over 2003-14 reduced industry impetus to operate on a low-cost model, and the rapid fall in prices from 2014 onwards made these inefficient operational models unsustainable.[269] The average annual price of Brent crude – which is the North Sea benchmark – peaked in 2012 at $112 per barrel. By 2014 it had fallen to $99, and then continued to fall to $52 in 2015 and $44 in 2016, which led to mass redundancies. Around 20,000 jobs were lost between 2017 and 2018 alone, and there was also a significant decline in tax receipts for the UK Treasury.[270] The fluctuating nature of oil prices can therefore mean it takes operators longer to reach Cessation of Production (CoP) from fields as they are less likely to extract at low prices. This will have implications for decommissioning timescales which continue to get pushed further and further into the future.

Financially, there is also competition from abroad. Foreign facilities and consortia who are supported or funded by their national governments are currently a lower cost option for oil and gas decommissioning. This means that to capture large-scale decommissioning projects in the UK, public sector investment is needed.[271]

1.13.6 Technological capital

There are substantial technological constraints in decommissioning activity. The 2018 UK Oil and Gas Decommissioning Insight paper states 'decommissioning is a significant technical and operational challenge and represents an opportunity for supply chain companies and technology developers across the UK to build a global competitive advantage'.[272]

The UK faces technological competition from other European countries. For example, the Netherlands have significant marine salvage capability and are likely to take the lead in removing the North Sea structures. This may mean that the UK's opportunities are limited to processing these structures on land rather than the offshore work[273].

Aside from international competition, there are a number of other technological constraints for the UK oil and gas decommissioning sector, particularly in onshore recycling and disposal. Firstly, the steel recycling facilities and other options needed to dispose of final parts are not currently located in Scotland. This means an increase in transportation and cost for contractors[274]. Similarly, there are challenges around the

[269] Ibid.

[270] Ibid.

[271] Oil & Gas Decommissioning Action Plan, HIE and SE (2016) https://www.gov.scot/policies/oil-and-gas/oil-and-gas-decommissioning/

[272] Oil & Gas Decommissioning Insight Report (2018) https://oilandgasuk.cld.bz/Decommissioning-Insight-2018

[273] Foresight Future of the Sea Report (2018) https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/706956/foresight-future-of-the-sea-report.pdf

[274] Oil & Gas Decommissioning Action Plan, HIE and SE (2016) https://www.gov.scot/policies/oil-and-gas/oil-and-gas-decommissioning/

identification and characterisation of hazardous materials, and limited facilities with permits and capability for handling and disposing hazardous waste. Scotland's Oil and Gas Decommissioning Action Plan therefore calls for improved and better quantified technologies, and a better understanding of what is required in terms of these facilities and their locations[275]. The Plan also states that it is difficult for companies to invest in greater recycling and disposal capacity and capability without a proven demand. Similarly, Zero Waste Scotland have been investigating opportunities for increasing levels of re-use in oil and gas decommissioning in the North Sea[276]. They state the applying circular economy principles to decommissioning could reduce the environmental impact of recycling or disposing of materials, as well as reducing associated costs. The study calls for a business case to be developed for decommissioning re-use, based on further research with the industry and equipment.

However, recognising the potential value of the sector and its current technological market failures, new facilities are being developed in Scotland. The Oil and Gas Technology Centre and the University of Aberdeen are developing a new National Decommissioning Centre, a £38m partnership project which is part of the Aberdeen City Region Deal[277]. The Centre will look to tackle current and future challenges backed by world-class research and development facilities[278]. The Centre will build on the R&D capability at the University of Aberdeen in decommissioning technologies, predictive modelling, environmental assessment and the economics of decommissioning.

1.13.7 Social and political capital

In Scotland and the UK, there are currently substantial guidelines and requirements for decommissioning activity, which have been produced by the decommissioning regulator, the Department for Business, Energy and Industrial Strategy (BEIS).[279] These include environmental appraisals[280] and applications for permits associated with oily discharges, seabed deposits, chemicals etc. Oil and Gas UK set out a thorough set of consent requirements for a decommissioning project, ranging from 5-6 years prior to the work to compliance post decommissioning.[281]

---

[275] Ibid.

[276] North Sea Oil and Gas Rig Decommissioning and Re-Use Opportunity Report, RSA The Great Discovery (2015) https://www.zerowastescotland.org.uk/sites/default/files/North%20Sea%20Oil%20and%20Gas%20Rig%20Decommissioning%20%26%20Re-use%20Opportunity%20Report.pdf

[277] Oil & Gas Decommissioning Insight Report (2018) https://oilandgasuk.cld.bz/Decommissioning-Insight-2018

[278] https://www.theogtc.com/research/national-decommissioning-centre/

[279] Guidance Notes: Decommissioning of Offshore Oil and Gas Installations and Pipelines, BEIS (2018) https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/760560/Decom_Guidance_Notes_November_2018.pdf

[280] https://decomnorthsea.com/about-dns/projects-update/environmental-appraisal-guidelines

[281] https://oilandgasukenvironmentallegislation.co.uk/contents/tables/decommissioning_table.htm

As stated in Scotland's Oil and Gas Decommissioning Action Plan, decommissioning is driven by existing legislation and regulations. There is a need to determine whether this supports the delivery of efficient decommissioning activity[282]. In particular, disposal route and regulatory compliance for waste management can be complex, and so disposal contractors need to be integrated in to the process earlier. There is a risk that any regulatory changes, particularly for operator liabilities or environmental requirements, may impact long term arrangements between operators and the supply chain. This could increase the costs associated with decommissioning.

The Influence of Man-Made Structures in the Ecosystem (INSITE) programme is investigating how decommissioning man-made structures affects the North Sea ecosystem, such as in their potential effects on species distribution, food webs or migration[283]. INSITE is funded by industry partners, and Phase 2 of the research is currently underway to produce independent science leading to a greater understanding of the influence of man-made structures on the North Sea ecosystem[284].

There is a discussion on the impact that decommissioning activity has on the commercial fishing industry. Decommissioned infrastructure, such as platforms, pipelines, wellheads etc., being left on the seabed is of particular concern to the commercial fishing industry. This concern is from both a safety perspective (decommissioned infrastructure can present a snagging hazard to ships) and a seabed access perspective.[285] For pipelines in particular, operators must evaluate the impacts of the different decommissioning options to commercial fishing. This evaluation forms a significant part of the decision over whether pipelines can be left on the seabed or must be removed.

Finally, there are significant social pressures associated with oil and gas decommissioning, due to the uncertainty about the cost of decommissioning to the UK tax payer, though it should be noted that both Government and industry were clear on the rules regarding decommissioning at the outset of the development of the UKCS, with taxes and investment plans set accordingly, with costs built in. Taxpayers are liable for the costs of decommissioning in the North Sea through significant tax reliefs granted to oil companies by HMRC.[286] Operators are able to deduct up to 75% of their spending on decommissioning from their tax, and can reclaim corporation tax paid since 2002. The most recent estimate from HMRC of

[282] Oil & Gas Decommissioning Action Plan, HIE and SE (2016) https://www.gov.scot/policies/oil-and-gas/oil-and-gas-decommissioning/

[283] Foresight Future of the Sea Report (2018) https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/706956/foresight-future-of-the-sea-report.pdf

[284] https://www.insitenorthsea.org/

[285] Commercial fisheries losses arising from interactions with offshore pipelines and other oil and gas infrastructure and activities, Rouse, Hayes, Wilding (2018) https://academic.oup.com/icesjms/advance-article/doi/10.1093/icesjms/fsy116/5116261

[286] UKCS Decommissioning – 2017 Cost Estimate Report

the cost to the public through tax relief is £24bn, which includes £13bn in repayments of taxes previously collected.[287]

1.14 Marine tourism

1.14.1 Overview

Marine tourism can be defined as: recreational activities which involve travel away from one's place of residence and have the marine environment or inland waters/waterways as their host or focus. This includes:

- Established: cruising, sea angling, marine wildlife watching, day boat trips
- Core: sailing, motorboating
- Emerging: sea kayaking, coastal rowing, surfing, windsurfing
- Others: canal boats, SCUBA diving, water-skiing, kite-surfing

1.14.2 Human capital

Tourism continues to be of significant economic importance for many coastal towns. In some communities almost 60% of local employment is in the tourism sector. Evidence suggests that a dependence on tourism for employment can result in low-skilled, seasonal, poorly paid work. Coastal populations also have a generally lower proportion of workers with Level 4 or 5 qualifications (i.e. certificate or diploma of HE).[288]

1.14.3 Natural resources/physical capital

British Marine and Green Blue launched its Environmental Legal Register for Marinas in 2010.[289] The register records all environmental legislation that may be directly or indirectly applicable to a marina's operations and activities, and provides the means by which marinas can demonstrate their compliance with environmental law.

It is estimated that UK marine tourism and recreation is worth £4-5bn GVA per year, equating to 0.24% of total UK GVA. The Foresight Future of the Sea report states that *'if coastal communities are to continue to rely on the tourism industry, protecting the marine environment, and better understanding its value will be important'*.[290]

In Scotland in particular, there is a significant amount of natural resources for marine tourism, with the coastline running to around 10,000km and over 30,000 lochs and

[287] Oil and gas in the UK – offshore decommissioning, National Audit Office (2019)

[288] Foresight Future of the Sea report (2018) https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/706956/foresight-future-of-the-sea-report.pdf

[289] https://www.britishmarine.co.uk/Resources/Knowledge-Centre/Environment-and-Facilities/The-Environmental-Compliance-Legal-Register

[290] Foresight Future of the Sea report (2018) https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/706956/foresight-future-of-the-sea-report.pdf

lochans.[291] Wildlife and natural resources are also important for the marine tourism sector. For example, dolphin watching in the Moray Firth in Scotland generates at least £4m for the local economy each year.[292]

Seaside and coastal destinations in Wales attract a large number of largely day visitors each year. It is estimated that in 2017, 17 million visits were made to seaside/coastal destinations in Wales.[293] The total expenditure for these Wales seaside visits was £615 million. Activities during these visits included:

- Visiting a beach 8,203,000;
- Fishing 1,195,000;
- Boating/sailing/water sports on or by the sea: 517,000;
- Sunbathing: 1,909,000; and
- Swimming indoors or outdoors: 2,415,000.

However, this brings challenges. Massive influxes of tourists, often to a relatively small area, have a huge impact. They add to the pollution, waste and water needs of the local population, putting local infrastructure and habitats under pressure. Ocean warming, acidification and pollution are a threat to marine species, particularly those in coral reef systems who are especially vulnerable. These are of economic importance to eco-tourism and tourism, which can be negatively affected.[294]

The rise in cruise tourism in the UK also has adverse effects on the marine environment. The ships are a major source of marine pollution through the dumping of garbage and untreated sewage at sea, and the release of other shipping-related pollutants.[295]

1.14.4 Infrastructure capital

Scotland has significant marine tourism infrastructure. It has an estimated 6,680 pontoons, 6,790 moorings. There are currently around 12,800 boats with a home resident berth in Scotland, growth of 23% from the 2009 figure of 10,400. Research indicates that demand has kept pace with this increased capacity, with average

[291] https://www.visitscotland.com/about/themed-years/

[292] Foresight Future of the Sea report (2018) https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/706956/foresight-future-of-the-sea-report.pdf

[293] Great Britain Day Visitor Survey 2017

[294] Ibid.

[295] http://www.coastalwiki.org/wiki/Impact_of_tourism_in_coastal_areas:_Need_of_sustainable_tourism_strategy

occupancy remaining at 95% at a national level. Of the 12,800 resident boats in Scotland, 22% are owned by individuals who are resident outside of Scotland.[296]

Poor infrastructure on land can be a constraint, particularly in UK coastal towns where marine tourism is a large part of the local economy. In UK coastal communities, poor transport infrastructure (e.g. inadequate roads, limited public transport options) and access to services are a particular problem for many coastal communities, which can be geographically isolated and far from major settlements.[297] In addition, roughly half of housing stock in coastal towns where tourism is the dominant industry is of poor quality, compared to 33% elsewhere. The lack of affordable housing may be a key factor in causing young people to leave coastal areas.[298]

The global cruise market is growing strongly, as is the number of cruise liners visiting Scotland. However, cruise liners are getting larger and larger in size. This has implications on port infrastructure. Many ships currently being built are over 250m in length, with only a few Scottish ports that could accommodate these. A number of ports, e.g. Aberdeen, Stornoway and Scrabster are currently looking to expand their port size to accommodate larger ships.

Similarly, harbours and local transport need to modernise facilities to accommodate a greater number of visitors, e.g. Stornoway have done this recently and Scrabster Harbour Trust are planning improvements.[299]

The rise in cruise tourism has also had implications on onshore infrastructure through over-tourism. The popularity of cruise ship calls in places such as Orkney, with over 130,000 cruise tourists per year, which has grown very strongly in a few years, has caused problems. Some shopkeepers have struggled with the large number of tourists, and many are not big spenders. It is also very seasonal, with barely any tourists Jan-March.[300] Over-tourism from cruise has also had a negative impact on preserving historical sites. Population cruise destinations in the world are already putting a cap on the number of passengers allowed to come ashore, in a bid to preserve historical sites and prevent over-tourism, e.g. Hawaii, Dubrovnik.

