



Northern Ireland Fishing & Seafood Development Programme

Stage 2: Seafood & Port businesses

Final Report

January 2021

The
**Strategic
Investment
Board**



Department of
**Agriculture, Environment
and Rural Affairs**

www.daera-ni.gov.uk

Report Information

This report has been prepared for the Northern Ireland Department for Agriculture, Environment and Rural Affairs (DAERA). The views expressed in this study are purely those of the author and do not necessarily reflect the views of DAERA, nor in any way anticipates their future policy in this area. The content of this report may not be reproduced, or even part thereof, without explicit reference to the source.

Citation: Cappell R. (2021). Fishing & Seafood Development Programme Stage 2: Seafood & Port Businesses. Final Report. Strategic Investment Board.

Client: DAERA, NI

Version: Final

Report ref: 1530/R/03/A

Date issued: January 2021

Photo credit: EU MSP Platform, R. Cappell

Acknowledgements:

Our thanks the members of the project steering committee, the stakeholder consultative group and all those that have engaged with this work.

CONTENTS

Executive Summary

1.	INTRODUCTION.....	1
1.1	THE FSDP.....	1
1.2	STAGE 1 SUMMARY	1
1.3	STAGE 2 WORK.....	2
1.4	RECENT DEVELOPMENTS.....	2
1.5	NEXT STEPS	5
2.	SEAFOOD PROCESSING AND MARKETS.....	6
2.1	THE NI SEAFOOD PROCESSING SECTOR.....	6
2.2	CURRENT SUPPLY CHAINS	7
2.3	FUTURE MARKETS.....	16
2.4	CURRENT AND FUTURE BUSINESS NEEDS	18
2.5	SUMMARY.....	21
3.	ANCILLARY SECTORS	22
3.1	FLEET SUPPLIES	22
3.2	VESSEL SERVICES AND REPAIR.....	22
4.	OTHER PORT-BASED INDUSTRIES	26
4.1	CURRENT SECTORS	26
4.2	POTENTIAL SECTORS	28
5.	SOCIO-ECONOMIC CONTRIBUTION	34
5.1	PORT INTER-DEPENDENCIES	34
5.2	SOCIO-ECONOMICS OF THE NI SEAFOOD SECTOR AND NIFHA PORTS	34
5.3	COMPARATIVE CONTRIBUTIONS	40
5.4	ECONOMIC DEVELOPMENT POLICY	41
5.5	PORT DEVELOPMENT	42
6.	CONCLUSIONS & RECOMMENDATIONS	45
6.1	CONCLUSIONS	45
6.2	RECOMMENDATIONS	47
	APPENDIX A: REFERENCES	48
	APPENDIX B: NIFHA FISHING PORT MAPS.....	50
	APPENDIX C: MARINE RENEWABLE ENERGY IN THE IRISH SEA	53
	APPENDIX D: BLUE BIOTECH PROJECTS	55
	APPENDIX E: FUTURE FUELS.....	59
	APPENDIX F: SOCIO-ECONOMICS OF NI SEAFOOD SECTOR AND NIFHA PORTS.....	60

TABLES

TABLE 1 APPROVED FOOD HANDLING ESTABLISHMENTS IN NI LISTING FISH AS PRODUCT TYPE.....	6
TABLE 2 UK EXPORTS OF KEY SEAFOOD PRODUCTS TO THE EU AND CONTRIBUTION BY NI LANDINGS*.....	10
TABLE 3 SERVICE SECTOR RELIANCE ON LOCAL FLEET AND PORT INFRASTRUCTURE.....	24
TABLE 4 SOCIO-ECONOMICS OF THE NI SEAFOOD SECTOR AND NIFHA PORTS.....	36
TABLE 5 WAY FORWARD FOR THE BLUE BIOECONOMY	55
TABLE 6 SOCIO-ECONOMICS OF THE NI FISHING FLEET PER PORT	62

FIGURES

FIGURE 1 FSDP & PROGRAMME IMPLEMENTATION PROCESS.....	5
FIGURE 2 TOTAL VALUE OF NORTHERN IRELAND'S SEAFOOD EXPORTS AND IMPORTS (£)*	8
FIGURE 3 NORTHERN IRELAND SEAFOOD EXPORTS IN 2019	9
FIGURE 4 NORTHERN IRELAND SEAFOOD IMPORTS IN 2019	9
FIGURE 5 OVERVIEW OF UK NEPHROPS EXPORTS 2008-2017	11
FIGURE 6 HOUSEHOLD EXPENDITURE ON FISHERY & AQUACULTURE PRODUCTS IN EU MEMBER STATES	17
FIGURE 7 SLIPWAYS IN USE AT KILKEEL HARBOUR.....	24
FIGURE 8 THE INCREDIBLE FISH VALUE MACHINE	29
FIGURE 9 MINESTO OCEAN ENERGY R&D PLATFORM, STRANGFORD LOUGH	31
FIGURE 10 NEW HAMPSHIRE OPEN OCEAN AQUACULTURE SITE	33
FIGURE 11 CONNECTIVITY WITH CURRENT AND POTENTIAL PORT-BASED ENTERPRISES	34
FIGURE 12 ECONOMIC IMPACT ASSESSMENT	35
FIGURE 13 TURNOVER PER SEAFOOD SECTOR PER PORT (%)	39
FIGURE 14 EMPLOYMENT PER SEAFOOD SECTOR PER PORT (FTE)	39
FIGURE 15 SATELLITE VIEW OF KILKEEL HARBOUR AND SURROUNDING LAND	43
FIGURE 16. ARDGLASS HARBOUR AREA, SOURCE: NIFHA.....	50
FIGURE 17 KILKEEL HARBOUR AREA. SOURCE: NIFHA	50
FIGURE 18 PORTAVOGIE HARBOUR AREA. SOURCE: NIFHA	52
FIGURE 19 OFFSHORE WIND FARM DEVELOPMENTS IN THE IRISH SEA.....	53
FIGURE 20 OFFSHORE AND ONSHORE COMPONENTS OF ARKLOW OFFSHORE WIND FARM.....	54
FIGURE 21 GWYNT Y MOR OMF AT PORT OF MOSTYN & WIND FARM LOCATIONS	54

Abbreviations

ANDBC	Ards & North Down Borough Council
ADG	Ardglass Development Group
AFBI	Agri-Food Biosciences Institute
ANIFPO	Anglo-North Irish Fish Producers Organisation
CFP	Common Fisheries Policy
CMG	Crab & Lobster Management Group
DAERA	Department for Agriculture, Environment & Rural Affairs (NI)
Defra	Department for Environment, Food and Rural Affairs (UK)
DfE	Department for the Economy
ERC	Enterprise Research Centre (Queen's University Belfast)
EU	European Union
FSDP	Fishing & Seafood Development Programme
FTE	Full Time Equivalent
GHG	Greenhouse Gases
GVA	Gross Added Value
ICES	International Council for the Exploration of the Sea
ICT	Information Communication Technology
IPCC	Intergovernmental Panel on Climate Change
KSP	Kilkeel Strategic Partnership
LDP	Local Development Plan
LTMP	Long Term Management Plan
LWE	Live Weight Equivalent
NICHE	Nutrition Innovation Centre for Food and Health
NIFHA	Northern Ireland Fishery Harbour Authority
NIFPO	Northern Ireland Fish Producers Organisation
NIGEAE	Northern Ireland Guide to Expenditure Appraisal and Evaluation
NISRA	Northern Ireland Statistics and Research Agency
NMDDC	Newry Mourne & Down District Council
NPV	Net Present Value
OMF	Operations and Maintenance Facility
PO	Producer Organisation
QUB	Queens University Belfast
RAS	Recirculating Aquaculture Systems
R&D	Research and Development
ROI	Republic of Ireland
SICG	Scallop Industry Consultation Group
SNIAC	Seafish Northern Ireland Advisory Committee
TAC	Total Allowable Catch

TEV.....Total Economic Value

UK.....United Kingdom

UUEPCUlster University Economic Policy Centre

Definitions

Full Time Equivalent (FTE) DAERA's Food & Drink Processing Report (DAERA, 2020) defines this as working a minimum of 30 hours/week

Net Present Value (NPV) The NPV is the sum of the discounted benefits of an option less the sum of its discounted costs, all discounted to the same base date. NPV is the key summary indicator of the comparative value of an option.

Value Added (VA) Calculated by deducting all of the 'inputs', which are the 'outputs' of other industries, from gross turnover. It is equal to the sum of the wages and salaries, depreciation, net profit and interest paid in the subsector

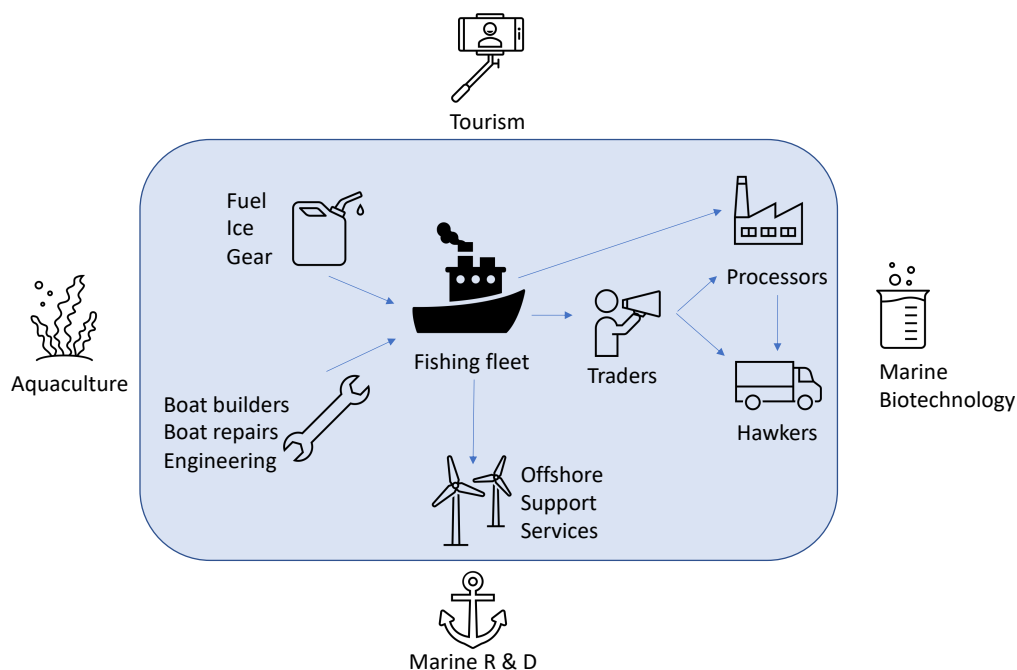
Executive Summary

Background

The Fishing and Seafood Development Programme (FSDP) is established in response to calls from the Northern Ireland (NI) fishing industry to make significant investments in fishing harbour infrastructure. The FSDP will review the opportunities for developing the sea fishing and seafood sectors in NI as a whole, including the potential role of new public investment in infrastructure, and will make recommendations to the Departments. This requires a long-term view (25+ years) as port infrastructure is intended to have a long life span.