[296] Sailing Tourism in Scotland (2016) EKOS http://scottishtourismalliance.co.uk/uploads/TS2020%20Marine/Sailing%20Tourism%20in%20Scotland%20-%20Final.pdf

[297] Foresight Future of the Sea report (2018) https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/706956/foresight-future-of-the-sea-report.pdf

[298] Ibid.

[299] Scottish Ports: Gateways for Growth (2018) https://www.britishports.org.uk/system/files/documents/scottish_ports_gateways_for_growth_2018.pdf

[300] https://www.bbc.co.uk/news/uk-scotland-40731839

There is a '1000 calls' target for the cruise market in Scotland for 2019, and the Scottish Government are currently looking at ways in which to ensure that we do not go over capacity.[301]

1.14.5 Financial capital

The UK-wide Coastal Communities Fund (CCF) is a programme created and funded by the UK Government which aims to encourage the economic development of UK coastal communities by awarding funding to create sustainable economic growth and jobs.[302] Since 2012, the fund has invested £174m into 295 project UK-wide. The programme is administered and delivered by the Big Lottery Fund across the UK, and funding is allocated on a competitive basis for individual projects. Round 5 of the fund currently has £40m available for spend between April 2019 and March 2021.[303]

Many of the projects funded through the CCF look to revitalise or expand the tourism offer in the local area. Significant recent projects include a £4m grant to North East Lincolnshire Council to extend the traditional tourism season at Cleethorpes and diversify its appeal, and a grant to West Summerset Council to redevelop the seafront at Minehead, facilitate new seafront tourism attractions and establish new harbour markets[304]

The UK Government also funds the Coastal Revival Fund, which supports projects to help revive heritage asserts that are important to local communities but have not yet reached their full potential or are facing neglect. As part of the next round of funding, £1m will be spent in 2018/19, targeted at bringing at-risk coastal heritage sites back into economic use.[305]

For the 2020 Year of Coast and Waters, VisitScotland and Event Scotland run an Events Programme Open Fund. This has been designed to create new, high profile opportunities to celebrate out coasts and waters whilst adding value to the existing calendar of events. The funded events programme will create new opportunities for responsible participation, celebration and promotion of the key themes.[306]

The Events Programme Open Fund has a £600k budget, available across 2 funding rounds. Round 2 for submissions close in June 2019, with match-funded allocations of £10k-£50k available. The four programme strands cover:

- Our natural environment and wildlife

301 https://www.parliament.scot/CrossPartyGroups/Session5CrossPartyGroup/Minutes/20190115_JointMeeting.pdf

302 https://www2.gov.scot/Topics/marine/seamanagement/CCF

303 https://www.gov.uk/government/collections/coastal-communities

304 https://www.tnlcommunityfund.org.uk/media/documents/coastal-communities-fund/prog_coastal_communities_fund_england_yr_4_funding.pdf

305 Ibid.

306 http://www.eventscotland.org/funding/year-of-coasts-and-waters-2020/

- Our historic environment and cultural heritage
- Activities and adventure
- Food and drink

1.14.6 Technological capital

In Scotland, the marine leisure industry is unlike the wider UK Marine Industry as there is not a significant manufacturing presence, and its revenue is almost entirely from marine tourism. This limits the impact of the sector in Scotland.[307]

1.14.7 Social and political capital

There is no UK-wide marine tourism strategy, and, equally, there is no mention of marine tourism in the current VisitBritain tourism strategy.[308] However, in Scotland, Fergus Ewing launched the Scottish Marine Tourism strategy 'Awakening the Giant' in 2015, which sets out the vision for Scotland to be:

> *"…a marine tourism destination of first choice for high quality, value for money and memorable customer experience delivered by skilled and passionate people"*

The strategy focuses on 3 main themes of: providing authentic experiences; improving the customer journey; and building our capabilities. The strategy sets the target of growing sailing tourism expenditure from £101m to £145m by 2020, and also growing the value of the sector by 25% by 2020, from £360m to £450m.[309]

2020 is the themed Year of Coast and Waters in Scotland, which is led by VisitScotland and will support Scotland's marine and coastal tourism sector, as well as the marine tourism strategy.

Since the 1992 Earth Summit in Rio de Janeiro, there is increasing awareness of the importance of sustainable forms of tourism. Carbon constraints are a challenge for the marine tourism sector, and it constitutes a direct short-term threat to marine tourism resources and to the enabling infrastructure on which the sector depends.

In 2005, the World Tourism Organisation (UNWTO) and United Nations Environment Programme (UNEP) identified an international agenda of 12 aims for sustainable tourism. These are: biological diversity, resource efficiency, environmental purity, economic viability, local prosperity, employment quality, social equity, visitor

[307] Awakening the Giant - Scotland's Marine Tourism strategy (2015) http://scottishtourismalliance.co.uk/uploads/TS2020%20Marine/Awakening_the_Giant_final.pdf

[308] Delivering a Golden Legacy, 2012-2020 https://www.visitbritain.org/sites/default/files/vb-corporate/Documents-Library/documents/Britain_Growth_%20Strategy%20_inbound_Golden_Legacy_2012_to_2020.pdf

[309] Ibid.

fulfilment, local control, community wellbeing, cultural richness, and physical integrity.[310]

The Paris 2015 Conference of Parties (COP 21) gives new constraints to emissions, which presents a major challenge to the marine sector because current rates of growth mean that absolute emissions are set to continue into the future.[311]

[310] Marine Management Organisation (2013) https://webarchive.nationalarchives.gov.uk/20140305104248/http://www.marinemanagement.org.uk/evidence/documents/1038.pdf

[311] Sustainable Futures for Marine Tourism: Challenges and Opportunities (C Michael Hall)

Appendix 3: Mapping of financial and technical support

Source of support	Type of support / description	Eligibility criteria	Geography	Levels or extent of support	Period /time frame	Benefits	Issues / gaps
European Maritime and Fisheries Fund (EMFF)	The fund provides support for sustainable development within the fishing and aquaculture sectors and conservation of the marine environment, alongside growth and jobs in coastal communities in the UK. The following organisations act as managing authorities for the EMFF scheme in the UK: Marine Management Organisation (MMO) – In England	The EMFF provides funding for investments in areas such as: on board fishing vessels gear replacements improvements to shore-based facilities advisory services, partnerships, training and innovation fisheries management and seafood processing aquaculture, animal health and inland fishing Applicants need to be at least one of the following to be eligible:	EU wide	The UK has €243 million (around £190 million) of the programme which is split between England (€92.1 million), Scotland (€107.7 million) Northern Ireland (€23.5 million) and Wales (€19.7 million).	2016 - 2020 or until all available money has been allocated	Fisheries receive support to ease implementation of the reformed CFP and bridge the innovation gap. Fish farmers and fisheries product processors receive funding to adopt new techniques, raise health and environmental standards or diversify into new species and new market outlets. Public authorities receive support	Criticised by some groups for continuing heavy subsidies for both environmentally and economically unsustainable fishing. Also for the lack of substantive funding for areas such as data collection, control or increased protection of fish stocks and the marine environment. Eligibility criteria excluding large businesses, as well as de minimis may mean that more innovative, impactful projects

Source of support	Type of support / description	Eligibility criteria	Geography	Levels or extent of support	Period /time frame	Benefits	Issues / gaps
	Marine Scotland – In Scotland Department of Agriculture and Rural Development of Northern Ireland (DARDNI) - in Northern Ireland Welsh government – in Wales	the owner of an EU or UK registered fishing vessel and you commercially fish from a port based in England fisherwoman, spouses or legal partners a producer organisation a public or semi-public organisation an aquaculture organisation an organisation of fishermen or fisherwomen involved in production, processing, marketing, distribution of fisheries and aquaculture products non-governmental organisations				to strengthen data collection and to comply with their obligations on the control of fishing activities. Professional organisations receive funding to draw up and implement production and marketing plans. The processing industry benefits from steady supplies of wild and farmed products. Consumers have access to products that are healthy, highly nutritional and caught or farmed sustainably.	are not taken forward.

Source of support	Type of support / description	Eligibility criteria	Geography	Levels or extent of support	Period /time frame	Benefits	Issues / gaps
		an association, including new aquaculture farmers universities and research institutes small, micro and medium-sized businesses scientific organisations working in the maritime sectors				Information provided for consumers is also improved. Coastal and inland communities dependent on fishing receive support to find new opportunities in the general maritime economy — in turn, this has a positive spin-off effect on local growth and development. Scientists and researchers receive funding for studies of immediate interest to the industry, in fisheries management,	

Source of support	Type of support / description	Eligibility criteria	Geography	Levels or extent of support	Period /time frame	Benefits	Issues / gaps
						ocean management, marine environment, climate change, coastal protection, social science, maritime economy, etc. Private companies working onshore or offshore receive support for green technologies.	
Coastal Communities Fund	Financial In 2012 the UK Government introduced the Coastal Communities Fund (CCF) to support economic development projects in coastal areas across the UK.	Coastal Communities Organisations and projects which benefit coastal communities are eligible. Consideration will be taken of how plans for economic growth	UK	The UK Government announced in 2015 that the CCF was to be extended to 2020/21, With at least £90 million of new funding available across the UK for the	The Coastal Communities Fund Round 5 has £40 million available for spend from April 2019 to end of March 2021. It is now closed for new applications.	Since the start of the CCF, grants have been awarded to 295 projects across England, Scotland, Wales and Northern Ireland to a value of £174 million. These projects are forecast to	A number of concerns have been expressed about the CCF, including: criticism of the way in which the bidding process operated, a perception that it favoured larger communities' improvement; that the Fund was

Source of support	Type of support / description	Eligibility criteria	Geography	Levels or extent of support	Period /time frame	Benefits	Issues / gaps
	The CCF aims to support the economic development of coastal communities by promoting sustainable economic growth and jobs, so that people are better able to respond to the changing economic needs and opportunities of their area.	address local needs and priorities, the number of jobs that will be created and their long-term sustainability		period 2017/18 to 2020/21. Funding awards in excess of £50,000 are available.		deliver 18,000 direct and indirect jobs, and help attract over £316 million of additional funds to coastal areas.	short-term in nature and therefore did not necessarily support more holistic and sustainable approaches to regeneration; that the levels of funding set aside for the CCF have been reduced by the Government; and that there has been insufficient evaluation of the scheme to assess the way in which public funds have been used.
Seafish	Various- marketing, training, funding and research Seafish is a Non-Departmental Public Body (NDPB) set up by the Fisheries Act 1981.	Seafood industry Specific eligibility for Training Grant funded by EMFF and the Maritime & Coastguard Agency: Funding is only available for new entrants	UK	Provides information, support, and guidance on careers and training in the seafood industry, including co-ordinating	Current deadlines for EMFF/MCA funding for training are as follows: England: 31 March 2020	Seafish works across the whole seafood industry to increase consumer awareness, raise standards and improve efficiency	Concerns have been raised over the Seafish's role as a government body and a representative of the UK seafood industry. This has led to perceived mixed messaging,

Source of support	Type of support / description	Eligibility criteria	Geography	Levels or extent of support	Period /time frame	Benefits	Issues / gaps
	It is funded by a levy on the first sale of seafood products in the UK, including imported seafood in accordance with the 1982 Fisheries Act.	wanting to enter the fishing industry and experienced commercial fishermen who are fully compliant with Basic Safety Training requirements.		training for commercial fishermen working on UK-registered fishing vessels. The onshore training team coordinate the activities of a UK wide community of trainers, Seafood Training Networks and apprenticeship providers. Provides research and data on a range of topics, including market figures and economics information. Promotes seafood in order to increase consumption	Scotland: 31 December 2019 Northern Ireland: 31 March 2019 Wales: 30 September 2019	towards a sustainable and profitable future for the seafood industry. Research work goes towards improving marine and fisheries management and seafood supply chains to enhance the sustainable profitability of UK seafood businesses.	for instance, around the viability of cod fishing in the North Sea. From Seafish perspective, industry challenges include over-reliance on migrant workforce, difficulty retaining new, younger workers, difficulty in attracting new workers, and few pathways into the sector (lack of college course demand and presence). There is also the problem of low productivity due to low automation.