The Stage 1 FSDP report focused on the current and future needs of Northern Ireland’s fishing industry. This Stage 2 report focuses on seafood and port-based business (**Figure A**) at the three fishing ports of Ardglass, Kilkeel and Portavogie. Together these reports, along with an assessment of the UK/EU Fisheries Agreement and NI protocol, provide the evidence base for the FSDP and an Outline Business Case for the programme. This will enable a ministerial decision to be made and, if favourable, infrastructure investment to progress.

Figure A Current and potential port-based enterprises



Socio-economic Contribution

The total estimated direct impact from fishing and seafood processing in Northern Ireland comes from 341 enterprises with a turnover of £135m (£90m processing, £45m fishing), 1,550 FTE jobs (905 in fishing and 645 in processing) and an estimated GVA of £55.5million. Three quarters of this comes from enterprises located at and around the three NIFHA fishing ports.

Nearly 400 companies contribute £169.5million in turnover, 1,820 FTE jobs and £67.3m in GVA to the seafood and fishing port economies. These figures illustrate the regional economic and social importance of the NIFHA ports to the seafood sector and the communities they support.

Seafood processing

In 2018 the fish processing sector accounted for 2% of Northern Ireland's food and drinks processing sector with an estimated turnover of £90million (DAERA, 2020). It employs around 700 people, with the great majority of enterprises located at or near the NIFHA ports.

There is substantial trade between NI & GB (imports that reflect consumer preferences for the 'big five': salmon, tuna, cod, haddock and warm water prawns) and exports of landed shellfish. In addition to this intra-UK trade, Northern Ireland exported £61.7m of seafood in 2019 (mostly to the EU) and imported around half that (£31.1m).

NI's contribution to UK scampi production and langoustine exports is considerable, both from direct landings and from raw material coming into NI processors from the rest of the UK and Ireland. Nephrops remains Northern Ireland's most important fishery, accounting for 51% (£16m) of landed value in 2019. The scampi processing sector has seen growth following a period of consolidation, with the largest processor continuing to invest in Kilkeel as its centre for UK scampi production as expansion at its premises was possible and, most importantly, Kilkeel offered a skilled local workforce.

Growth in other seafood processing sub-sectors is constrained by the ability of NI processors to compete for available raw material. New local raw material sources could emerge in the short term with recovery of Irish Sea whitefish stocks, specifically haddock, and in the long-term through the development of the aquaculture sector in Northern Ireland.

Consumer trends indicate that there will be increasing demand for the seafood landed into NI ports from continental Europe's higher spending seafood consumers and emerging markets such as Asia, that have the volume of consumers willing to pay a premium for high value seafood products. A focus on quality for NI's key shellfish products is consistent with a growing interest in provenance, linked to responsible sourcing. Northern Ireland producers should be able to capitalise on this interest with supply chains that involve relatively short distances and few transactions.

NI processors face other common issues including labour (costs and availability) and waste. In the long-term labour challenges, particularly for the prawn fleet, should be addressed through automation, which is actively being explored by some processors and such innovations should be supported.

On waste, economies of scale are difficult to achieve with varied waste streams, but the relatively close proximity of most processing facilities around the NIFHA ports creates the potential for a collective approach to increasing value from by-products. Moving towards a circular economy should link with and underpin the development of NI's marine biotechnology sector in using seafood by-products.

Ancillary sector

The ancillary sector (businesses that supply goods and services to the fishing fleet) is present at all three NIFHA ports, with Kilkeel home to a cluster of engineering businesses that provide vessel services and repair. The availability of maintenance and repair facilities for the fishing fleet around the Irish Sea is limited and Kilkeel could build on its reputation for good quality work at a reasonable cost. However the companies making up this cluster in Kilkeel identify the port's infrastructure as most significant constraint to growth. The availability of slipway space and space adjacent to the slipways limits the number of vessels that can be serviced at any one time. With the trend towards larger vessels for both fishing fleets and guard vessels, the physical limitations of the slipways will increasingly limit the potential market available to the vessel services sector.

Other port-based industries

Offshore developments (e.g. wind farms, pipelines, cables, and potentially aquaculture) require vessel services and port-based facilities. Offshore vessel service companies have grown from being a provider of useful additional income to the NI fishing fleet, to a sector in its own right providing services and expertise well beyond the Irish Sea. Invest NI has identified that with future offshore renewable developments and its established track record, the NI sector could double over the coming years to more than £20m per annum. Given the growth in guard vessel services, the NIFHA ports could also be promoted to Irish Sea developers as locations operation and maintenance facilities. As with the fishing fleet, harbour capacity restricts the size of vessels that these companies would ideally invest in for guard work. Larger vessels can be deployed further offshore, in more challenging conditions, for longer periods and have more space for crew comfort, which is important for contracts lasting several weeks.

Other potential sectors requiring port infrastructure and services

The economic sectors within the blue economy present many future opportunities. Potential sectors include tourism, aquaculture, marine biotechnology and other maritime training and R&D. Balancing the interests and needs of tourism with working ports is notoriously difficult to achieve, but port investment plans should recognize the benefits from tourism and ensure adequate visitor provision. Aquaculture demand for port infrastructure is most likely to come from the development of offshore aquaculture (stand-alone sites or co-located within wind farms), requiring servicing by vessels and port-based operations and maintenance facilities in much the same way as offshore energy. Marine biotechnology, training and R&D associated with the ports is likely to emerge from linkages with commercial partners, e.g. processors seeking solutions to waste streams or the vessel services cluster seeking targeted training. Workspace and support for business incubators (as seen with Iceland's Ocean Cluster) would help to kick-start these sectors in the NIFHA ports.

Port Capacity

NIFHA ports require sufficient port capacity and land-side space to enable the private sector to take up future opportunities in the Blue Economy. A cluster of seafood processing and vessel services is already evident at Kilkeel, which accounts for the majority of turnover and employment, but is limited by port capacity. The port capacity needs of the boat repair and offshore services are consistent with the fishing sector, namely increased accessibility and water depth to accommodate larger vessels. More land is required adjacent to Kilkeel harbour for current enterprises to grow and for new sectors to establish.

The future needs of current and potential port-based businesses are difficult to specify, but a lack of space in Kilkeel and multiple ownership of Ardglass harbour properties are clear constraints to future development.

Recommendations

1. Include the specification of boat repair infrastructure (boat lifting and transfer) in the ToR for the Kilkeel Harbour Outline Design and Cost work to be commissioned.
 2. NIFHA should look to acquire land adjacent to Kilkeel harbour and properties within Ardglass harbour for future development of the harbour estates.
 3. The technical studies should include port master-planning to ensure the needs of current and potential port-based sectors are given due consideration.
-

1. Introduction

1.1 The FSDP

The Fishing and Seafood Development Programme (FSDP) was established by DAERA in response to calls from the Northern Ireland (NI) fishing industry to make significant investments in fishing harbour infrastructure.

Before embarking on significant capital infrastructure investment, DAERA recognised a need to carry out a strategic programme of work to explore the challenges and opportunities facing the NI fishing and seafood sectors. This work will help to shape long term plans to develop the Northern Ireland fishing and seafood sectors, including its infrastructure and enable the sectors to realise their full potential. A long-term view is needed for the FSDP as port infrastructure is intended to have a long life span¹.

The overall purpose of the Programme is to provide a substantive evidence base for the long-term planning of sea fishing and seafood development, including, catching and processing sectors, and associated infrastructure investment, taking account of the UK's transition into an independent coastal state. The output of the FSDP will provide a sound basis for future decisions to be taken by NI Ministers.

1.2 Stage 1 summary

Stage 1 focused on the needs and development opportunities of Northern Ireland's fishing fleet. It found that the fleet is ageing compared to elsewhere in the UK. It consists of about 140 over 10m vessels (most are demersal trawlers fishing for Nephrops and some whitefish along with scallop dredging); around 200 inshore vessels fishing crab & lobster; and a modern pelagic fleet of three large vessels over 50m in length fishing for mackerel, herring and other small pelagic species.

The last 10 years has seen a slight reduction in demersal fleet capacity with fewer, but relatively larger and more powerful vessels, and growth in pelagic fleet capacity with upgrades to the three pelagic vessels. New demersal vessels are getting larger and deeper to make them more efficient (in terms of fuel, fishing and catch handling); less weather dependent (more able to operate in adverse weather); and more comfortable (important for attracting and retaining crew). Many of the new vessels entering demersal fleets elsewhere, such as Scotland (traditionally the main second-hand market for NI), would face too many operational constraints to fish from NI's fishing ports of Ardglass, Kilkeel and Portavogie. Without suitable replacements, NI's demersal fleet would become relatively less efficient and so less competitive than other demersal fleets.

The modern, three-vessel pelagic fleet is highly profitable: it has seen multimillion-pound investment and has no problem attracting and retaining local crew. These new vessels are already too large for the NIFHA ports. The rest of the fleet (demersal and inshore) has mostly consolidated into the 3 NIFHA fishing ports: Ardglass and Portavogie (both showing recent reductions in the over 10m fleet and increases in the inshore fleet) and Kilkeel (a stable over 10m fleet in recent years, but some reduction in inshore vessel numbers). The fleet sector facing the most significant operational constraints due to port capacity in the NIFHA ports is the demersal fleet. The largest fleet is based in Kilkeel which faces the greatest operational constraints.

¹ The Northern Ireland Guide to Expenditure Appraisal and Evaluation (NIGEAE) suggests at least a 25 year evaluation period, while HM Treasury Greenbook suggests that up to 60 years may be appropriate for such long-term infrastructure.

DAERA noted in its response to the Stage 1 report, “our fishery harbours, which have served us well in times past, may now be limiting fleet development as average vessel size in UK is increasing. Over time this could lead to the fishing fleet becoming less competitive if vessel owners feel they can’t invest in larger and generally more profitable vessels.”

1.3 Stage 2 work

Stage 2 of the FSDP, conducted between October and December 2020, considers Northern Ireland’s seafood sector (the businesses trading and processing fish landed into NI and from further afield), as well as the other port-based businesses, most with a direct connection to fishing. This involved interviews with port-based stakeholders and public agencies (conducted remotely due to COVID-19 restrictions); online research and business tracking; and socio-economic analysis.

1.4 Recent developments

The world has changed since the Stage 1 report was completed in early 2020. Below we explore some of the known and expected impacts of recent developments. The twin effects of Brexit and COVID-19 are ongoing. It remains unknown what impacts will be short-term social and economic shocks that we may recover from or the extent to which they have created or accelerated changes that will continue over the long-term. And that uncertainty is expected to continue. The coming year [2021] promises to be particularly unpredictable, given the interactions between the pandemic, an uneven economic recovery, and fractious geopolitics².

1.4.1 COVID-19

COVID-19 has had a huge impact on people’s lives and the economy. For Northern Ireland, still lagging behind in the UK’s recovery from the 2008-2009 financial crisis and subsequent recession, the economic impact of COVID-19 is severe. The Northern Ireland Statistics and Research Agency (NISRA) reports that to date the reduction in economic output (-17.8% to end of Q2 2020)³, which is still to take into account the ongoing restrictions in Q4 and into 2021. The economy continues to be supported to an unprecedented extent by UK government and NI Executive support schemes, cushioning the economy and wider society from the full impact of such a huge economic downturn.

The scale of economic impacts is expected to differ between districts based on their dependence on certain sectors. In Newry, Mourne and Down (which contains Ardglass and Kilkeel ports), 34.5%, are estimated to have been furloughed and laid off⁴. This is higher than the NI average of 32% and Ulster University’s Economic Policy Centre reports that ‘Mourne and Down had higher than average employee concentrations in three of the five most vulnerable sectors (UUEPC, 2020⁵).

The number of foreign-owned businesses in Northern Ireland is 2.5%, but these account for 23.6% of NI jobs⁶. As noted in NMDDC’s Regeneration & Economic Development Strategy published in 2020 “The importance of one large employer can be summed up by the example of the airplane seat manufacturer Rockwell Collins which is based in Kilkeel in the Mournes DEA and employs around 800 people.” (NMDDC, 2020). However, COVID-19 had immediate knock-on impacts for the aircraft sector, forcing that employer [now part of the US-based Collins Aerospace] to lay off 235 staff in 2020 with future redundancies at the Kilkeel site a real possibility. This illustrates the risk to local economies of a

² ‘The World in 2021’ Tom Standage, The Economist, accessed 30/11/20

³ NISRA, 2020 <https://www.nisra.gov.uk/system/files/statistics/NI-Composite-Economic-Index-Q2-2020.pdf>

⁴ NMDDC, 2020 Regeneration and Economic Development Strategy 2020-2025.

⁵ https://www.ulster.ac.uk/data/assets/pdf/file/0009/659574/UUEPC-Covid-Business-Impacts_Summary-Report_Final_25092020.pdf

⁶ NISRA, 2020 <https://www.nisra.gov.uk/system/files/statistics/NI-Composite-Economic-Index-Q2-2020.pdf>

reliance on one large employer, particularly where that employer is part of an international group that has no historic connection with a location.

COVID-19 has had significant and lasting impacts on the food economy in general and the seafood sector in particular in terms of production, supply and demand:

- Demand for fish drastically altered as the Hotel, Restaurant and Catering (Horeca) sector closed throughout Europe during lockdowns, with re-opening subject to various constraints.
- Consumer patterns relating to fresh fish changed: a growth in retail seafood sales due to more consumption at home; growth in direct sales from local landings and consumers buying more pre-packed, processed seafood.
- Logistics challenges of getting supplies to markets and major disruptions to export markets. Some have created alternative markets to get fish to the table, such as support for online buying and home delivery at local and regional levels. Some of these new channels have remained with the easing of lockdowns, while others re-established existing supply chains as soon as possible.
- Changing labour availability as some migrant workers return home during the crisis and demand for labour altered as production patterns were impacted.
- Ongoing sanitary challenges to operate in a 'COVID-compliant' way within working environments.

The impacts on the supply and demand of the main seafood products landed and produced in Northern Ireland are described in more detail in section 2.2.

The ICES Working Group, WG Social, identified that some intrinsic characteristics of the seafood sector could make the impacts due to the crisis more significant. For example, workers in low pay sectors such as seafood processing would be less resilient to shocks such as temporary stops in production⁷.

Seafood operators continue to be faced with the multiple challenges of ensuring their businesses remain economically viable and can function safely during the ongoing pandemic in what can be unique working conditions. As we enter a 'second phase' of what has been the most challenging trading environment most commercial operators have ever seen, they are faced with continued uncertainty due to COVID-19, as well as the implications of the UK leaving the EU.

The Economic Policy Centre at Ulster University (UUEPC) identifies that one of a number of critical 'recovery actions' is to 'Accelerate government investment plans', noting that 'all forecasts suggest a reduction in private sector investment and spending, at least in the short term, and this creates a role for Government to take advantage of the spare capacity to undertake necessary public infrastructure investment. This could include fast-tracking current investment plans (and particularly smaller ones which can have greatest local impact) and providing an investment pipeline to provide certainty to the construction sector.'⁸

⁷ ICES Reflections Webinar on COVID-19 Impacts, 16th September 2020

⁸ Magennis et al (2020) Pathways to Recovery after Covid19, UUEPC August 2020.

https://www.ulster.ac.uk/_data/assets/pdf_file/0017/614132/UUEPC-Pathways-to-Recovery-after-Covid19-Paper-3-05082020.pdf

The above evidence suggests that the impact of COVID-19 could hit the local economies associated with NI's fishing ports particularly hard, making the contribution of NI's fishing and seafood businesses to local economies all the more important.

1.4.2 Brexit

The transition period finished at the end of 2020. At the time of writing, arrangements under the NI protocol have been clarified, but await implementation, and negotiations are continuing around several critical matters to the NI fishing and seafood sectors, such as the trade in goods, access to UK fishing waters and the proportion of shared stocks allocated to the UK as an independent coastal state.

The seafood industry, which is highly reliant on EU export markets, has explored the impact that moving to trade under World Trade Organisation (WTO) conditions would mean. For UK shellfish exporters, which includes the great majority of NI traders and processors, 'the relevant EU external tariff charge for these species of shellfish ranges from 7.5% to 12%, depending on the species and product format. Feedback from shellfish exporters suggests that this additional cost could be offset by market price fluctuations, advantageous exchange rate shifts or increased domestic landings, however, higher costs might have to be absorbed by the supply chain rather than the customer' (Seafish, 2020)⁹.

1.4.3 Other policy developments

While COVID-19 and Brexit have inevitably dominated 2020 and dictated public sector activities, some other policy areas have progressed. Notably, the pressing need to tackle climate change has accelerated some government policy in this area. DAERA's Northern Ireland Climate Change Adaptation Programme¹⁰ was published in September 2019. The fishing ports under DAERA through the NIFHA are not mentioned explicitly in the report. It does, however state in relation to 'Infrastructure Services', one of five priority areas, that 'adaptation to climate change under this key priority area requires two forms of response: dealing with the long-term effects on infrastructure such as rising sea levels, and also developing resilience to acute and extreme weather events such as flash flooding.'

Land-based transport has seen the rapid development of electric power and its take-up is being incentivised by government policy. Northern Ireland's public transport has also seen recent investments in hydrogen with buses to be fuelled by Antrim wind farms¹¹. The B9 Power to X project, based in Belfast Harbour, is a demonstrator project linking surplus renewable energy supply sources with various demand sources via the electrolysis of water¹². As part of this NI water has set up an electrolyser project producing hydrogen for fuel and oxygen for enhanced water treatment¹³. These projects are consistent with Northern Ireland's energy strategy, expected to be finalised in 2021, which will aim for net-zero Carbon by 2050¹⁴.

In June 2020, the Minister announced that DAERA is to implement a Green Growth Strategy and Delivery Framework. The aim of 'Green Growth' is to 'ensure the sustainability of Northern Ireland's natural environment into the heart of future Executive policies while fostering the necessary conditions for innovation, investment and competition that can give rise to new sources of economic growth, while building resilient ecosystems'¹⁵.

⁹ <https://www.seafish.org/insight-and-research/market-supply-data-and-insight/seafood-trade-and-brexit/>

¹⁰ <https://www.daera-ni.gov.uk/publications/northern-ireland-climate-change-adaptation-programme-2019-2024>

¹¹ <https://smartbelfast.city/story/translink-hydrogen-buses/>

¹² <http://www.power-to-x.co.uk/>

¹³ <https://www.niwater.com/news-detail/11886/hydrogenius/>

¹⁴ <https://www.economy-ni.gov.uk/articles/northern-ireland-energy-strategy-2050>

¹⁵ <https://www.daera-ni.gov.uk/news/poos-plans-green-growth-approach-ni#:~:text=The%20aim%20of%20'Green%20Growth,growth%2C%20while%20building%20resilient%20ecosystems>

At a district level, Newry Mourne and Down District Council (NMDDC), including the NIFHA ports of Kilkeel and Ardglass, published its Regeneration and Economic Development Strategy 2020-2025. It was revised to address the short-term support needs resulting from COVID-19, alongside ongoing needs for businesses in the region. Ards and North Down Borough Council (ANDBC), including the NIFHA port of Portavogie, produced an Integrated Strategy for 2018-2030 on 'Tourism, Regeneration and Economic Development entitled 'Blue-Green: Creatively Connected'¹⁶. These strategies have informed the production of Local Development Plans (LDPs), including preferred options for land use, and are considered in more detail in section 5.4 of this report.