Source of support	Type of support / description	Eligibility criteria	Geography	Levels or extent of support	Period /time frame	Benefits	Issues / gaps
				levels throughout the UK.			
Wave Energy Scotland (WES)	Financial / networking Funded by Scottish Government, WES was formed in 2014 and is a subsidiary of Highlands and Islands Enterprise. The aim of WES is to ensure that Scotland maintains a leading role in the development of marine energy.	Marine Energy WES is driving the search for innovative solutions to the technical challenges facing the wave energy sector. Through a competitive procurement programme, it supports a range of projects focused on the key systems and sub-systems of Wave Energy Converters. The aim is to produce reliable technology which will result in cost effective wave	Scotland	Technology developers can get involved in the Wave Energy Scotland programme via the competitive call process. These calls are advertised widely and are open for several weeks to encourage wide take up. Applications are always made through Public Contracts Scotland. Developers are also invited to attend WES workshops and conferences and to receive further updates	No current funding opportunities. Projects are selected for stage 1, usually at concept level. A stage gate then takes place where the best projects are selected for further funding. This is repeated as projects move through the programme to stage 3. The approach selects the best as they progress ensuring that the most	WES have funded 86 contracts, invested £38.6m and been involved with 200 separate organisations, across 13 different countries.	Concerns have been made around whether the publically-funded organisation undercuts other Scottish wave energy companies (i.e. Pelamis and Aquamarine Power) given displacement of funding to Wave Energy Scotland.

Source of support	Type of support / description	Eligibility criteria	Geography	Levels or extent of support	Period /time frame	Benefits	Issues / gaps
		energy generation.		via WES newsletters.	promising technologies receive maximum investment.		
Aquaculture Industry Engagement Fund	Financial The University of Highlands and Islands Aquaculture Hub brings together a unique collection of expertise and facilities located within the Highlands and Islands of Scotland. The Fund is designed to support short term collaborative projects and to assist the aquaculture industry to access the university's expertise and facilities. The Fund enables	Aquaculture Sector 1) The main applicant must be an employee of the university or its constituent academic partners, in partnership with an aquaculture business or regulator. 2) Proposal should meet at least one of the desired outcomes described in section 2. Activities can include (but are not limited to):	Scotland	Grants awarded in the region of £1,000 and £10,000, which covers the academic project costs and is paid directly to the university. Companies will be expected to make a contribution in cash or in kind (such as staff time, materials or equipment) or a combination of both.	The project/feasibility study should be no longer than 6 months in length. The closing date for 2nd round applications was 30th November 2018.	The first round of awards were made in February 2018. A total of £42000 was awarded to 6 projects which enable the University of the Highlands and Islands to work directly with a number of industrial partners to explore new research opportunities and collaborations.	

Source of support	Type of support / description	Eligibility criteria	Geography	Levels or extent of support	Period /time frame	Benefits	Issues / gaps
	businesses to innovate, progress new technology or techniques, develop bespoke training, and to support a sustainable aquaculture industry in Scotland.	•Development of a feasibility study. •Field trials for new products or processes. •Trialling products and processes across different geographical areas. •Development of testing methods and methodologies. •Use of a range of specialised equipment and expertise. •Curriculum/training development and delivery •Staff secondments. •Organisation of meetings/workshops.					
Energy Investment Fund (EIF)	Financial The Energy Investment Fund (EIF) replaces the Renewable	Energy Sector Eligible applicants – both community energy projects	Scotland	In 2018 to 2019 a total of £20 million has been made available.	Current funding is allocated until 31 March 2019.	EIF provides flexible investment and debt funding for energy projects	The EIF will not fund R&D, feasibility or pre-development costs.

Source of support	Type of support / description	Eligibility criteria	Geography	Levels or extent of support	Period /time frame	Benefits	Issues / gaps
	Energy Investment Fund (REIF) and provides investment and funding for energy projects throughout Scotland, via either loans or equity investments. The fund is delivered by Scottish Enterprise and is a temporary measure put in place until the Scottish National Investment Bank (SNIB) becomes operational.	and commercial energy projects, providing they are able to demonstrate their commitment to delivering community benefits. Projects must have a demonstrable funding gap, be located in Scotland and have the potential to provide economic benefits to Scotland. Consideration will be given to both the short and long-term economic impact of projects, and will include a focus on both the fit with the Scottish			However, projects which are seeking funding for drawdown after 31 March 2019 are also encouraged to discuss funding options directly with the EIF team.	in Scotland that will facilitate, catalyse and accelerate Scotland's transition to a low carbon economy.	

Source of support	Type of support / description	Eligibility criteria	Geography	Levels or extent of support	Period /time frame	Benefits	Issues / gaps
		Government's Energy Strategy and the impact. Projects must be able to evidence the expected carbon emission reduction associated with the project and use no more than 20% fossil fuels (including gas) within the primary fuel source for generation projects. The fund will not fund R&D, feasibility or pre-development costs.					
Decommissioning Challenge Fund	Financial Scottish Government's Decommissioning Challenge Fund (DCF) supports infrastructure	Oil and Gas Decommissioning Sector Eligible projects: infrastructure upgrades and	Scotland	The DCF ran for two successful calls in 2017 and another in 2018.	The Fund is now closed to new applicants	In 2017 the DCF awarded grants totalling £4.8m for projects that strengthen Scotland's	

Source of support	Type of support / description	Eligibility criteria	Geography	Levels or extent of support	Period /time frame	Benefits	Issues / gaps
	improvements and innovation to deliver decommissioning of North Sea oil and gas infrastructure.	innovation in retrieval and transportation methods at ports and harbours supply chain projects to strengthen Scottish decommissioning capabilities and capacities projects to develop high quality and comprehensive investment-grade business proposals for decommissioning engineering scoping work at key sites to build business cases feasibility studies to help to attract private investment The DCF aligns with and supports cost reduction				decommissioning capacity. These included more than £800,000 for infrastructure upgrades at Kishorn Dry Dock in Wester Ross, by owners Kishorn Port Ltd. The Lyness Oil and Gas decommissioning base in Orkney, a project by Orkney Islands Council, received more than £90,000 for work at the Lyness quayside and surrounding area.	

Source of support	Type of support / description	Eligibility criteria	Geography	Levels or extent of support	Period /time frame	Benefits	Issues / gaps
		efforts related to retrieval and disposal activities, with the aim of improving the Scottish onshore decommissioning market.					
Saltire Tidal Energy Challenge Fund	Financial The principal aim of the Saltire Tidal Energy Challenge Fund is to drive innovation and incentivise investment in the Scottish tidal energy sector, supporting a pathway to long term cost reduction.	Tidal Energy Sector The project must relate to the development of a material/technical innovation aimed at reducing the levelised cost of tidal energy. This may relate, but is not be limited to, the development or improvement of component parts, but must be relevant to improving the commercial viability of a tried and tested tidal energy device.	Scotland	The award of funding may take the form of a grant, loan or other form of repayable assistance, and will be discussed with successful projects. A total of up to £10 million is available through the fund. Individual applications are invited for funding of up to	The fund is open to applications until 6 December 2019 or until the fund is exhausted.	The Saltire Tidal Energy Challenge Fund aims to: stimulate/drive collaboration and knowledge sharing accelerate deployment and commercial development secure benefits for Scotland help maintain Scotland's lead and promote Scottish facilities	The original Saltire Prize ran from 2008 to 2017, however no organisation claimed the £10 million prize fund.

Source of support	Type of support / description	Eligibility criteria	Geography	Levels or extent of support	Period /time frame	Benefits	Issues / gaps
		The proposal must relate to the capital costs incurred by a tidal energy project. The proposal must relate to a project to be deployed in Scottish waters no later than September 2020 and be deliverable within clearly defined and manageable timelines. The proposal should set out clearly the requirement for, and added value of, Scottish Government support including why funding from alternative sources is not possible or appropriate.		£5 million which must be match funded. Match funding must not be from other Scottish public sector grant funding sources, however applications using public sector commercial funding will be considered.		strengthen investor confidence join up existing initiatives and facilities support innovations towards cost reduction attract wider participation stimulate and support a Scottish supply chain	

Source of support	Type of support / description	Eligibility criteria	Geography	Levels or extent of support	Period /time frame	Benefits	Issues / gaps
Scottish Aquaculture Innovation Centre (SAIC)	Financial / Research / Networking/ Training SAIC is one of eight innovation centres introduced by the Scottish Government to drive growth in areas of key economic and social importance. It connects industry with academia to encourage collaboration on priority issues; share insights and knowledge gleaned with the wider sector; attract additional UK and EU funding into Scottish aquaculture; encourage new generations into	Aquaculture Sector Eligibility for Funding - any company that is active within Scottish aquaculture or a related sector (including those headquartered overseas but have operations in Scotland), and is willing to contribute resources to the project – be it cash, in-kind or a combination of both – is eligible to apply. In collaboration with an industry partner, any recognised Scottish higher education institution (HEI) or	Scotland	SAIC funding will be awarded up to a maximum of 50% of the total project cost. Therefore, industry partners must be able to demonstrate that they are able to contribute a minimum of 50% of the cost. HEIs and research institutes will be awarded funding at the rate of 80% Full Economic Costing (FEC). WiSA is a collaborative network for everyone working in the Scottish aquaculture	Ongoing	SAIC aims to connect businesses, researchers and other stakeholders, stimulating and supporting commercially relevant collaboration. This pooling of resources is designed to share the risk of innovative R&D, enable more businesses to invest in the areas that will help them grow, and ensure that SAIC's public funding delivers maximum benefit. To date, SAIC has invested around £5.4m into	Less finance available for project funding – SAIC is now competing with academic partnerships. Also difficulty in getting 50% of match funding. There are Issues around market failure and infrastructure, i.e. no marine trials facilities.

Source of support	Type of support / description	Eligibility criteria	Geography	Levels or extent of support	Period /time frame	Benefits	Issues / gaps
	the sector and develop those already working within it. SAIC's innovation programme is delivered through three key workstreams: Driving Innovation, Sharing Innovation and Nurturing Innovation.	research institute can also apply. Each project should contribute to one of the four PIAs: PIA 1: Address environmental and health challenges, particularly sea lice and gill health PIA 2: Develop feeds that optimise fish health and nutrition PIA 3: Unlock additional capacity for aquaculture development through innovative, evidence-based approaches PIA 4: Establish a reliable supply of mollusc spat.		industry. Open for men and women to join, WiSA promotes the diverse and rewarding careers that are available in aquaculture, to encourage more women to enter the sector. It also supports the progression, opportunities and development of women who are already working in aquaculture. Aquaculture Academy offers a range of academic programme assistance.		collaborative research, working with 38 different project partners across 25 collaborative research projects.	

Source of support	Type of support / description	Eligibility criteria	Geography	Levels or extent of support	Period /time frame	Benefits	Issues / gaps
		It must be a collaboration with at least one industry partner and one academic partner (all must be a members of the SAIC consortium). Projects must also be innovative in their approach or lead to innovative solutions for Scottish aquaculture.					
Accelerating Aquaculture Innovation (AAI)	Financial This fund offers SMEs in the HIE region the opportunity of match-funding to help commercialise innovative new processes, products, services or technologies.	Aquaculture Sector The project should offer tangible economic benefit to Scotland, be innovative (or lead to innovative solutions) for Scottish aquaculture and,	Scotland - HIE region	Generally, funding awards will be at a maximum of 50% intervention. Therefore, the company must be able to demonstrate that they are able to meet a minimum 50%	Ongoing	Offers support for: In-house innovation Partnerships between companies delivering innovation In partnership with SAIC, innovation with	

Source of support	Type of support / description	Eligibility criteria	Geography	Levels or extent of support	Period /time frame	Benefits	Issues / gaps
		ideally, have export potential.		cash contribution to the project, in addition to any associated in-kind contributions. Projects from £25,000 to £1m in total project size will be considered.		academic partners Help for SMEs across the supply chain to achieve greater commercialisation of new products and services that will have a positive economic and social impact Where certain projects do not meet the funding criteria, the AAI team will point SMEs to more suitable support avenues to help them	
Seafarers UK	Financial A charity that has been helping people in the maritime community for over 100 years, by	Support organisations which provide welfare and support services for seafarers.	UK	In 2018, they awarded 76 grants totalling £2.46m to 56 maritime welfare charities.	Continuous grant making process - assess applications on a rolling basis. Can submit an	Support covers a wide range of issues, such as training, welfare and housing.	Does not give grants to individuals, only organisations – however, Seafarers UK does provide

Source of support	Type of support / description	Eligibility criteria	Geography	Levels or extent of support	Period /time frame	Benefits	Issues / gaps
	providing vital support to seafarers in need and their families. By giving grants to organisations and projects that make a real difference to people's lives, across the Merchant Navy, Fishing Fleets, Royal Navy and Royal Marines.	Older seafarers, over the usual age of retirement, and their dependants. Working age seafarers working at sea in the maritime industries, former seafarers under retirement age and Merchant Navy cadets and trainees. Families and dependants of current or former seafarers who are still of working age. Young people in maritime youth groups focusing on those considering or pursuing a career at sea.			application at any time.		contact details for other organisations that do offer welfare support to individuals (British and all).
Fisheries Innovation Scotland	Funding / research / networking	Marine Fisheries Sector	Scotland	Since 2014, FIS has commissioned	No current calls	Networking and collaboration, research and	FiS is supported by the Scottish Government and

Source of support	Type of support / description	Eligibility criteria	Geography	Levels or extent of support	Period /time frame	Benefits	Issues / gaps
	An independent, non-profit-distributing organisation with the remit of bringing together government, scientists, industry and other key stakeholders to lead an on-going programme of research, knowledge exchange and education concerned with the management of Scotland's marine fisheries and related areas.	Fisheries Innovation Scotland commissions underpinning applied research and provides advice to help inform the governance and management of sustainable fisheries, the fishing industry and related supply chain in Scotland. FIS research is focused on innovation and problem solving and is designed to address: specific industry requirements, inform policy development and improve regulation.		£1.7 million project spend on research and investing in people to make Scottish fisheries more prosperous and sustainable through innovation. FIS has a range of members including representatives from the fishing industry, government organisations, processing and retail sectors, and environmental NGOs.		knowledge exchange. To advance, and to encourage advance of, expertise, science and management of an in relating to prosperous and environmentally sustainable fisheries in Scotland.	EMFF – there may be challenges to ongoing operation without the latter as a funding source.