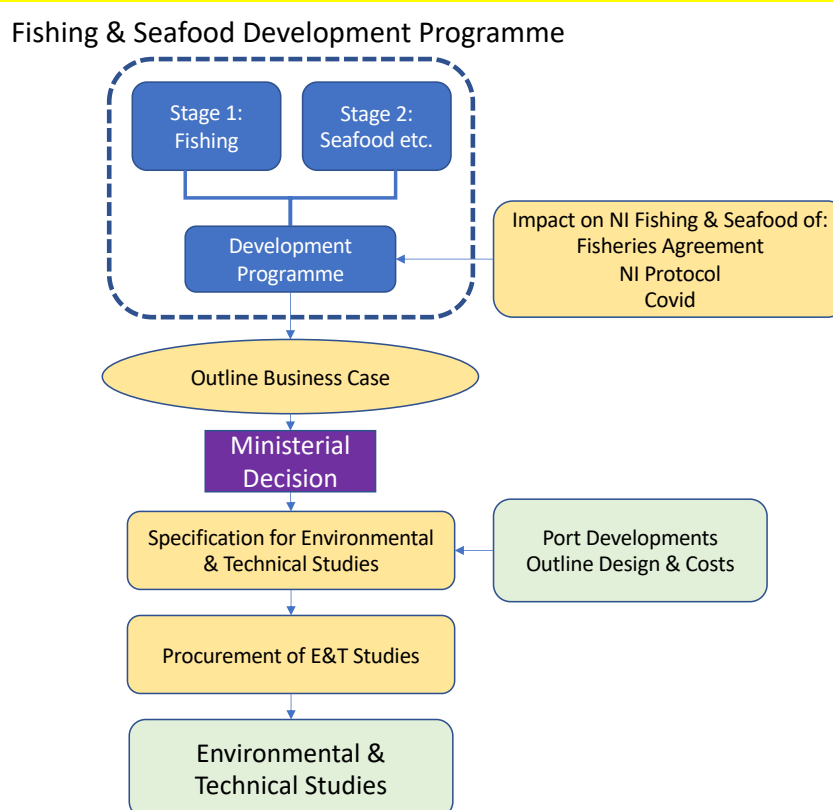
NI Policy developments in 2020 show an intent to support infrastructure investment to enhance Northern Ireland's economic output, recognising the need to address climate change through decarbonization of the economy and by ensuring that infrastructure is resilient to its effects. These are particularly important aspects when considering port infrastructure with its coastal location and long-term nature of investments.

1.5 Next steps

Figure 1 illustrates the expected next steps for the FSDP and the approval process required prior to the substantial public sector investment anticipated.

The FSDP final report, presenting the proposed development programme based on the findings of Stage 1 and Stage 2, will be drafted when the final arrangements for the UK exiting the EU are confirmed and DAERA can assess the implications for Northern Ireland's fishing and seafood sectors.

Figure 1 FSDP & programme implementation process



¹⁶ <https://www.ardsandnorthdown.gov.uk/business/integrated-strategy-2018-2030>

2. Seafood processing and markets

2.1 The NI seafood processing sector

In 2018 Northern Ireland's Food & Drinks processing sector was estimated to have a turnover of £5.2 billion, of which fish processing accounted for 2% with an estimated turnover of £90 million (DAERA, 2020). This latest data shows a 39% increase for fish processing over the last ten years and the total turnover is likely to be an underestimate for a sector that is dominated by micro-enterprises, as only firms with a turnover of £250,000 or more are included.¹⁷ The processor data presented by Seafish¹⁸ also under-represents Northern Ireland in survey returns as only 14 sites in NI are recorded for 2018.

To gain a more complete picture of the fish processing sector in Northern Ireland, this report used several data sets and information sources. To compile a comprehensive listing of fish handling and processing companies, irrespective of scale, the Food Standards Agency (FSA) data on licensed food handling premises was analysed (Table 1). This shows over 71 types of businesses handling seafood to some extent, with 21 fish processing companies and 16 wholesalers and dispatch centres. Sixty-eight percent of these are within five miles of the three NIFHA ports. There are a further 25 food processing businesses that process seafood to some extent. Thirty-seven percent of Northern Ireland's licensed fish handling and processing businesses are located around Kilkeel.

Table 1 Approved food handling establishments in NI listing fish as product type

Type	Total	Location (5 km radius)			
		Ardglass	Kilkeel	Portavogie	Other
Auction Hall	3	1	1	1	0
Fresh Fish Products Plant	8	0	5	0	3
Fresh Fish Processing Plant	21	4	6	6	5
Processing Plant	25	1	9	0	15
Dispatch Centre	8	2	2	2	2
Purification Centre	2	0	0	0	2
Others*	4	0	3	0	1
Total	71	8	26	9	28

* Wholesale market & three freezer vessels

Source: Food Standards Agency¹⁹

There has been significant consolidation in the NI processing sector in recent years, following an international trend to seek efficiencies and economies of scale, but it is evident that there are many small-scale traders doing their own processing still operating in Northern Ireland. A review of available company accounts for the companies listed in Table 1 shows only 16 of the listed a fish handling premises have a turnover over £250,000, indicating that a further 30 smaller seafood businesses are

¹⁷ In this report 'seafood buyers and traders' are considered as a separate post-harvest sector to processors in terms of their socio-economic contribution in section 5.2.

¹⁸ <https://www.seafish.org/insight-and-research/seafood-processing-data-and-insight/>

¹⁹ Establishments approved to handle, prepare or produce products of animal origin for which requirements are laid down in Regulation (EC) No 853/2004. As at November 2020. Database accessed 11/11/20
<https://data.gov.uk/dataset/2c80e0ce-ee1c-4f26-ba6f-1e1ae1bd8ee9/approved-food-establishments>

not included in the figures resulting in an underestimate of turnover and employment in the post-harvest sector. Official figures report 633 employed in fish processing in 2018 and a review of available recent accounts gives a similar total of 645 employed (see section 5.2).

'Of the home nations, Northern Ireland had the highest proportion of British [sic] staff at 67%' (Seafish 2019²⁰). Interviews with NI seafood processing companies indicates that this varies substantially from just 15% to 95% of the workforce being EU workers. Those interviewed report strong staff retention, irrespective of nationality with many EU nationals resident in NI for ten years or more. They also indicated that for the most part employment levels were maintained during the COVID-19 crisis.

In terms of processor types, there are three pelagic processing plants (2 in Ardglass, 1 in Kilkeel); one remaining major scampi processor based in Kilkeel with several much smaller scale operators in Kilkeel and Portavogie, and several shellfish processors (mainly crab, scallop and whole langoustine) in Kilkeel. One of the shellfish processors also operates a depuration facility for its own cultured oyster production.

2.2 Current supply chains

Brexit has placed a renewed emphasis on domestic and international supply chains with NISRA analysing overall trade data to identify the current main trade routes for goods²¹. It highlights the importance of trade with GB, including exports by NI businesses with GB accounting for 52% of sales outside NI, ROI 18%, the rest of the EU 9% and the rest of the world 20%²².

In 2019 the UK exported £2bn worth of seafood, while it imported £3.5bn²³. However, in terms of trade with the EU, the UK is a net exporter with £1.4bn exported compared to £1.2bn in imports from the EU. Northern Ireland shows a similar 'seafood balance sheet' to the rest of the UK and Ireland. There is a mismatch between what is landed and what is consumed. Imports reflect consumer preferences for the 'big five': salmon, tuna, cod, haddock and warm water prawns. Scottish salmon is supplemented by Norwegian product imported directly or via Sweden (20% of the UK's EU imports is salmon from Sweden). Cod is imported from Iceland and other north Atlantic areas, while tuna and warm water prawns are mostly imported from outside the EU.

While not considered as exports or imports, for Northern Ireland, GB is the main seafood trade route. There is a flow of seafood in both directions as part of intra-UK trade. Fresh whitefish for distribution around Northern Ireland and Nephrops for NI processors are brought in from Scotland. While landings into NI of all species are shipped to buyers in GB. It is also important to note that NI uses Republic of Ireland (ROI) ports for its trade with GB. The expected impacts of the final Brexit arrangements and the implementation of the Northern Ireland protocol will be explored once these are known.

In addition to the substantial amount of intra-UK trade between NI & GB, Northern Ireland exported £61.7m of seafood in 2019 and imported around half that (£31.1m).

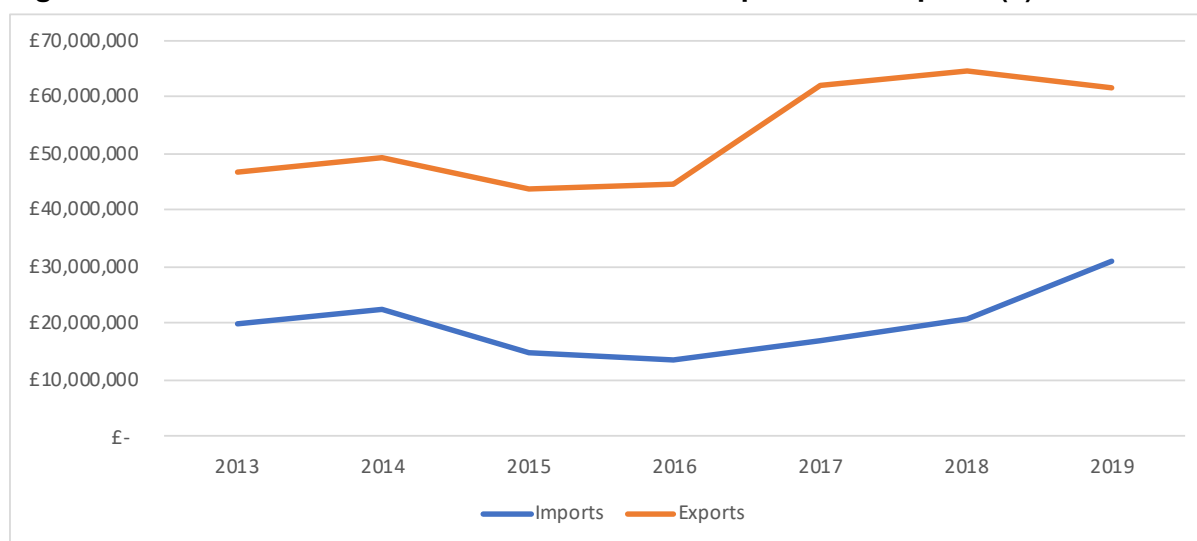
²⁰ <https://www.seafish.org/document/?id=16687d65-6e8c-488d-ac3f-f592f9fe9253>

²¹ <https://www.nisra.gov.uk/statistics/eu-exit-analysis/eu-exit-trade-analysis>

²² https://www.nisra.gov.uk/sites/nisra.gov.uk/files/publications/NISRA_Overview_of_NI_Trade_with_GB_2017_0.pdf

²³ <https://www.seafish.org/insight-and-research/market-supply-data-and-insight/>

Figure 2 Total value of Northern Ireland's seafood exports and imports (£)*



Source: NISRA *excluding GB

As can be seen from the figures below, the EU is Northern Ireland's largest seafood export market. Most significant is the cross-border trade with the Republic of Ireland (£26m) followed by France (£9.3m), Spain (£6.4m), Denmark (£5.4m), the Netherlands (£5.1m) and Italy (£3.0m). Trade with Ireland is evident across all species, Denmark pelagics and Netherlands mussels, while trade into France Spain and Italy is dominated by high value shellfish (*Nephrops*, scallops, crab and lobster).

For the export of processed fish, the picture is somewhat different. After the 46% of sales to GB, sales into ROI are only 8%, while exports to the rest of the EU are more significant at 27% of total sales²⁴. Export markets to Asia, particularly for crab, have also grown substantially in recent years.

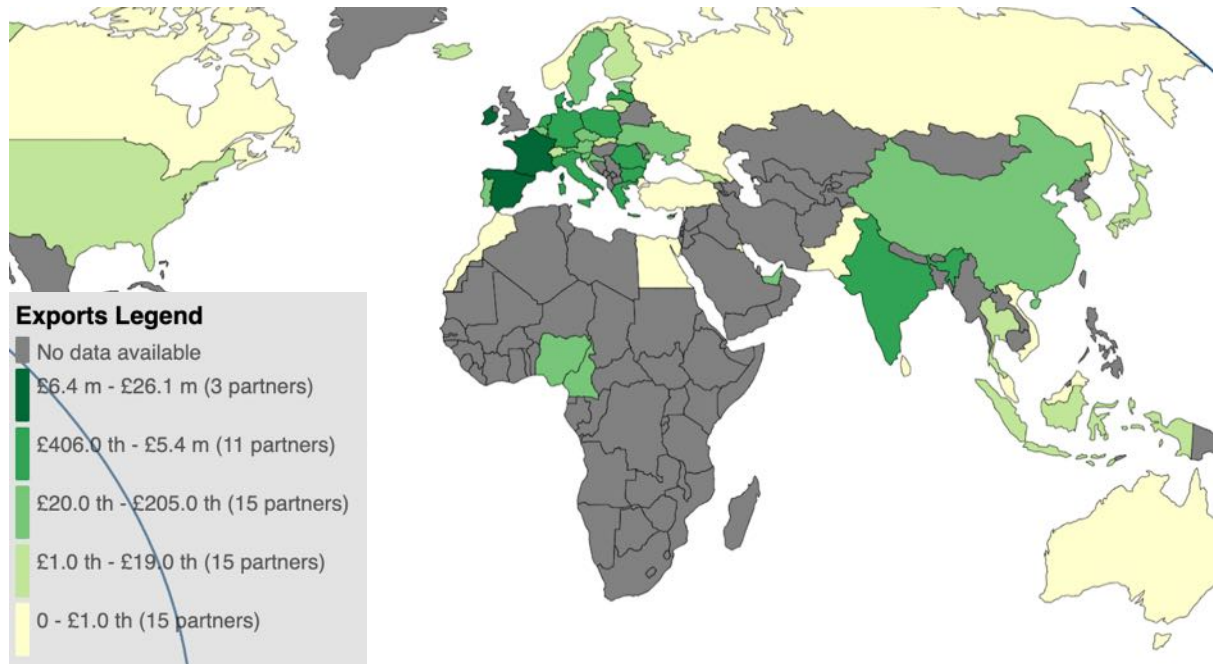
Of the £31m in seafood imports to Northern Ireland, ROI accounted for 63%, comprising of raw material sought by NI processors (mainly shellfish plus herring & mackerel), followed by Sweden (£3.2m), mainly salmon, Germany (£3.2m) and Denmark (£1.1m), mainly herring and mackerel.

A breakdown of UK exports to the EU and the main destination markets for key NI seafood commodities is given in Key species

Table 2 gives an indication of NI's contribution to UK exports, noting that this is an underestimate as NI figures relate to landed value rather than export value (which includes value-added products). The sections below describe the current supply chains for the main landings into Northern Ireland.

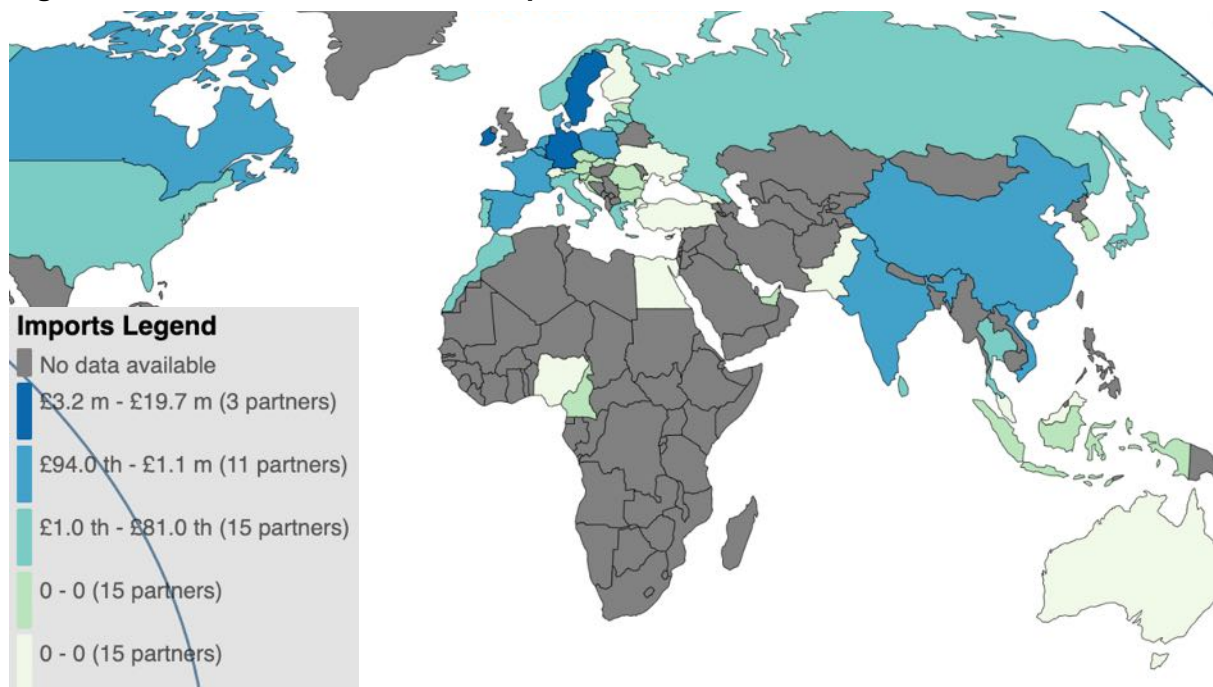
²⁴ NI Food and Drinks Processing Report 2018.

Figure 3 Northern Ireland Seafood Exports in 2019



Source: NISRA

Figure 4 Northern Ireland Seafood Imports in 2019



Source: NISRA

2.3 Key species

Table 2 UK exports of key species to the EU and contribution by NI landings*

Main NI products			Total UK exports 2019		main EU markets	Landings into NI ports 2019			
Species	form	HS Code	quantity (t)	value (£)		Volume tonnes	as % of UK exp	Value £	as % of UK exp
Nephrops	fresh	30634	3,332	33,566,094	France 71%, Spain 17%				
	frozen	30615	7,605	58,765,181	Spain 34%, Italy 27%, France 23%				
			10,937	92,331,275		6513	60%	£ 16,072,790	14%
Scallops	fresh	30721	4,073	45,605,289	France 74%, Italy 16%				
	frozen	30722	3,245	35,368,819	France 44%, Italy 21%, Spain 18%				
			7,318	80,974,108		525	7%	£ 1,217,251	1%
Haddock	fresh	30252	715	2,692,443	Ireland 56%, France 30%				
	frozen	30364	68	207,874	Ireland 60%				
			783	2,900,317		1299	166%	£ 1,994,812	56%
Hake	fresh	30254	4,769	23,493,635	Spain 90%				
	frozen	30366	433	1,051,124	France 69%				
			5,202	24,544,759		131	3%	£ 316,571	1%
Herring	fresh	30241	3,393	1,568,751	Denmark 96%				
	frozen	30351	1,453	6,856,721	Netherlands 56%, Malta 13% (to tuna culture)				
			4,846	8,425,472		4384	90%	£ 1,994,812	19%
Mackerel	fresh	30244	25,406	39,979,367	Denmark 62%, France 32%				
	frozen	30354	29,547	34,561,915	Netherlands 33%, Lithuania 28%				
			54,953	74,541,282		3190	6%	£ 3,961,309	4%
crab	fresh	30633	8,693	41,198,077	France 40%, Spain 29%, Portugal 20%, Ireland 7%				
	frozen	30614	4,629	27,424,193	France 44%, Spain 27%, Portugal 14%, Ireland 9%				
			13,322	68,622,270		1185	9%	£ 2,316,359	3%
lobster	fresh	30632	1,598	30,079,842	France 58%, Spain 28%				
	frozen	30612	691	10,055,018	France 45%, Spain 42%				
			2,289	40,134,860		70	3%	£ 807,192	2%