Source of support	Type of support / description	Eligibility criteria	Geography	Levels or extent of support	Period /time frame	Benefits	Issues / gaps
		Eligibility for Membership: Membership of FIS is open to any organisation that meets the following requirements and is accepted for membership by the sitting Board of Trustees/Directors . 1. Supports the FIS Charitable Purposes, which are; i. To provide information and support to members, other organisations, public bodies and governments and to inform fisheries policies and management; and ii. to advance, and to encourage the					

Source of support	Type of support / description	Eligibility criteria	Geography	Levels or extent of support	Period /time frame	Benefits	Issues / gaps
		advance of, expertise, science and management of and in relation to prosperous and environmentally sustainable fisheries in Scotland; and iii. To establish, undertake, manage, enable, encourage and promote education, research and training; and iv. To contribute to and enhance the public's knowledge and understanding of fisheries in and surrounding Scotland and elsewhere. 2. Has a demonstrable track record as a stakeholder in					

Source of support	Type of support / description	Eligibility criteria	Geography	Levels or extent of support	Period /time frame	Benefits	Issues / gaps
		relation to Scotland's fisheries and/or seas; and 3. Is willing and able to pay the minimum agreed annual subscription.					
Centre for Environment, Fisheries and Aquaculture Science (Cefas)	Research and Advisory – Cefas is an executive agency, sponsored by the Department for Environment, Food & Rural Affairs. Cefas collects, manages and interprets data on the aquatic environment, biodiversity and fisheries. It offers a range of services, including:	Cefas works with industries across a range of sectors including: Aquaculture Fisheries International government capability development Marine and coastal infrastructure Nuclear energy Offshore renewable energy Oil and gas Shipping SIF focuses on delivering longer	UK	As well as paid for services, the Cefas Data Hub provides open access research data, allowing the public and UK businesses to explore, download and reuse the data for their own research. Cefas welcomes SIF applications from all sectors, however products must benefit the sustainability	Ongoing The first call for SIF applications for feasibility studies and larger R&D projects opened in July 2019 and will close in early September 2019. The second call with open in early 2020.	Cefas is involved in: Ensuring safe and sustainable seafood Forecasting ecosystem change Developing innovative monitoring Providing open and transparent evidence Supporting sustainable blue growth	There is a need for a more strategic approach to international investments to ensure that larger international programmes fit within the Cefas Science and Evidence Strategy and enhance the science capability for government. In an organisational sense, there is a need for an up to date Cefas Science and

Source of support	Type of support / description	Eligibility criteria	Geography	Levels or extent of support	Period /time frame	Benefits	Issues / gaps
	Research, Advice and Consultancy Emergency response Laboratory services and analysis Modelling Programme management and training Specialist surveys Technology Cefas also administers the UK government's Seafood Innovation Fund (SIF), a £10m research and development fund that launched in July 2019.	term, cutting edge innovation across the seafood sector, as well as helping to take innovative ideas from early stage research to commercial viability. The programme includes: Primary producers Onshore supply chains Marine and diadromous fisheries Marine and land-based aquaculture.		and productivity of the seafood industry. Applications for collaborative projects that include both seafood sector organisations and technology businesses are encouraged.			Evidence Strategy that offers clarity around structures and opportunities in science. A 2012 independent Science Review of Cefas identified challenge areas such as developing a more interactive approach to future evidence needs and strategy, engagement with customers, ICT risks and the role of the Cefas Science Advisory Committee. SIF funding excludes freshwater fishing and recreational fishing.

Source of support	Type of support / description	Eligibility criteria	Geography	Levels or extent of support	Period /time frame	Benefits	Issues / gaps
National Oceanography Centre	Research The NOC undertakes world leading research in large scale oceanography and ocean measurement technology innovation. Works with Government and business to turn science and technology into advice and applications.	Various marine sectors The NOC collaborates with companies across a range of industries, working on the creation and advancement of new technologies. These are funded by Innovate UK. The NOC works with businesses of all sizes, from SMEs to multinationals, across a range of industries including renewable energy, shipping, water management, and oil and gas.	UK	The NOC's Marine Robotics Innovation Centre in Southampton is shared with SMEs working alongside the NOC on a range of projects. The centre also has an active community of Associate Members from global businesses.	Ongoing	Industry expertise Collaborative networks Marine data	
Marine Alliance for Science and Technology	Research & Financial	Marine Science and Technology MASTS provides access to		Businesses can sponsor or part sponsor a MASTS	Formed in 2009, Phase II funding is expecting to	Networking, knowledge transfer,	There is a need to get to grips with climate change

Source of support	Type of support / description	Eligibility criteria	Geography	Levels or extent of support	Period /time frame	Benefits	Issues / gaps
for Scotland - MASTS	MASTS is a research pooling initiative that brings together the majority of Scotland's marine research capacity. MASTS pools the talent of about 700 researchers and the management of resources consisting of over £66 million annually, in marine science from across Scotland	resources, expertise and funds to support industry R&D.		Internship or PhD and benefit from the significant research infrastructure and capacity of their host institutions and the wider MASTS network.	take the consortium through to 2022.	research expertise.	(from all agencies).
Horizon 2020	Financial / Research - Horizon 2020 is an EU Research and Innovation programme which provides about €80 billion of funding available over 7 years (2014 to 2020); the UK has secured €5.1 billion of funding to	Various sectors To be eligible for Horizon 2020 funding, applicants must usually be a consortium made up of at least 3 organisations from different countries.	EU	Example Funding Call - European Pre-Commercial Procurement Programme for Wave Energy Research & Development 14th Nov 2018 – 27th Aug 2019. The challenge is the design,	2014-2020	Small or medium sized companies (SMEs) can also get help from a coach or mentor, e.g. to improve management skills, create a marketing strategy or raise finance.	Given this is an EU-led programme, there are likely to be uncertainties around UK funding post-Brexit.

Source of support	Type of support / description	Eligibility criteria	Geography	Levels or extent of support	Period /time frame	Benefits	Issues / gaps
	date (14.3% of the total).	Funding is provided for projects which: involve ground breaking research or new technologies improve research training and development, or research infrastructure create growth in sectors like advanced manufacturing, materials, biotechnology, information and communication technology, nanotechnology and space increase private investment in research respond to challenges like climate change, food security or		development and validation of cost-effective Wave energy convertors that can survive in a harsh and unpredictable ocean environment as the ocean through demand-driven Pre-Commercial Procurement.			

Source of support	Type of support / description	Eligibility criteria	Geography	Levels or extent of support	Period /time frame	Benefits	Issues / gaps
		healthcare for an ageing population					
Interreg 2 Seas Programme 2014-2020	Financial/Networking Interreg 2 Seas 2014-2020 is a European Territorial Cooperation Programme which covers England, France, the Netherlands and Belgium (Flanders). It is part-financed by the European Regional Development Fund and has a total of €241m ERDF to co-finance projects in the 2014-2020 period.	Various sectors (including low carbon technologies and adaptation to climate change) The Programme can support a wide range of organisations: public bodies, public equivalent bodies, not for profit organisations and private bodies are all eligible for funding. Specific projects that have been funded include: FRESH4Cs: Alternative FRESH water resources for saline Coastal Areas	England, France, the Netherlands and Belgium	€51.3m of investment is designated for low carbon technologies with a further €38.5m for adaptation to climate change efforts.	2014-2020	■Reduction of greenhouse gases through technological solutions ■Increased and more effective cooperation between businesses, knowledge institutes and public sector bodies ■Increased awareness of potential causes of climate change ■Enhanced coordination and cohesion between adaptation strategies and actions, and mechanisms for cross border exchange of	

Source of support	Type of support / description	Eligibility criteria	Geography	Levels or extent of support	Period /time frame	Benefits	Issues / gaps
		SARCC: Sustainable and Resilient Coastal Cities PECS: Ports Energy and Carbon Savings SUMARiS: Sustainable management of rays and skates MET-CERTIFIED: Development of International Standards and Certification schemes for Marine Energy Technologies				information and data related to climate change expected effects.	
Interreg North Sea Region (European Regional Development Fund (ERDF) INTERREG VB)	Financial Overall aim is to support development and foster sustained economic growth across the region. Helping enterprises, institutions, public administrations, NGOs and others	Various sectors There is a budget of 167 million euros to manage projects with a particular focus on pilots, demonstrations and trials. Projects typically explore how organisations can	North Sea Region	The co-financing rate is 50 %. The success rate of final applications was above 70% in 2018.	Programme ends in 2020. Call 10 for expression of interest closed on the 8 April 2019 and these applications will also be reviewed by	Example current project: Inn2POWER is a four-year Interreg project of eleven partners from the five leading offshore wind clusters in the North Sea Region –	

Source of support	Type of support / description	Eligibility criteria	Geography	Levels or extent of support	Period /time frame	Benefits	Issues / gaps
	to pool their expertise, share their experience and cooperate to develop realistic solutions to problems shared across the region.	work better, often together, for the long-term. Although cutting edge technology is important, work to develop and test new organisational structures, support networks and innovative practices is just as important. Current themes: 1. Thinking growth 2. Eco-innovation 3. Sustainable North Sea Region 4. Green transport and mobility			the Steering Committee in June. Call 11 is open for full applications 28 June 2019 - 11 October 2019. Call 12 scope is to be confirmed.	Denmark, United Kingdom, Germany, Belgium and the Netherlands. The aim is to expand the capacity for innovation and to improve access to the offshore wind industry for small and medium enterprises (SMEs) by connecting offshore wind businesses in the North Sea Region. Example proposed project: To develop a viable and sustainable future economy, based on the	

Source of support	Type of support / description	Eligibility criteria	Geography	Levels or extent of support	Period /time frame	Benefits	Issues / gaps
						historic role and core qualities and values of fishing communities. It aims to make maximum use of the available social, cultural and economic capital within these communities. The project activities are focused on developing new business opportunities and innovation through cooperation of SMEs, knowledge institutes, maritime stakeholders, regional authorities and municipalities and the	

Source of support	Type of support / description	Eligibility criteria	Geography	Levels or extent of support	Period /time frame	Benefits	Issues / gaps
						fishermen themselves. The success rate of applications in 2018 was above 70%.	
France (Channel) England Programme (European Regional Development Fund (ERDF) INTERREG IVA)	Financial The programme has 3 Priorities divided into 5 Specific Objectives: Priority 1: Innovation, Social Innovation Priority 2: Low Carbon Technologies Priority 3: Natural & Cultural Heritage, Coastal and Transitional Water Ecosystems	Various sectors The Programme area covers the South and East Coasts of England from Cornwall to Norfolk, and the North Coast of France from Finistère to Pas-de-Calais. The minimum requirement for a project to be eligible is for the partnership to have at least one English Partner and at least one French Partner, both based in the Programme Area.	Southern England (with Northern France)	Regular Projects Intervention Rate up to 69%, no maximum budget, no maximum project duration, open call for projects. Micro Projects - only open to local authorities (EN) and collectivités publiques (FR) and organisations employing less than 50 people and have a turnover of less than €10 million.	Programme ends in 2020. Regular Projects – ongoing application process. Micro Projects – 2 calls per year. Project Duration 27 Months (max).	The programme aims to encourage an area of common citizenship, a shared identity for the area of cooperation, and a sense of belonging to a cross-border area. The programme currently funds nearly 150 cooperation projects between France and England that involve some 550 different organisations	Only projects supporting the broad Europe 2020 agenda will receive funding. Projects must have at least one French and one English Partner within the strictly defined geographical area.