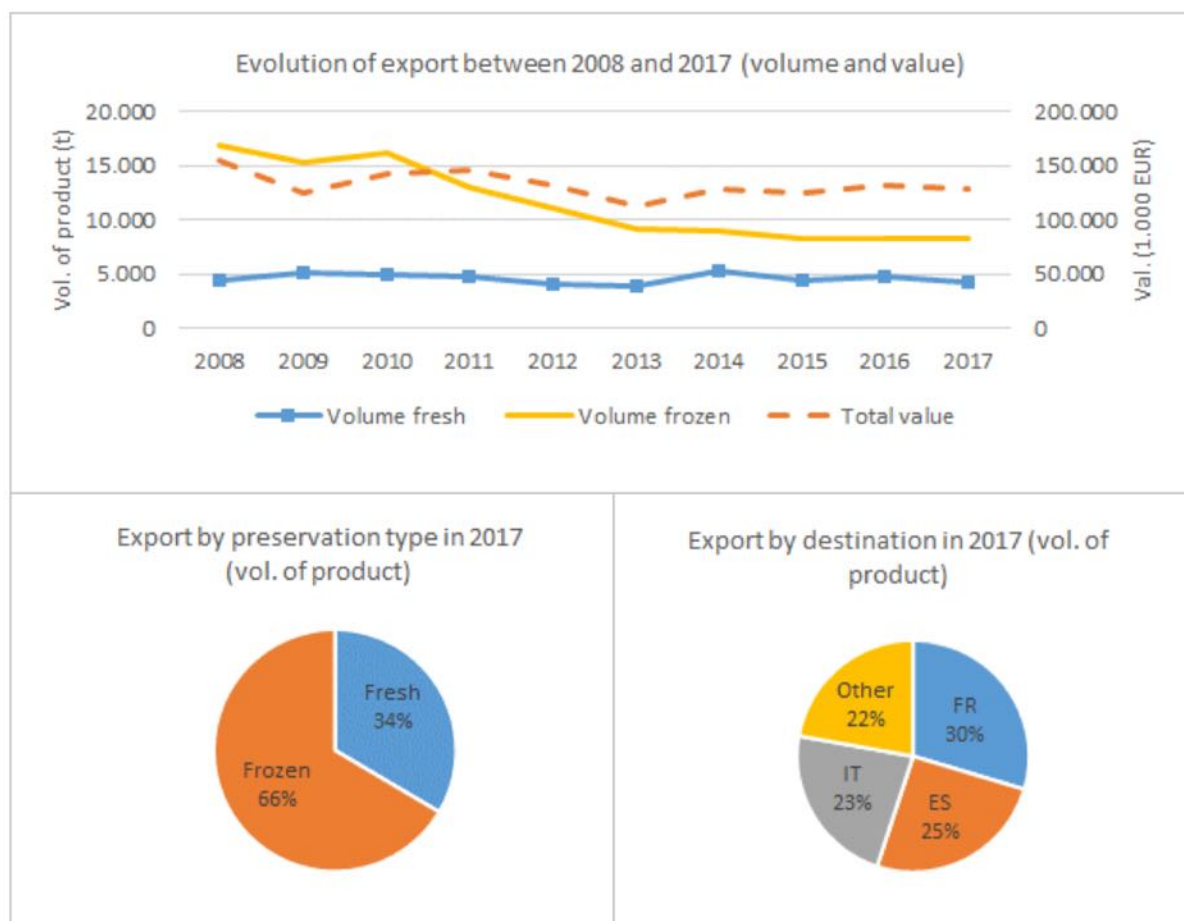
Source: Eurostat, DAERA

*NI contribution based on landed value and volume

2.3.1 Nephrops

The UK accounted for more than half of EU production of *Nephrops norvegicus*²⁵ in 2017 (56%), followed in volume by Ireland, Denmark and France. These four Member States (MS) accounted for 86% of EU catches of Norway lobster. The main importers are France, Italy and Spain (Figure 5) with trade mainly comprising of frozen Norway lobster, which accounted for 66% of UK exports and 87% of Irish exports in 2017 (EUMOFA, 2019). NI feeds into the Irish export market, where Italy is the main export destination.

Figure 5 Overview of UK Nephrops exports 2008-2017



Source: EUMOFA, 2019

As Key species

Table 2 illustrates, NI's contribution to UK production of scampi and exports of langoustine is considerable, both from direct landings and from raw material coming into NI processors from the rest of the UK and Ireland.

Nephrops continues to be Northern Ireland's most important fishery, accounting for 51% (£16m) of landed value in 2019. Consequently, these 'prawns' are the main product for most NI seafood companies. A range of trip lengths from day trips to week-long trips delivers mainly fresh Nephrops into NI ports, which then supply the two main Nephrops markets:

- whole fresh or frozen langoustine (mainly for EU export markets) or

²⁵ Also known as Norway lobster, Dublin Bay Prawn, langoustine, scampi

- tailed, frozen and coated to produce scampi (mainly for UK domestic markets).

The ratio of whole prawns to tails varies between grounds and seasons, but in live weight equivalent terms 3 to 4 times more is landed into NI as tails compared to whole.

Whole Langoustine

Compared to Scotland, which has extensive creel fisheries along its West Coast, only a very small amount of langoustine is caught by creel/pot in Northern Ireland (e.g. from Strangford Lough where trawl gear is banned). This supplies the whole, live market and goes to high-end restaurants and high value export markets such as France where live langoustine achieve a premium price.

Instead, the great majority of NI supply comes from the trawl fleet, which fishes nearby grounds in the Irish Sea and the Clyde, with the larger vessels that are able to travel further afield fishing in the North Sea and the Porcupine Bank off SW Ireland on a seasonal basis, depending on how good the fishing is on local grounds.

The Irish Sea grounds are renowned for being highly productive, but also producing a relatively small prawn, which limits the proportion of the catch that can be landed as whole prawns for subsequent freezing by NI processors. Prices within the whole frozen langoustine market are very size dependent with NI processors feeding into the Irish export market, where Italy is the main export destination.

There has been limited adoption of freezing at sea by the NI fleet as the Irish Sea and Clyde are characterised by relatively small prawns. Some NI owners that have invested in (26m in length) freezer trawlers (e.g. the three listed in Table 1) are unable to operate from Kilkeel due to the port constraints and so operate from Castletownbere in SW Ireland where they can target larger prawns on the Porcupine Bank.

Better prices for whole langoustine in export markets has driven the landing of whole prawns where size-permits and landing whole is also preferred by the crew as it means less tailing of product at sea. Trip lengths and trawl durations have reduced and handling has improved the quality of landed product to maximise the amount of catch that can go to the whole market.

Tailed scampi

Scampi production in Northern Ireland is around Kilkeel port with Kilkeel Seafoods dominating production, while another major scampi producer, Youngs, now only purchasing and storing product in NI for processing at its factory in Annan, Scotland. There are also a number of small-scale processors in Kilkeel and Portavogie producing battered scampi products mainly for the domestic market.

Kilkeel Seafoods, the largest employer in the NI seafood sector, is part of Whitby Seafoods, which acquired NI and Scottish scampi processors in recent years as part of expansion and investment plans. It recently reported 12% year on year sales growth to nearly 8,000t of scampi production in 2019²⁶, the majority of the UK's estimated 12,000t of annual sales of scampi²⁷. The dependence on local landings varies from year to year based on where prawns are caught (West of Scotland, North Sea or Irish Sea). Last year (2019) saw more North Sea quota and so a lower scampi production came from local landings, with raw material brought in from Ireland and Scotland both fresh and frozen.

²⁶ <https://www.express.co.uk/finance/city/710610/Scampi-maker-enters-new-golden-age>

²⁷ <https://www.fishfarmermagazine.com/archive-2/ireland%C2%92s-top-scampi-processor-makes-a-key-acquisition-fishupdate-com/>

Sales of scampi increased significantly in 2020 along with retail sales of other prepared and frozen seafood during COVID-19 restrictions as consumers sought alternative meal options. The 2020 growth in retail sales may not persist and will not have fully compensated for lost sales in the hotel, restaurants and cafes (Horeca) sector, but recent years had already seen growth in scampi sales (even though 80% of UK consumers don't know what scampi is²⁸). This has encouraged Whitby seafoods to increase capacity and continue to invest in Kilkeel as its centre for scampi production due to available space (not NIFHA-owned) to build new production and storage facilities at its existing site and, most importantly, access to a skilled local workforce²⁹.

2.3.2 Scallops

France and the UK dominate production of the king scallop, *Pecten maximus*, with much of the UK production then exported to France, Italy and Spain. The fisheries, and consequently sales, are seasonal peaking in the winter months and declining over the summer. Landings into Northern Ireland make a relatively small contribution to this trade, with 525t of over 7,000t exported from the UK.

Most NI scallop is exported fresh either 'live' in the shell, half-shell or as shucked meat. There is no further value-added products as the king scallop achieves a premium price live/fresh. Added-value scallop products produced in the UK usually use frozen scallop imported from Chile or Canada.

A small proportion (<5%) of landings are retained for domestic consumption, mostly in restaurants. As with whole langoustine, interest in local seafood has risen in Northern Ireland in recent years, but current supply chains into the EU markets are expected to continue to account for the bulk of production.

2.3.3 Whitefish

Whitefish³⁰ processing is limited in Northern Ireland as most fish processors have diversified into shellfish in line with landings. There are currently around 4 or 5 vessels targeting whitefish, with the rest of the whitefish supplies coming as bycatch from the Nephrops fishery. The number of whitefish vessels reflects the state of Irish Sea fish stocks, with vessels moving into other fisheries when opportunities are limited.

Only a few hundred tonnes of most whitefish species were landed in 2019, with the exception of haddock where landings exceeded 1,000t. The next largest catch was of monkfish at nearly 800t, with cod only around 200t. A significant proportion of the haddock was exported to ROI (table 1). As haddock is a popular species for NI consumers, this apparent lack of demand from the NI domestic market and NI processors is due to existing supply chains providing haddock supplies from Scotland.

The whitefish that is landed fresh by NI boats feeds into those existing supply chains opportunistically, with local landings topping up regular supply routes. Those trading fresh whitefish in NI source regular supplies from Scotland (Shetland, Grampian). The few secondary processors in NI that produce coated whitefish fillets (e.g. TS Foods) import frozen fillets e.g. cod, Alaskan pollock and hake.

Supply chains require certainty and it is not evident that NI landings of haddock are consistent enough to replace supplies from larger landing centres such as Scotland. The five years between 2011 and 2015 saw haddock landings drop below 1,000t, limited by Irish Sea fishing opportunities. But since then

²⁸ <https://www.undercurrentnews.com/2019/09/19/uk-survey-finds-over-80-of-people-dont-know-what-scampi-is/>

²⁹ Kilkeel Seafoods pers. comm.

³⁰ demersal species like cod, haddock, hake, monkfish, whiting, etc.

an improvement in Irish Sea haddock means that those receiving local landings are considering opportunities for further processing.

Consistently securing more local landings of whitefish will present processing opportunities. This depends on a number of factors including the status of the Irish Sea stocks (cod has not recovered despite years of restrictions), the ability to manage by-catch in the Nephrops fishery and the outcome of Brexit negotiations.

The NI Producer Organisations (POs) hold close to all the cod and 88% of the haddock quota in the Irish Sea (ICES sub-area VIIa), and 42% of the hake throughout ICES Area VII. Uptake of this quota by vessels in the NI POs in 2019 was close to 100% for the small amount of cod available, 73% for haddock and 30% for hake.³¹ Some of the Area VII hake and monkfish was landed outside NI ports by NI vessels fishing further afield. This gives a small margin for increased whitefish landings.

The final outcome of the Brexit negotiations will be analysed in detail as part of the final report. The proportion of Total Allowable Catch (TAC) currently allocated to the UK for those quota species that are important to the NI fleet gives some indication of the 'size of the prize':

- Nephrops Area VII: 33% allocated to the UK with the rest mostly with Ireland and France
- Haddock Area VIIa: 47% allocated to UK, with the rest mostly to Ireland
- Hake Area VII: 18% allocated to UK, with the rest mostly to Spain and France
- Cod Area VIIa: 29% allocated to UK, with the rest mostly to Ireland
- Monkfish Area VII: 18% allocated to UK, with the rest mostly to France

The above illustrates that for NI, the outcomes for Nephrops and haddock are particularly significant NI POs hold the majority of Irish Sea quota. For the Area VII stocks (hake and monkfish), NI quota holdings are at a lower level and landings outside NI ports are more likely, while Irish Sea cod is currently at such a low level, that any increase would not result in a significant additional volume.

For flatfish (sole and plaice) opportunities for uptake by the NI POs in the Irish Sea is currently limited. The very small amount of sole quota is fully taken as bycatch, while the more significant 700+t of plaice is not targeted: vessels are not geared to target plaice and sole would likely become a choke species with so little sole quota available.

A constraint on further whitefish processing will also be the availability of skilled labour. The volumes of raw material are not sufficient to consider automation and so hand-filleting is needed and experienced filleters in very short supply. Future whitefish processing opportunities should be supported through investment and training support.

2.3.4 Pelagics (herring & mackerel)

NI pelagic processing is undertaken by three processors (two in Ardglass and one in Kilkeel). These process two pelagic species; herring and mackerel. Other pelagic species such as horse mackerel and blue whiting are not currently processed. As described in the Stage 1 report, the species sought by processors and their capacity (the amount of fish they can receive at any one time), to an extent determine the landings into NI made by the three NI pelagic vessels and by visiting vessels. Other

³¹ <https://www.gov.uk/government/statistical-data-sets/quota-use-statistics#section-1>

important factors include the location of the resource and the prices offered. Killybegs in West Donegal is a major centre for landing and processing pelagic species.

The location of the NI processors in relation to the resources mean that they are strategically very well placed to receive catches made in the Irish Sea, but this is limited to a seasonal herring fishery, which had a TAC of around 8,000t in 2020³² and some mackerel from NI and ROI vessels fishing in the North Channel and West of Scotland. The NI vessels are allocated 74% of Irish Sea herring quota with the remainder going to Irish vessels. There is quota swapping between the UK and Ireland and between the NI vessels. The end result is that NI processors receive most of the Irish Sea herring as ROI vessels land their catch into Ardglass along with the two NI pelagic vessels that land into Belfast.

The processors receive the raw material by road, either the short distance from the quayside to the Ardglass factories or the 30 miles from vessels landing in Belfast. The Ardglass processors own and operate over 5,000t of coldstore capacity to enable the catch to be frozen and stored for processing outside of the season, as well as for providing additional income for storing raw material for other processors, such as frozen prawns.

Some of the largest herring is smoked as kippers, which is for the NI and GB/ROI markets. But the great majority of pelagic products are exported. Herring fillets are exported to German canneries as well as in Poland, France and Eastern Europe, as the relatively small sized fillet is a good size for cans. Mackerel is mostly headed and gutted for export to canneries.

At present the main determinant of pelagic processing output is the landings into NI, which has fluctuated between 6,000 and 8,000t per annum, mostly due to fishing opportunities in the Irish Sea fishery. Future pelagic processing revenue will depend on a range of factors, mainly the continued availability of NI landings, with an increase expected through the UK/EU fisheries agreement³³.

2.3.5 Crab

The UK exports the great majority of its crab landings, mostly to the EU (around 13,000t in 2019) with around 40% of that going to France, 25% to Spain and 20% to Portugal. Two thirds are exported fresh and a third is frozen.

Since 2015 the market in China has grown to become an important destination for UK brown crab with around 5,000t. Some is sent live air-freight, but the bulk shipped frozen by sea. In 2019 the UK accounted for 70% of EU crab exports to China worth over £25m, with Ireland third after the Netherlands accounting for 12% worth nearly £5m³⁴. Some of the handful of NI crab processors based in Killeel were quick to join this new market, with one reporting it sent 800t of frozen crab to China in 2019. As a result of this new market, prices rose considerably. In December 2018, first-sales value rose by almost 150% (EUMOFA, 2019). There has since been a price crash, even prior to the disruption to the export market caused by COVID-19, due to oversupply of poor quality crab. There are ongoing quality issues with white crab, including in NI landings resulting in poor prices for landings due to low meat yields.

Exporting frozen crab is lower priced per kilo, but less risky than sending live animals as delays due to logistics or testing (e.g. for heavy metals) could result in high mortality rates and buyers unwilling to pay for the full consignment. NI processors produce the traditional fresh pasteurised or frozen crab products mainly for wholesale customers: dressed crab, claws, and hand-picked white and brown meat. Removing crab meat by hand is a labour intensive form of primary processing. Future growth in this

³² Approx. 10% decrease is recommended by ICES for 2021

³³ to be explored in the final FSDP report when the outcome is known.

³⁴ Source: Eurostat (Comext), latest update: 13 Nov 2020

sector is likely to come from developing retail packs³⁵ and producing added-value products utilise this quality ingredient in convenience meals.

2.4 Future markets

The majority of seafood consumed in the UK is purchased through retail with nearly 70% of the seafood by weight purchased is through 'supermarkets' or multiple retailers (around 95% of this is pre-packed), and around 30% sold through food service outlets. Recent Seafish consumer analysis shows that Seafood consumption has been in general decline since 2007 and unless the decline slows, seafood eaten 'in home' is projected to hit a new record low before 2040³⁶.

The decline is being driven by a fall in retail seafood consumption; which has declined by -25% over the past 10 years, equating to around £5.5bn lost out of retail seafood sales. The impact of lockdown due to Covid-19 reversed this trend in 2020 as consumers looked to vary their at home meal choices, with strong growth seen in frozen seafood retail sales, but this did not compensate for the loss of seafood consumption outside the home and it is unclear whether this growth in retail sales will be sustained.

Seafood consumption in foodservice has remained more resilient [up to end of 2019], remaining flat and returning to growth in recent years. However, UK seafood consumption (both in and out of home) declined to 152.8g /person/wk. in 2018, equating to 1.09 portion per week which is only eating around half of the amount of seafood recommended by health professionals.

Three retail shopper trends were observed in the 2019 data, which are considered unusual as all three trends command higher average price for seafood at a time where consumer personal finances are under pressure:

1. a growth in the chilled seafood consumption;
2. growth in farmed species consumption (but most consumers don't know they are farmed); and
3. growth of seafood sales in the quality focused retailers (M&S, Waitrose, Co-op).