Source of support	Type of support / description	Eligibility criteria	Geography	Levels or extent of support	Period /time frame	Benefits	Issues / gaps
				Intervention Rate 80%, Total Budget € 500,000 (max). Targeted Projects - larger than usual projects that are developed by the Programme, in a 'top down approach' to ensure it aligns with the needs of the Programme area.		from both countries. These projects deal with a wide range of cooperation topics that are supported by the programme: economic development, environment, culture, tourism, social inclusion, but also maritime cooperation.	
Ireland Wales Territorial Cooperation Programme 2014-2020 (European Regional Development Fund (ERDF) INTERREG IVA)	Financial The Ireland Wales 2014-2020 European Territorial Co-operation (ETC) programme is a maritime programme connecting organisations, businesses and	Various sectors Organisations from the public, private and third sector can apply for EU funding. Projects must involve at least one partner organisation from Wales and Ireland, with one organisation	Wales (with Ireland)	The overall value of the programme is €100m, utilising €79m from the European Union's European Regional Development Fund (ERDF).	Programme ends in 2020 having begun in 2014.	Encourages collaboration and sustainability through: Cross border innovation Adaptation of the Irish Sea and Coastal Communities to Climate Change	Given the programme accessed a significant proportion of its funding from the EU's ERDF, there may be uncertainty around the impact of Brexit.

Source of support	Type of support / description	Eligibility criteria	Geography	Levels or extent of support	Period /time frame	Benefits	Issues / gaps
	communities on the West coast of Wales with the South-East coast of Ireland. The Ireland Wales programme focuses on seeking solutions to shared challenges on both sides of the Irish sea to improve the economic and sustainable development priorities of Wales and Ireland. The programme focuses on: Cross border innovation Adaptation of the Irish Sea and Coastal Communities to Climate Change	taking on the role of lead partner.		The Wales Ireland Networking (WIN3) Scheme provides financial support to organisations travelling overseas to meet or seek potential partners. The aim is to increase the formation of new partnerships in Ireland and Wales. The scheme offers a €250 payment towards travel and subsidence costs.		Cultural and Natural Resources and Heritage	

Source of support	Type of support / description	Eligibility criteria	Geography	Levels or extent of support	Period /time frame	Benefits	Issues / gaps
	Cultural and Natural Resources and Heritage						
Visit Scotland	Financial – Growth Fund	Marine Tourism Funding for collaborative tourism marketing focussing on growth. Applications must come from groups with a strong mix of tourism businesses.	Scotland	Growth Fund Grant awards are available from £10,000 to a maximum of £40,000. • The Grant can provide Groups with up to 50% of approved marketing activity. • Applications with 50% match funding will be prioritised.	The next Growth Fund Panel is: Summer 2019 - The deadline for initial expressions of interest is 24 April 2019.	Encourages industry collaboration to deliver partnership marketing campaigns.	Covers the whole Tourism sector – not just Marine.
Offshore Renewable Energy Catapult	Technology, Innovation and Research Support	Marine Renewable Energy Works with industry, academia, and government.	UK	Provide SMEs with industry-led opportunities via Innovation Challenges. Has support 597 SMEs as of August 2019.	Ongoing	Catapult offers access to sector knowledge and expertise, networks, facilities and 3rd party funding.	

Source of support	Type of support / description	Eligibility criteria	Geography	Levels or extent of support	Period /time frame	Benefits	Issues / gaps
				648 industry collaborations across the globe as well as 469 academic collaborations.			
Events Scotland	Financial	Marine Tourism 2020 has been designated Scotland's Year of Coasts and Waters to spotlight, celebrate and promote opportunities to experience and enjoy Scotland's Coasts and Waters. The dedicated Year of Coasts and Waters 2020 (YCW2020) Events Programme Open Fund has been designed to create new, high	Scotland	A total Open Fund of £600,000 has been made available across two funding rounds. Applications for grants of between £10,000 and £50,000 are invited.	Round 2 is open for applications until 5pm Friday 7 June 2019.	There is still an opportunity to align events with the Year of Coasts and Waters 2020, albeit in a non-funded capacity.	Funding for Marine Tourism specifically is only available short term – for 2020 only.

Source of support	Type of support / description	Eligibility criteria	Geography	Levels or extent of support	Period /time frame	Benefits	Issues / gaps
		profile opportunities to celebrate Scotland's coasts and waters. The four programme strands are: - our natural environment and wildlife - our historic environment and cultural heritage - activities and adventure - food and drink					
Trinity House	Trinity House is a charity dedicated to safeguarding shipping and seafarers, providing education, support and welfare to the seafaring community with a statutory duty as a General Lighthouse Authority to deliver	Applications are welcome from charities and organisations whose work aligns with the charitable objectives and who can demonstrate support of seafarers in the areas below:	UK	Today, the charity disperses over £4 million to meet goals, including providing almshouses for retired mariners and their dependents in Kent and sponsoring cadets through	Applications are considered 6 times a year	Support covers a range of marine necessities, including education and training, community-building, vessel services contracting and navigation aids in its role as a General	

Source of support	Type of support / description	Eligibility criteria	Geography	Levels or extent of support	Period /time frame	Benefits	Issues / gaps
	a reliable, efficient and cost-effective aids to navigation service for the benefit and safety of all mariners.	a. Support, maintenance and provision of Alms Houses and Annuities; b. Advancing the education and training of officers, cadets and seamen (including grants and bursaries); c. Advancing the education of the public, including assisting schools and other institutions providing education, and commissioning research; d. Advancing public safety and the safety of shipping;		the Merchant Navy Scholarship Scheme. 18 almshouses for mariners. 150 Trinity House yeoman. Over 20 charities supported each year, with £4-5 million distributed annually to charities. 32 new cadets sponsored annually.		Lighthouse Authority.	

Source of support	Type of support / description	Eligibility criteria	Geography	Levels or extent of support	Period /time frame	Benefits	Issues / gaps
		e. Relieving the need of mariners and former mariners of all ranks, and their families; f. Publishing and disseminating information in any form relating to navigation, shipping and seamanship.					
UKMPG	The United Kingdom Major Ports Group Ltd (UKMPG) was formed in 1993 and is the trade association representing most of the larger commercial ports in the United Kingdom. UKMPG represents the interests and concerns of its	Ports Applications from UK ports are welcome at any time.	UK	Group contains nine members who, between them, own and operate over 40 ports accounting for more than 70% of the total tonnage handed in UK ports.	Ongoing	UKMPG works very closely with the other ports sector trade association, the British Ports Association (BPA) and with the ports sector skills and safety organisation, Port Skills and Safety (PSS). The three organisations share offices close to the	Need to get the best out of Brexit

Source of support	Type of support / description	Eligibility criteria	Geography	Levels or extent of support	Period /time frame	Benefits	Issues / gaps
	members to policy makers and opinion formers in the UK and Europe, on those areas of Government or EU policy which affect the industry. It also provides forums for its members to share with other ports ideas and best practice on issues including the environment, port infrastructure and navigation.					offices of the UK Chamber of Shipping, therefore collaboration links and infrastructure are there.	
British Ports Association	The British Ports Association represents the interests of its 100 full members, and numerous associate members, to the UK and devolved Governments, the EU and national	Ports Membership comprises many ports, terminal operators and port facilities, all of varying size, location and nature; the Association is able to draw upon	UK	Represents the interest s of its 100 full members and a number of associate members, at government level.	Ongoing	Membership organisation therefore an Elected Council, supported by Regional Committees and Working Groups in specialist areas, meets to decide strategy and funding.	Overarching challenge for ports in the U is that they are competitive and operate independently – frail market (i.e. there are specific issues around environmental objectives).

Source of support	Type of support / description	Eligibility criteria	Geography	Levels or extent of support	Period /time frame	Benefits	Issues / gaps
	and international bodies.	a wide range of experience and knowledge to represent its members' interests. Non-port authorities can join as associate members (i.e. engineering companies, environmental consultancies, insurance specialists, accountants, finance companies and law firms) at an annual fee of £988 plus VAT.				Strong networking links with a variety of port and port-related groups and organisations.	Some technology/innovation gaps however ports are getting better, for instance embracing smart technologies. Challenges around connectivity and surrounding infrastructure (i.e. sufficient road and rail connections). Environmental considerations are a big issue, particularly around air quality, emissions, water quality, biodiversity and noise pollution. It is crucial to look minimising the impacts of climate change – ports are on the

Source of support	Type of support / description	Eligibility criteria	Geography	Levels or extent of support	Period /time frame	Benefits	Issues / gaps
							frontline of extreme weather conditions. Brexit is also a concern, especially for those part of the sector (fishing and ferry ports) that have an interaction with the EU.
British Marine	British Marine is the trade association for the UK leisure, superyacht and small commercial marine industry. Leading and promoting the industry and work with members to achieve sustainable growth in a competitive global environment, through the provision of world-	Expertise spans in-depth technical services, representation with government and non-governmental bodies, UK and global marine trade development, legal services, general business advice and much more besides. British Marine members gain	UK	Support over 1,500 members who come from a broad range of businesses including boat builders, chandlers, brokers, marinas, passenger boats and engines.	Ongoing	Benefits delivered in four core areas: Business Support Growth Representation and Promotion Networking	Main challenges: ■ Skills shortages in some areas. Around 20% of the workforce of larger boatbuilding companies (such as Sunseeker) are EU citizens. ■ Diesel engine vessels will have to be adapted as Maritime 2050 report and legislation comes into fruition.

Source of support	Type of support / description	Eligibility criteria	Geography	Levels or extent of support	Period /time frame	Benefits	Issues / gaps
	class goods and services. We support over 1500 members with a range of services and expertise which help their business.	free membership to a British Marine region as well as groups and associations relevant to their business. Minimum subscription fee to be become a member of British Marine is £240 plus VAT.					■ Changing boat ownership models is a financial challenge as people are increasingly looking for experiences and not ownership of boats, particularly the younger demographic. ■ As industry is wholly reliant on key waterfront sites, there needs to be opportunities to integrate marine industries with new developments – Marine Protected Areas network in Scotland may be restricted in terms of access.
SAMS Research Services Ltd	Research Specialist marine consultancy and survey service	Supports the following industries with surveys,	UK	SAMS has an annual budget of £11m, with 70% of income coming from UK	N/A	SAMS/SRSL recognised as a global centre of expertise in marine science	

Source of support	Type of support / description	Eligibility criteria	Geography	Levels or extent of support	Period /time frame	Benefits	Issues / gaps
		modelling and analysis services: Aquaculture Seaweed Marine Biotech Decommissioning Marine Renewables Seafood Security Marine Mining		and EU research grants and contracts, 10% from higher education and 20% from commercial contracts.			
NAFC Marine Centre UHI	Research Specialist marine and fisheries consultancy	Supports fisheries industry and government with surveys, modelling and analysis services. Also provides advisory support on the development of marine spatial plans. Also provides training including Merchant Navy Cadet Programme	UK, but largely Shetland/NE Scotland focused	Support through annual fisheries stock surveys, trawl survey data, etc. and industry-focused research outputs.	N/A	Recognised as leading UK research centre for fisheries	Fisheries oriented, but does some research into shellfish. Currently exploring options to expand industry offering by establishing a Chair in Seafood Industries
Marine Stewardship Council	Certification and marketing	Fisheries and supply chain businesses	Global	MSC certification confirms a	N/A	Since the MSC was founded in 1997, fisheries	Has been criticised in the past for awarding

Source of support	Type of support / description	Eligibility criteria	Geography	Levels or extent of support	Period /time frame	Benefits	Issues / gaps
	International not-for-profit organisation that uses ecolabel and fishery certification program to contribute to the health of the world's oceans by recognising and rewarding sustainable fishing practices, influencing the choices people make when buying seafood and working with our partners to transform the seafood market to a sustainable basis.			fishery is well-managed and is sustainable. Certified fisheries benefit from: enhanced reputation better visibility improved dialogue with stakeholders a pathway for improvements protected livelihoods access to new markets secure markets promotional opportunities		responsible for almost 15% of marine catch have been certified to the MSC Fisheries Standard. Certification is helping to grow and maintain the number of sustainable fish populations. To remain certified, fisheries have so far made over 1,200 improvements to their performance and management. More than 38,000 sites, including supermarket chains, restaurants,	MSC Certification to controversial fisheries with little or no evidence of their sustainable practices, particularly in terms of bycatch.

Source of support	Type of support / description	Eligibility criteria	Geography	Levels or extent of support	Period /time frame	Benefits	Issues / gaps
						fishmongers and hotels are now certified to sell seafood with the blue MSC label.	
RYA Foundation	Financial The RYA Foundation is the charitable arm of the RYA. It has the objective of making boating more accessible to everyone, regardless of circumstance.	RYA-affiliated sailing clubs and centres, and other organisations that are seeking to develop their facilities for disadvantaged people, may apply for funding. Grant applications are available to groups under the following headings: 1. Volunteer recruitment 2. Training 3. Provision for children and young people 4. Equipment provision	UK	Applications for grants up to £3000 may be submitted at any time and will be processed by the Trustees on receipt. Applications for grants over £3000 are considered at the next Trustees meeting.	N/A	Promotion of boating for everyone regardless of circumstance. Able to provide technical advice and support. Able to offer advice about boats and safety issues. Training opportunities and provision of sailing instructors.	

Source of support	Type of support / description	Eligibility criteria	Geography	Levels or extent of support	Period /time frame	Benefits	Issues / gaps
Scottish Seafood Association	Industry representation, networking and collaboration, business development support A national body representing the whole of Scotland's seafood, processing and trading sectors.	Seafood Processing Provides a united voice for members and for the wider processing sector in the policy and legislation arenas through effective dialogue, consultation, collaboration and partnership working. The Scottish Seafood Association (SSA) was formed in 2011 in response to a growing need for a national body to represent the whole of Scotland's seafood, processing and trading sectors. It now has around	Scotland	SSA has around 70 members from across Scotland.	Formed in 2011.	Member benefits include: Industry standard training Business development advice Industry networking Group MSC Certification (making the accreditation process much more affordable for small and medium sized processors	Membership required to access full benefits

Source of support	Type of support / description	Eligibility criteria	Geography	Levels or extent of support	Period /time frame	Benefits	Issues / gaps
		70 members from across Scotland.					
Grimsby Fish Merchants Association	Industry representation, networking and collaboration, business development support	Seafood Processing Provides a united voice for members and for the wider processing sector in the policy and legislation arenas. Grimsby FMA currently has 21 full members and 6 associate members. The majority of members are small processors employing between 5 - 20 staff. The Association has a board of five directors and one chairman who meet and hold board meetings	England (Grimsby based)	Member benefits include: Industry representation Legal Advice Bespoke financial service that guarantees payment to suppliers, vessel owners, merchants' within 10 days.	N/A	The goals and ambitions of GFMA are to: Be a knowledgeable and accessible point of contact and supporting and increasing the supply of fish to the Grimsby market. Maintain a profitable fish merchants business and providing a responsive service to meet member needs. Deliver a robust, accountable and transparent settlement scheme. Sustain and grow FMA membership.	Membership required to access full benefits There is an issue around training in that it is practical, non-transferable skills. There is also a need to tackle sustainability issues, as with any other industry. Related to this is the use of plastics. Aging infrastructure needs upgrading. Plus, difficulty to access finance for businesses (albeit this is not a key inhibitor as long as the parameters of funds are fair).

Source of support	Type of support / description	Eligibility criteria	Geography	Levels or extent of support	Period /time frame	Benefits	Issues / gaps
		on a monthly basis.				Promote awareness of funding and the industry through its national and international network. Assist members with environmental legislation, documentation, training and import and export routines.	
Seafood Scotland	Industry promotion, information and business development support The national trade and marketing body for the Scottish Seafood Industry	Seafood Industry including the Scottish catching, seafood processing and fish farming sectors. An Interbranch Organisation (IBO) set up "by the industry for the industry" in 1999 to increase the value of return to the Scottish	Scotland	Offers: Trade marketing promotion Business development support Industry information Services are offered free to all the industry, inclusive of any size, scale or part of the	Ongoing	Seafood Scotland's aim is to achieve sustainable business development for the Scottish seafood industry.	

Source of support	Type of support / description	Eligibility criteria	Geography	Levels or extent of support	Period /time frame	Benefits	Issues / gaps
		seafood sector. The board consists of representatives from the Scottish catching, seafood processing and fish farming sectors, with meetings joined by observers from the Scottish Government, Scottish Enterprise and Highlands & Islands Enterprise.		supply chain. The team holds a wide range of skills, building personal one to one relationships, and supporting individual company needs.			
Wise Marine	Research and information WISE-Marine is a portal and infrastructure for sharing information with the marine community on the marine environment at European level.	N/A	Europe	Support offered around policy, research and data across European Union member states.	Ongoing	Networking and information-sharing within the marine sector. A wide array of resources and tools available related to various aspects of the sector for public use.	

Source of support	Type of support / description	Eligibility criteria	Geography	Levels or extent of support	Period /time frame	Benefits	Issues / gaps
	Focusing on the state of the marine environment at the European scale, WISE Marine shows the information and knowledge gathered or derived through the MSFD process and other key marine policy drivers						
Funding Fish	Financial Funding FISH is an international funders collaborative established with the express purpose of supporting the implementation of the Common Fisheries Policy in order to achieve sustainable fisheries in Europe.	Fisheries Funding FISH is works with a cross section of stakeholders and with different approaches, prioritising collaborative work involving several partners across regions.	EU	The majority of Funding FISH's support takes the form of grant making. In addition, they work with potential partners to identify matching funding, develop projects and provide other in kind services.	The funding partners help identify, assess and approve all projects for investment. The partners meet approximately every 2 months to consider funding applications. The standard process is for	Support for stakeholders to participate in the drafting of management plans for the various European regional seas, as called for by the new Common Fisheries Policy. Supporting the promotion of solutions to	

Source of support	Type of support / description	Eligibility criteria	Geography	Levels or extent of support	Period /time frame	Benefits	Issues / gaps
					an applicant to submit a project outline. If approved by the partners the applicant will be invited to submit a full application which is resubmitted for final approval at a subsequent meeting.	policy-induced changes, and the promotion of best practice to key audiences to ensure smooth transitions. Opportunities to work with seafood buyers, raising awareness around fisheries requirements and developing potential responses.	
Sail Scotland	Marketing National marketing organisation for sailing and marine tourism.	Marine Tourism Platinum and Gold Membership is open to organisations providing sailing and marine tourism activities in Scotland.	Scotland	Sail Scotland delivers a range of strategic marketing activities, aimed at bringing more sailing visitors to Scottish waters, in order to grow the sector and deliver benefits to members	Ongoing	Regional information available on various recreational boating-related issues, including marinas and boatyards, sailing schools, Scottish canals	

Source of support	Type of support / description	Eligibility criteria	Geography	Levels or extent of support	Period /time frame	Benefits	Issues / gaps
		Free Associate Membership is open to organisations who provide hospitality, activities and attractions, retail and specialist services for sailing visitors (i.e. hotels, bars, cafes, restaurants, visitor attractions, activity providers, chandlers, general retailers and boat maintenance etc.)		businesses and the wider economy.		and cruising areas.	
The Seafood Training Academy	Training A collaboration between seafood training networks, training organisations, providers and individual trainers.	Seafood Processing The Academy focuses on the training and learning needs of the onshore sectors of the UK. It has a growing portfolio of	UK	Each network will between 20 and 40 businesses from the processing, mongering, frying and other onshore sectors of the fish and shellfish industry.	From October 2018 the Seafood Training Academy website will be changing as much of the content will be absorbed into the new	Collaboration opportunities across different providers and service areas, including business, training and academia.	

Source of support	Type of support / description	Eligibility criteria	Geography	Levels or extent of support	Period /time frame	Benefits	Issues / gaps
		training programmes, qualifications and resources which are intended to make available cost effective and high quality fish and shellfish training throughout the UK. Four Seafood Training Networks in the UK, covering Scotland, Wales, Northern Ireland and Yorkshire & Lincolnshire. Employer members and Training Provider members.			Seafish website (Onshore Training Section).		
Crown Estate	Knowledge sharing, partnership working and sustainable development	Offshore renewable energy and marine aggregates	UK except Scotland	Works with customers and stakeholders to support the long-term sustainable	Ongoing	The Marine Data Exchange, one of the biggest sources of marine data in the world, is	

Source of support	Type of support / description	Eligibility criteria	Geography	Levels or extent of support	Period /time frame	Benefits	Issues / gaps
	The Crown Estate manages the seabed of England, Wales and Northern Ireland, including offshore energy, aggregates, and cables and pipelines. It also looks after around half of the UK's foreshore.	Works in partnership with customers and stakeholders.		development of the seabed - awarding seabed rights and sharing knowledge and data. Plays an active role in offshore wind sector, from leasing sites to collaborating with customers to help boost performance, reduce costs and de-risk investment. The Marine Data Exchange provides access to survey data and reports collected by Crown Estate offshore renewable and marine		freely accessible, promoting collaboration within the sector and reducing survey costs. Works with developers and stakeholders to explore the potential to unlock other energy resources offshore, such as wave and tidal, and storage of natural gas and CO2.	

Source of support	Type of support / description	Eligibility criteria	Geography	Levels or extent of support	Period /time frame	Benefits	Issues / gaps
				aggregates customers.			
Crown Estate Scotland	Knowledge sharing, partnership working and sustainable development In relation to the Marine Sector, Crown Estate Scotland is responsible for managing: Rights to fish wild salmon and sea trout in in river and coastal areas Just under half the foreshore around Scotland including 5,800 moorings and some ports and harbours Leasing of virtually all seabed out to 12 nautical miles covering some 750 fish farming	Offshore renewable energy, marine aggregates and commercial fishing Works in partnership with customers and stakeholders. For the Local Management Pilots Scheme they are keen to work with innovative proposals that have the support of local people including existing tenants, and that will use Scottish Crown Estate assets to enhance sustainable development.	Scotland	Works with developers as they navigate through pre-planning and consenting to construction and operation. Leverages sector expertise (in planning, consenting, finance, commercial, legal, and environmental) to ensure the seabed is developed sustainably. Shares best practice to help emerging technologies become viable, from floating wind to tidal	Ongoing	Crown Estate Scotland hopes that the Local Management Pilot projects will enable them to work with others to test different methods of managing assets, empowering communities and giving people more say in decisions that impact the land, foreshore and sea near where they live.	

Source of support	Type of support / description	Eligibility criteria	Geography	Levels or extent of support	Period /time frame	Benefits	Issues / gaps
	sites and agreements with cables & pipeline operators The rights to offshore renewable energy and gas and carbon dioxide storage out to 200 nautical miles.			stream, and to address challenges facing new industries. Works with investors, developers and partners to build confidence and help make projects more competitive. Continues to work with partners to build the Carbon Capture & Storage sector. The Local Management Pilots Scheme has been designed to encourage local authorities, development trusts and other			

Source of support	Type of support / description	Eligibility criteria	Geography	Levels or extent of support	Period /time frame	Benefits	Issues / gaps
				eligible bodies to manage Scottish Crown Estate land and property rights in their local area.			
The Waterloo Foundation	Funding The Waterloo Foundation (TWF) is an independent grant-making Foundation created in 2007, based in Cardiff, Wales. A registered charity, it gives grants to organisations in both the UK and worldwide. Under the Marine programme, preference will be given to initiatives working to halt the decline of fish stocks that communities in developing	Marine Sector Local projects Applications for local projects should demonstrate that they will positively impact upon the marine fisheries they are working to protect, and could include: Development of marine protected areas or sustainable fisheries management Addressing local causes of over-exploitation of fish stocks and other seafood	Wales - Global	The Foundation aims to give annual grants of around £6 million for charitable purposes in its four core programme areas. These include the Environment, under which there are two themes – one of which is Marine.	Each year there are 2 deadlines per programme for applications to the Environment Fund with the aim of processing all applications received within 6 months of the deadline date. The next deadline for applications to the Marine programme will be on the 1st September 2019.	Intended to support initiatives that would work to halt the decline of fish stocks that communities in developing countries rely on, as well as initiatives working to bring about sustainable fisheries in Wales.	

Source of support	Type of support / description	Eligibility criteria	Geography	Levels or extent of support	Period /time frame	Benefits	Issues / gaps
	countries rely on, and those working to bring about sustainable fisheries in Wales. Both practical local projects, and strategic initiatives will be considered.	Creation of sustainable livelihoods for coastal and seafood dependent people Click here for examples of local projects supported under our Marine programme. Strategic projects Strategic projects that are working on addressing marine issues at a wider or international scale will be considered. These could include: Working on international or regional marine policy Campaigning for improved					

Source of support	Type of support / description	Eligibility criteria	Geography	Levels or extent of support	Period /time frame	Benefits	Issues / gaps
		practices in commerce Exploring different fishing practices and techniques Improving information exchange to eradicate illegal unreported and unregulated fishing.					
Marine Energy Wales	Information and guidance, marketing, networking and collaboration Marine Energy Wales brings together technology developers, the supply chain, academia and the public sector to establish Wales as a global leader in sustainable marine energy generation,	Marine Energy Membership organisation – fee paying	Wales	Premium Member - £2,000 Regular Member (100+ employees) - £750 Regular Member (11 - 99 employees) - £500 Regular Member (1 - 10 employees) - £250 Concession - £100	Annual membership (April-March)	Provides support and guidance for the sector Encourages learning and collaboration through regular working group meetings Raises awareness of Wales' key development opportunities	Businesses must pay a membership fee to access full benefits

Source of support	Type of support / description	Eligibility criteria	Geography	Levels or extent of support	Period /time frame	Benefits	Issues / gaps
	making a significant contribution to a low carbon economy.					Engages with stakeholders Provides a conduit for information for industry Encourages wide participation in the marine energy industry Promotes wider public understanding of the benefits of marine energy	
Strength in Places Fund (SIPF)	Funding Led by UK Research and Innovation SIPF is a competitive funding scheme that takes a place-based approach to research and innovation	All sectors SIPF is a competitive fund for collaborative bids between businesses and research organisations. Bids must demonstrate	UK	Up to £50k seedcorn funding at stage 1. Between £10-50 million at stage 2.	Wave 1 has closed. Wave 2 will be announced later in 2019. The programme consists of two stages. The first will call for	Supporting innovation-led relative regional growth. Enhancing local collaborations involving research and innovation: bringing	Bids must demonstrate strong engagement from local leadership partners, but the following cannot lead a bid: Local Enterprise Partnerships (LEPs); Combined

Source of support	Type of support / description	Eligibility criteria	Geography	Levels or extent of support	Period /time frame	Benefits	Issues / gaps
	funding, to support significant regional growth. The aims of the Fund are to support innovation-led relative regional growth by identifying and supporting areas of R&D strengths that are: Driving clusters of businesses across a range of sizes that have potential to innovate, or to adopt new technologies; in order that those clusters will become nationally and internationally competitive. To enhance local collaborations involving research and innovation.	strong engagement with a local leadership partner.			EOIs from regional consortia. Following expert review and panel assessment, the EOIs that pass this pre-qualifying stage with strongest alignment to the call criteria will receive up to £50K seedcorn funding to develop full stage proposals over a period of up to 24 weeks. For the second stage, those EOIs supported with seedcorn funding will bid for full funding of between	together work of universities, research institutes, Catapults and other R&D facilities with businesses at the forefront of delivering economic growth through innovation.	Authorities (CAs); enterprise bodies and similar economic development agencies across the four nations of the UK. Bids that do not have a clear and justifiable geography will not be supported. The following are out of scope for the funding: Investment in new strategic national infrastructure that should be supported through other UKRI programmes, e.g. establishing new Catapult centres, Innovation Knowledge Centres (IKCs) etc.;

Source of support	Type of support / description	Eligibility criteria	Geography	Levels or extent of support	Period /time frame	Benefits	Issues / gaps
	Building on the underpinning regional economic impact role of universities, research institutes, Catapults and other R&D facilities (such as Innovation and Knowledge Centres - IKCs); and engaging those businesses at the forefront of delivering economic growth through innovation within the identified economic geography.				£10 million and, exceptionally, £50 million. A number of the highest quality proposals will then receive funding for between 3 – 5 years, to deliver a bespoke package of interventions in that locality.		Recreating national grand-challenge programmes at a regional level that would risk duplication of funding through ISCF and other UKRI programmes; Developing outreach programmes to transfer a localities expertise to other regions around the UK.
Centre for Advanced Sustainable Energy (CASE)	Funding for Research The Centre for Advanced Sustainable Energy is an industry-led	Sustainable Energy including the Turbine Sector (wind, wave and tidal turbines).	Northern Ireland	CASE are currently seeking applications from suitably qualified consortia for research and	Since establishment in 2013, CASE has allocated £5m to 25 research projects involving	The research impact and outcomes will benefit the project consortium and the wider	

Source of support	Type of support / description	Eligibility criteria	Geography	Levels or extent of support	Period /time frame	Benefits	Issues / gaps
	research centre funded through the Invest NI Competence Centre Programme.	CASE funds collaborative R&D that has a positive impact on the Northern Ireland sustainable energy sector. Projects MUST be collaborative and include at least three companies and at least one research institution (Queen's University Belfast, Ulster University or the Agri-Food & Biosciences Institute). The research will largely be carried out by the academic team but will be in partnership with industry and responding to industry need. The funding will		development funding to support sustainable energy challenges in Northern Ireland and beyond. This call is for short term (3 – 6 month) projects, with a maximum budget of £50,000 per project in the areas of marine renewable energy, energy systems and bio-energy. Industry partners pay a membership fee to CASE of £550 per annum and also contribute to the cost of their project (cash contribution	Queen's, Ulster University, AFBI and 60 companies.	Northern Ireland economy.	

Source of support	Type of support / description	Eligibility criteria	Geography	Levels or extent of support	Period /time frame	Benefits	Issues / gaps
		go directly to the academic partner(s) undertaking the research.		dependent upon company size and an in-kind contribution totalling 25% of total project costs).			
SCORE	Financial & Innovation Support SCORE is a £6million grant programme, part funded by the European Regional Development Fund (ERDF) and delivered by enterprise specialists Nwes, in partnership with energy industry experts Nautilus Associates, the Offshore Renewable Energy Catapult; and OrbisEnergy, the offshore	Offshore Renewable Energy - offshore wind, wave and tidal, other marine renewable energy technologies and their direct supply chains. SCORE funding is available to support small and medium-sized businesses developing new technologies, processes and ideas which have an impact in lowering costs and increasing efficiencies in the East of England's	East of England	Grants are available for up to 30% of eligible costs or £50,000, whichever is the lower, with a minimum grant of £2,500.	Ongoing	The programme aims to support 200 innovative businesses and create 100 new jobs. The previous £2.5 million programme invested in 40 projects, support more than 50 companies and helped to generate 70 new jobs.	Limited geographical eligibility

Source of support	Type of support / description	Eligibility criteria	Geography	Levels or extent of support	Period /time frame	Benefits	Issues / gaps
	renewable innovation hub in Lowestoft, Suffolk.	offshore renewables industry. To qualify for a grant and specialist support the company must have a base in England employ fewer than 250 people and have net assets of less than €50million. SCORE is open to start-up and established companies. Funding can be to develop a new product, process or idea, e.g. patenting a new product or exploring concepts that offer new ways of looking at the generation of offshore					

Source of support	Type of support / description	Eligibility criteria	Geography	Levels or extent of support	Period /time frame	Benefits	Issues / gaps
		renewable energy. The economic benefit of the project must be in Cambridgeshire, Essex, Norfolk or Suffolk.					
Welsh Fishermen's Association - Cymdeithas Pysgotwyr Cymru (WFA-CPC)	Industry representation, networking and collaboration, business development support Recognised as the national body representing the interests of the fishing industry in Wales.	Fishing industry The WFA-CPC is managed by a board of directors from five regional associations whose members range from inshore static gear fishermen to offshore scallop, trawler and whelk fishermen. Vision A prosperous and sustainable fishing industry that supports the economic, social and cultural well-being of our	Wales	Represents Welsh fishermen in Welsh Government, Whitehall and Europe. Collaborates with Welsh Government, Natural Resource Wales and others to gather the necessary evidence to maintain access to fishing grounds and ensure our fisheries are sustainable. With Welsh Government,	Ongoing	Maintains access to fishing grounds To ensure fisheries are sustainable Improves the resilience of the Welsh seafood primary producing sectors Encourages new entrants into fishing Promotes an evidence-led based approach to the management of	Concern around access to markets (EWU and South Korea, for instance) after Brexit. Lack of infrastructure (e.g. no auctions in Wales) and an ageing workforce Access to finance is traditional, i.e. through banks (bank manager), however there has not been a lot of demand for finance to invest as a result of an ageing workforce

Source of support	Type of support / description	Eligibility criteria	Geography	Levels or extent of support	Period /time frame	Benefits	Issues / gaps
		coastal communities. Aim To ensure sustainable fisheries that support well-being and future generations of Welsh coastal communities.		Seafish and training providers, encourages and supports new entrants into the industry. Promotes the consumption of Welsh seafood as a healthy, sustainable and responsibly sourced product.		the marine environment Increases seafood consumption in Wales Minimises spatial conflict with other marine industries Develops innovative solutions to electronic data collection, reporting and control methods.	wishing to see its time out.
LIFE (replacing LIFE+ programme)	Financial - Nature and biodiversity best practice, pilot and demonstration projects in line with EU directives on birds, habitats	Various Environmental sectors Anyone registered in the EU can make a proposal for LIFE (traditional,	European Union	Project budget depends on project type, with no specifications for Traditional LIFE projects.	Current funding period is from 2014-2020 and there is a funding budget of €3.4 billion.	LIFE projects are very flexible in terms of how they are set up Large-scale, financial support opportunities for	Brexit will impact the UK's eligibility for funding should a no-deal Brexit occur – risk of ceased funding while still having to participate in projects, or having

Source of support	Type of support / description	Eligibility criteria	Geography	Levels or extent of support	Period /time frame	Benefits	Issues / gaps
	and biodiversity strategy 2020. - Environment and resource efficiency projects, including marine and coastal management, covering action grants for pilot projects and development and demonstration of innovative technologies. - Support for projects promoting awareness on environment Integrated projects combine LIFE funding with other sources of support to maximise impact over a large area, with water a concern. Preparatory projects (specific	integrated, preparatory, and technical assistance projects) This includes: - Public bodies operating under national government's authority (i.e. local authorities). - Private commercial organisations - Private non-commercial organisations (NGOs) If outside the EU you can contribute to a project as an associated beneficiary by undertaking actions necessary for achieving goals.		As an example, LIFE has co-funded large ambition projects with total costs for more than €5 million, however proposals for small projects with total costs below €500,000 have rarely been selected due to limited output/low added value. Integrated projects usually have a total budget around €17 million. For Preparatory projects, a maximum budget is specified in the documents of	Next deadlines: Traditional projects, 12 September 2019 (Climate Action) Integrated Projects, 5 September 2019 (Environment & Climate Action)	large projects across the EU Collaboration between Member States on addressing international environmental and biodiversity challenges A funding instrument build around addressing climate action Specific 2018 projects addressed species conflict, pest management alternatives and sustainable farming techniques 2015 project in Greece (SOL-	to leave projects entirely Smaller-scale projects are unlikely to be selected for funding given their limited output and low added value

Source of support	Type of support / description	Eligibility criteria	Geography	Levels or extent of support	Period /time frame	Benefits	Issues / gaps
	needs for development and implementation of EY environmental policy and law) and technical assistance support. The LIFE programme is divided into two sub-programmes, one for environment (75% of overall financial envelope) and one for climate action (remaining 25% of envelope).	No-deal Brexit: UK government has guaranteed to fund LIFE project bids submitted by UK organisations and approved by the European Commission while still a member of EU, as well as LIFE funding due to UK organisations acting as partners in projects led by other member states, and those given funding before the end of 2020.		the call for proposal. Generally speaking, both sub-programmes co-finance Traditional LIFE projects with up to 55% of total eligible project costs (nature and biodiversity, under environment, can receive up to 60% or 75%). Preparatory and Integrated projects co-funded up to 60%. Technical assistance projects up to 55%, cannot exceed €100,000.		BRINE project) used solar energy to separate the by-product of water desalination plants, eliminating the dumping of brine back into the sea and thus preserving the pristine marine environment, saving energy and creating new economic opportunities	
Fisheries & Conservation	Guidance, advice and research	N/A	UK and abroad	Provides guidance and	Research undertaken for	Focus on sustainable and	

Source of support	Type of support / description	Eligibility criteria	Geography	Levels or extent of support	Period /time frame	Benefits	Issues / gaps
Science Group (Bangor University)	With the collaboration of the fishing industry, research institutes and government, the group is working together to gather scientific evidence to ensure the future of fisheries in the UK and abroad.		(based in Bangor)	advice around fisheries science, for instance, to the Isle of Man Government Sustainable Fisheries for Wales project, in partnership with the Welsh Fishermen's Association and the European Fisheries Fund. The scientific surveys outlined within the project work packages are essential to inform the future management of fisheries and the Welsh marine environment. Project aims to put in place a programme of	Isle of Man's Department of Environment, Food and Agriculture since 2007	economically viable fisheries within an ecosystem context Health assessments of commercially important shellfish stocks (i.e. king/queen scallop, edible crab, lobster and whelk) and emerging fisheries species Quantifying bycatch and discards, and carrying out habitat surveys and studies to examine the impacts of fishing gear State of the art techniques used	

Source of support	Type of support / description	Eligibility criteria	Geography	Levels or extent of support	Period /time frame	Benefits	Issues / gaps
				scientific evidence gathering through industry, academic and governmental collaboration, with the intention to inform decision making around a truly sustainable future for Welsh fisheries.		to understand exploitation of the island's fisheries resources and management improvements	
Centre for Sustainable Aquatic Research (CSAR) (Swansea University)	Research and training Research and technological development, and provides training and advice on behalf of commercial farmers/aquaculture service providers, funding agencies and governmental institutions	N/A	UK and international (based in Swansea)	In addition to own experimental facilities, CSAR has direct access to comprehensive expertise and labs across Swansea University, encompassing biochemistry, molecular biology, water chemistry etc.	Smartaqua project running 2018-2022	State of the art, control environment facilities enabling applied research on a diverse range of aquatic organisms (from temperate to tropical and marine to freshwater environments) Supports undergraduate	

Source of support	Type of support / description	Eligibility criteria	Geography	Levels or extent of support	Period /time frame	Benefits	Issues / gaps
				Recent £1.4 million EU funding boost for project (Smartaqua) aimed at growing Welsh businesses in the aquaculture sector		and MSc research projects, as well as a vibrant postgraduate research programme in Aquaculture and Fisheries (MRes, PhD) Offers provisions for vocational training and internships and placements for university and industry Environment for technological research advancements, i.e. keyhole surgery innovation improving lumpfish welfare and production techniques	

Source of support	Type of support / description	Eligibility criteria	Geography	Levels or extent of support	Period /time frame	Benefits	Issues / gaps
Aquaculture Hub for Innovation (Stirling & Clackmannanshire City Region Deal)	Research and development Aquaculture Hub for Innovation creating research and development opportunities, as part of Innovation commitments within the Heads of Terms Agreement for Stirling & Clackmannanshire City Region Deal The Hub will be unique in Scotland and the UK and will operate four aquatic research facilities which, between them, will provide the full range of marine environmental conditions	N/A	Stirling and Clackmannanshire	The UK Government will invest up to £17 million to build the Aquaculture Hub for Innovation facility, with regional partners matching this with £15 million	City Region Deal covering the period of the next 10 to 15 years	Unique facility in Scotland and the UK Creation of research and development opportunities Secure jobs in the region Secure an economic contribution to the region Collaboration with the existing Scottish Aquaculture Innovation Centre, part of the national network of Innovation Centres supported by the Scottish Government	

Source of support	Type of support / description	Eligibility criteria	Geography	Levels or extent of support	Period /time frame	Benefits	Issues / gaps
Aquaculture, marine science & fisheries proposals (Argyll Rural Growth Deal)	Investment Contained within proposed Argyll Rural Growth Deal: Investment in critical infrastructure to accelerate growth in local marine industries in Argyll Investment in development of scientific techniques, technologies and expertise to support the sustainable production of food in aquatic environments, and the delivery of a new aquaculture business incubator hub at Machrihanish in Kintyre	N/A	Argyll	Argyll as a nature aquaculture hub, estimated costs around £10 million Business cluster innovation in aquaculture, estimated costs around £6.5 million Business cluster innovation in marine science, estimated costs around £7 million	In development	Critical infrastructure investment unlocking land-based sites and significantly increasing production capacity in Argyll, encouraging innovation in the industry, adding value to products and supporting development of supply chain Development of innovative scientific techniques, technologies and expertise to support sustainable production of food and aquatic environments	In development therefore proposals and funding opportunities are uncertain and liable to change

Source of support	Type of support / description	Eligibility criteria	Geography	Levels or extent of support	Period /time frame	Benefits	Issues / gaps
	Construction of a new state of the art industry training centre and a cluster development fund as part of a wider investment package in the European Marine Science Park					Creation of strong ties with industry through the development of Machrihanish Airbase as a centre of excellence for aquaculture Development of specialist skills among workforce in the region Retaining and attracting an increased working age population through extending educational opportunities Improving marine science industry practice	

Source of support	Type of support / description	Eligibility criteria	Geography	Levels or extent of support	Period /time frame	Benefits	Issues / gaps
						Marine science developments consistent with key recommendations of the MAXiMAR Science and Innovation Audit, particularly the creation of multi-sector clusters of marine energy, biotech and aquaculture organisations resulting in significantly increased growth rates for the marine sector	
Tidal Lagoon (Swansea Bay City Deal)	Investment Technological innovation and job creation through new plans for a tidal lagoon as	N/A	Swansea	The Dragon Energy Island proposal is closely aligned with the Homes as Power Stations project	Construction could start in 2021, with the Dragon Energy Island potentially operational by	Could lead to the creation of thousands of jobs Potential to make significant	Welsh Government looking to fund the project following the UK Government's decision to move

Source of support	Type of support / description	Eligibility criteria	Geography	Levels or extent of support	Period /time frame	Benefits	Issues / gaps
	part of a major renewable energy development in Swansea Bay The lagoon would form part of a new Dragon Energy Island off the Swansea coast, with floating modular homes development, underwater date centre, solar farm and the production of pure hydrogen and pure oxygen on site for storage or sale. Giant underwater turbines would also feature as part of the proposal, helping to power homes across the region and beyond.			due to be part-funded by the £1.3 billion Swansea Bay City Deal	the end of 2026	savings of up to 30% on the project Potential for a public procurement arrangement which could see councils and other public sector organisations buying electricity directly from the energy island Investment in the development of technology to address renewable energy targets and generate clean, green power for generations to come	ahead in June 2018

Source of support	Type of support / description	Eligibility criteria	Geography	Levels or extent of support	Period /time frame	Benefits	Issues / gaps
Dorset LEP: High Potential Opportunity in Aquaculture	Investment Department for International Trade (DIT) has identified Dorset as a High Potential Opportunity for inward investment in aquaculture.	N/A	Dorset and South West England			Regional water quality is excellent with significant potential for the sector to expand at sea and on land County is home to Cefas, world leader in marine science and technology Strong logistics network with nearby airport, road, rail and port links Strong marine and aquaculture skills pipeline in Dorset and wider South West (Unis of Exeter, Plymouth, Bournemouth	

Source of support	Type of support / description	Eligibility criteria	Geography	Levels or extent of support	Period /time frame	Benefits	Issues / gaps
						and Sparsholt College) Highly consolidated supply chain in the region	

1.14.8 Sources

- http://fisheries-conservation.bangor.ac.uk/index.php.en
- http://news.hie.co.uk/all-news/aquaculture-supply-firms-urged-to-apply-to-innovation-fund/
- http://seafoodacademy.org/
- http://ukmajorports.org.uk/about/about-us/
- http://wfa-cpc.wales/about-wfa-cpc
- http://www.eventscotland.org/funding/year-of-coasts-and-waters-2020/
- http://www.scoregrants.co.uk/
- http://www.waterloofoundation.org.uk/EnvironmentMarine.html
- https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/683603/CCF_Guidance_Notes.pdf
- https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/713699/Stirling_City_Region_Deal_-_2018_06_04_-_HOTA_MASTER.pdf
- https://ec.europa.eu/easme/en/life
- https://ec.europa.eu/fisheries/cfp/emff_en
- https://ec.europa.eu/programmes/horizon2020/
- https://fundingfish.eu/
- https://gov.wales/european-maritime-fisheries-fund
- https://grimsbyfishnearyou.co.uk/fma

- https://irelandwales.eu/
- https://northsearegion.eu
- https://ore.catapult.org.uk/
- https://publications.parliament.uk/pa/ld201719/ldselect/ldseaside/320/32009.htm
- https://thefishsite.com/articles/how-keyhole-surgery-is-improving-lumpfish-welfare-and-production-techniques
- https://water.europa.eu/marine
- https://www.argyll-bute.gov.uk/sites/default/files/Unknown/138022_text.pdf
- https://www.bbc.co.uk/news/uk-scotland-scotland-business-30400411
- https://www.britishmarine.co.uk/
- https://www.britishports.org.uk/about-us
- https://www.case-research.net/
- https://www.cefas.co.uk
- https://www.cefas.co.uk/media/201619/c-users-kb14-documents-qsr-2018-cefas-quinquennial-science-review-2018-final.pdf
- https://www.channelmanche.com/
- https://www.clientearth.org/eu-fund-proposal-would-artificially-keep-unsustainable-fisheries-afloat/
- https://www.crownestatescotland.com/about-us
- https://www.daera-ni.gov.uk/articles/european-maritime-fisheries-fund
- https://www.dorsetlep.co.uk/news-article/high-potential-opportunity-for-dorset-s-sustainable-aquaculture - and see presentation included within link
- https://www.energyvoice.com/otherenergy/192390/scot-gov-to-turn-the-tide-on-10m-marine-energy-scheme/
- https://www.fiscot.org
- https://www.gov.scot/policies/oil-and-gas/oil-and-gas-decommissioning/
- https://www.gov.scot/publications/saltire-tidal-energy-challenge-fund/pages/eligibility-criteria/
- https://www.gov.uk/business-finance-support/horizon-2020-business-grants-uk
- https://www.gov.uk/government/collections/coastal-communities
- https://www.gov.uk/government/publications/funding-for-uk-life-projects-if-theres-no-brexit-deal/funding-for-uk-life-projects-if-theres-no-brexit-deal
- https://www.gov.uk/government/publications/independent-science-review-of-cefas

- https://www.gov.uk/guidance/european-maritime-and-fisheries-fund-emff-before-you-apply
- https://www.gov.uk/guidance/uk-seafood-innovation-fund
- https://www.interreg2seas.eu/en/program
- https://www.marineenergywales.co.uk/
- https://www.masts.ac.uk/about
- https://www.msc.org/home
- https://www.nafc.uhi.ac.uk/about-us/
- https://www.noc.ac.uk/about-us
- https://www.organicauthority.com/buzz-news/why-is-the-marine-stewardship-council-in-deep-water-with-animal-rights-ngos
- https://www.rya.org.uk/about-us/charities-foundations/Pages/rya-foundation.aspx
- https://www.sailscotland.co.uk/about/
- https://www.scottishaquaculture.com/accelerating-aquaculture-innovation-aai/
- https://www.scottishaquaculture.com/apply-for-funding/
- https://www.scottish-enterprise.com/support-for-businesses/funding-and-grants/accessing-finance-and-attracting-investment/energy-investment-fund
- https://www.scottishseafoodassociation.com/about/
- https://www.seafarers.uk/helping-you/grant-funding/
- https://www.seafish.org/
- https://www.seafoodscotland.org
- https://www.srsl.com/
- https://www.swansea.ac.uk/bioscience/csar/
- https://www.swansea.ac.uk/press-office/news-archive/2018/14meuboostfornewaquacultureproject.php
- https://www.swansea.gov.uk/article/50669/Energy-Island-vision-for-new-tidal-lagoon-in-Swansea-Bay
- https://www.swanseabaycitydeal.wales/projects/homes-as-power-stations/
- https://www.thecrownestate.co.uk/en-gb/our-places/on-the-seabed/
- https://www.theguardian.com/environment/georgemonbiot/2013/nov/25/stealth-tax-north-sea-cod-seafish
- https://www.trinityhouse.co.uk/about-us
- https://www.uhi.ac.uk/en/research-enterprise/res-themes/mese/aquaculture/aief/#

- https://www.ukri.org/funding/funding-opportunities/strength-in-places-fund/
- https://www.visitscotland.org/supporting-your-business/funding/growth-fund
- https://www.waveenergyscotland.co.uk/
- https://www.welcomeurope.com/european-funds/life-814+714.html#tab=onglet_details
- https://www2.gov.scot/Topics/marine/grants-subsidies

Appendix 4: Consulted organisations

- Aberdeenshire Council
- Agri-Food and Biosciences Institute (AFBI)
- Association of Scottish Shellfish Growers
- Bangor Mussels Producers
- Bord Iascaigh Mhara/Cross Border Aquaculture Initiative
- British Association for Shooting and Conservation
- British Marine
- British Ports Association
- British Trout Association
- Clyde Fishermen's Association
- Comhairle nan Eilean Siar
- Cragen Llŷn a Môn
- Department for Environment, Food and Rural Affairs (DEFRA)
- Department for the Economy, Northern Ireland (DfE)
- Department of Agriculture, Environment and Rural Affairs, Northern Ireland (DAERA)
- Dŵr Cymru
- Fowey Shellfish
- Gael Force Fusion
- Grimsby Fish Market
- Highlands and Islands Enterprise
- Joint Nature Conservation Committee
- Keep Wales Tidy
- Llŷn Fishermen's Association
- Llŷn Pot Fishermen's Association
- Loughs Agency
- Marine Alliance for Science and Technology for Scotland (MASTS)
- Marine Conservation Society (MCS)
- Marine Energy Wales
- Marine Energy Wales
- Marine Scotland
- Mid & East Antrim Council
- National Federation of Fishermen's Organisations
- Natural Resources Wales
- Newry, Mourne and Down District Council

- North Eastern Lobster Fisherman's Co-operative Society (NELCO)
- Northern Ireland Fish Producers Organisation (NIFPO)
- Northern Ireland Fishery Harbour Authority (NIFHA)
- Northern Ireland Marine Taskforce
- Opportunity North East
- Orkney Fisheries Association
- Orkney Islands Council
- Pembrokeshire Coast National Park
- Pembrokeshire Coastal Forum
- Port of Milford Haven
- Pwllheli Partnership
- Royal Society for the Protection of Birds
- Royal Yachting Association
- Scottish Aquaculture Innovation Centre
- Scottish Fishermen's Federation
- Scottish Natural Heritage
- Scottish Salmon Producers Organisation
- Scottish Seaweed Industry Association
- Sea Source NI
- Seabed Users and Developers Group
- Seafish
- Seafood 2040 Aquaculture Leadership Group
- Seafood Industry Leadership Group (SILG)
- Seafood Scotland
- Severn Estuary Partnership
- Shellfish Association of Great Britain
- Shetland Fishermen's Association
- South & West Wales Fishing Communities
- South East Area Fisheries Local Action Group
- Ulster Wildlife
- Wales Environment Link
- Wales Marine Action and Advisory Group (WMAAG)
- Welsh Fishermen's Association – Cymdeithas Pysgotwyr Cymru (WFA-CPC)
- Welsh Government
- Welsh Marine Fisheries Advisory Group (WMFAG)
- West of Scotland Fish Producers' Organisation
- Wildlife Trust Wales

- Young’s Seafood
- Zoological Society of London