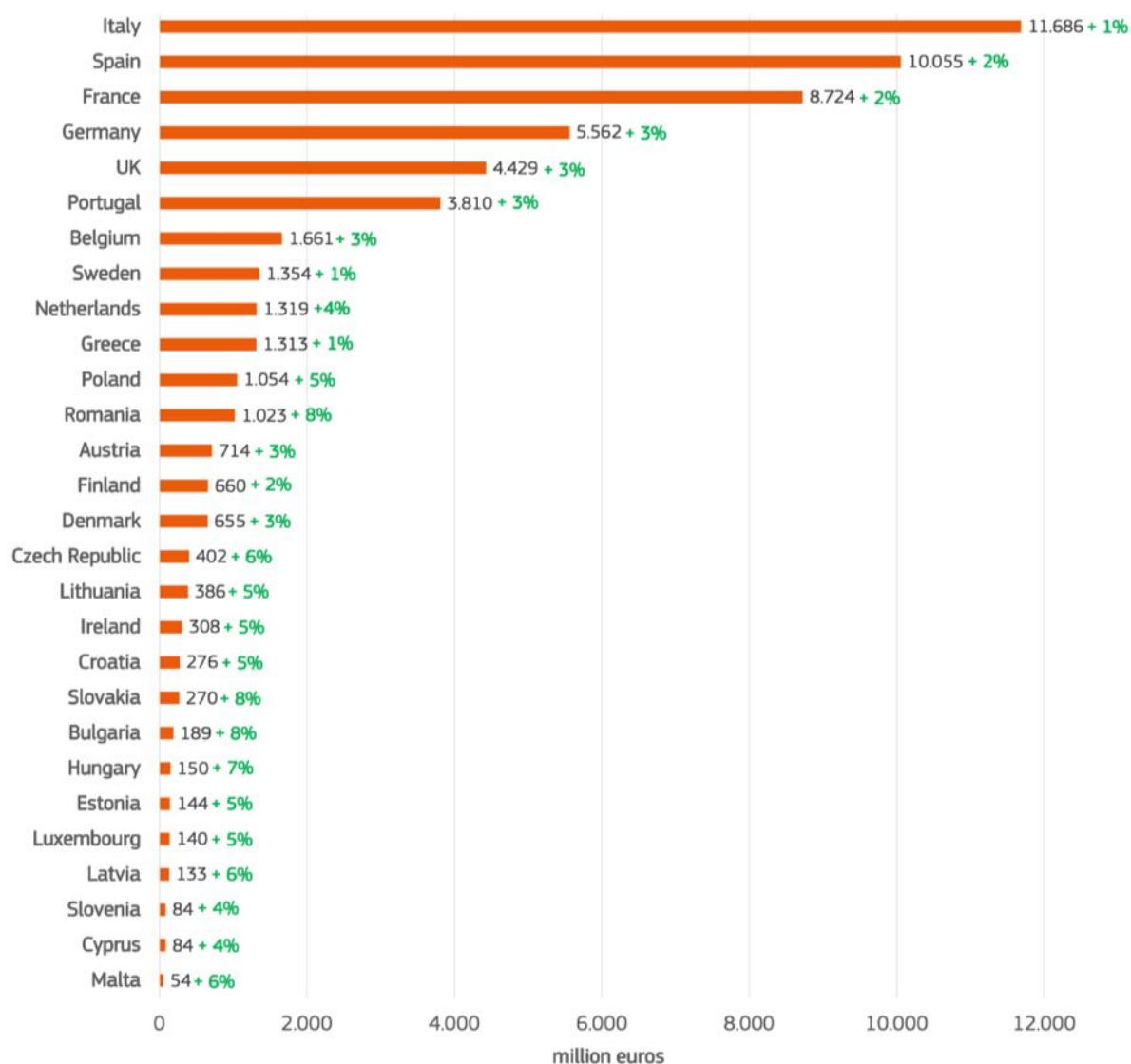
Seafood shoppers persistently rank quality/taste above price and sustainability credentials. The health and environmental benefits of seafood are important to some shoppers. However, only one third of UK consumers followed the NHS public health recommendation to eat two portions of fish a week. Over half (55%) of consumers would like to eat more seafood. and 70% of the fish buying public think that sustainability is important and that telling consumers about the specific health benefits of fish would encourage over 70% of them to eat more (Seafish, 2019).

While apparent consumption decreased across EU markets overall in 2018 compared to the previous year, the average level of consumption in the EU is higher than the UK, 50% greater in the main export markets of France and Italy; and in Spain consumers eat twice as much seafood as UK consumers. These countries continue to spend more on seafood purchases (Figure 6) with their choices dictated by quality and taste.

³⁵ As this SW England producer has done: <https://seafoodandeatit.co.uk/our-products/>

³⁶ Seafish Market Insight Factsheet: Seafood Consumption (2019)

Figure 6 Household expenditure on fishery & aquaculture products in EU Member States



source: EUMOFA, 2020 (out of home consumption not included)

Consumer trends indicate that in the long term there will be increasing demand for the seafood landed into NI ports, but most of that demand will not come from UK consumers. A small proportion of UK consumers are appreciative of high quality, locally produced seafood, but the majority of consumers will continue purchasing the 'big 5'. The greatest demand for seafood landed into Northern Ireland will continue to come from the continent and emerging markets such as Asia, that have the volume of consumers willing to pay a premium for high value seafood products.

A focus on quality for NI's key shellfish products is consistent with a growing interest in provenance and linked to responsible sourcing. Northern Ireland producers should be able to capitalise on this interest with supply chains that involve relatively short distances and few transactions. To a less extent this is also linked to sustainability considerations. The EU is currently considering the addition of sustainability criteria to seafood marketing standards, which provide standardised size and freshness grades across the EU supply chain.

2.5 Current and future business needs

Note: The impact of the final Brexit outcome on future supplies and market access will be assessed as part of the final FSDP report when the final details are known.

Seafood processor are challenged by a range of issues: include:

- Access to raw material,
- Growing markets,
- Production costs,
- Labour, and
- Waste

Access to Raw Material

Growing a processing business requires security of raw material supply as buyers are unlikely to return if orders are not fulfilled. In the short term this requires good supply agreements with the catching sector and in the long term, harvesting stocks at a sustainable level. For NI shellfish processors, only Nephrops is subject to quota (but not at the level of specific grounds or 'functional units').

In 2018 the Scallop Industry Consultation Group (SICG) commissioned a review of the industry leading to recommendations for long term management plans (LTMP) of UK scallop management areas and overseen by a national management group (Poseidon, 2018). Better management of shellfish stocks is receiving increased attention through the recent Project UK Fishery Improvement Projects for Nephrops and Scallop, and in 2020 with the establishment of the Crab & Lobster Management Group (CMG). The intention is for the UK's main commercial shellfish fisheries to be managed in a manner that is responsive to the status of stocks, which in the long term should provide greater certainty to those involved in the fishery and allow for that sustainability to be recognised in the market. This does, however, mean that the volume of landings of non-quota shellfish species (scallop, crab and lobster) will be better controlled and will not grow based on demand, but on what the stocks can sustain.

Whitefish processing is limited and for this to develop would require consistent volumes of whitefish being landed into NI ports. In the short-term this is only likely with haddock and some local processing of this species could be developed. Larger scale processing will rely on imported material until Irish Sea stocks recover and landings can increase to the extent that a whitefish processing sector can be sustained.

NI pelagic processors are well placed to receive Irish Sea catches, but it is challenging to attract raw material supplies from non-Irish Sea resources. For catches West of Scotland & Ireland they compete with major pelagic processors in Killybegs and Shetland. There may, however, be value in working with processors in identifying new product lines and markets based on the available raw material.

Aquaculture provides a source of raw material that is not limited by stock levels and is expected to provide the expected global growth in seafood consumption. One processor has already diversified with sales of their own cultured oysters, which are sold live. NI mussel production has the potential for value-addition, but is mostly exported to the Netherlands. In the longer term, growth in land-based recirculating aquaculture systems (RAS) is expected and this may provide a new source of raw material for NI

processors as well as fresh seafood. The recently published English Aquaculture Strategy³⁷ reports the potential for a ten-fold increase in English aquaculture production, with a substantial contribution from RAS³⁸. If the NI processing sector is to benefit from aquaculture as a raw material source, the future development of the aquaculture sector in NI must be supported.

Most of the above potential sources of additional raw material are only likely to materialize in the long-term, as has been seen with the scampi sector, growth is likely to be based on increased raw material from non-local landings. Comparative advantage for NI processors would then come from effectively addressing other constraints as identified below.

Growing markets

Growing a market is dependent on continuity of supply, which links to the availability of raw material discussed above. A positive sign is that the consumer trends described in the previous section show growing demand for the seafood produced in Northern Ireland. These will continue to be dominated by demand from export markets rather than domestic consumption. The EU is therefore expected to continue to be NI's main export market. If supply can be assured, the demand is there.

The impact of Brexit on future markets makes it difficult to identify the strongest opportunities at this time. With the UK's new trading arrangement and Northern Ireland's unique place within it, processors will certainly require help in identifying and accessing those new opportunities, as well as adjusting to new arrangements in existing markets.

Production costs

Production costs can be driven down through greater consistency in supply volumes and quality, as well as reduced energy use and improvements to waste management. Processors could benefit from support with environmental audits, such as Ireland's Origin Green, which works with processors to identify and implement environmental performance improvements, using these gains as positive stories for product marketing. There have been individual collaborations to improve energy efficiency such as between Ulster University and Errigal Seafood in Donegal through Intertrade Ireland's Fusion programme. As a result of the project a range of initiatives to improve efficiency have been implemented within the company. These include closer monitoring of equipment, new methods for converting waste into energy, improved staff training and enhanced energy management systems.³⁹

Labour

Labour is a particular challenge to the scampi sector due to the labour-intensive nature of production. This includes both tailing and peeling. Some product is still shipped to the Far East for hand peeling although the amount sent is reducing.

Tailing at sea makes work on a prawn trawler more taxing than other forms of fishing to the extent that finding and retaining local crew is difficult (there employment of foreign nationals in the fleet is extensive). With the higher volume of catch in the summer, some processors offer to receive landings to tail themselves, which is a benefit to the crew, but this then transfers the cost to the processor. The

³⁷ <https://www.seafish.org/about-us/working-locally-in-the-uk/working-with-the-seafood-industry-in-england/seafood-2040/english-aquaculture-strategy-from-seafood-2040/>

³⁸ <https://www.youtube.com/watch?reload=9&v=S7SQcCYPC4E>

³⁹ https://www.ulster.ac.uk/_data/assets/pdf_file/0008/57266/Errigal-Foods.pdf

long term solution is automation, which is actively being explored by some processors and such innovations should be supported.

A land-based de-heading machine is about to be piloted. If successful, it will have positive economic impacts as well as some environmental benefits. With less manpower needed, crew shares are improved, which along with no time spent tailing between hauls and shorter trips makes a more attractive proposition to the local labour market. With no tailing in between hauls, shorter tows are possible and the storing in large tubs with slush ice all leads to better catch and bycatch preservation. This also enables a quicker return of unwanted bycatch, potentially with higher survivability.

In addition to investment in the required research and development, moving to land-based tailing will require vessel investment (changes to layout to accommodate the large, insulated tubs, conveyors, sorters and slush ice production) and some port-side investment in cranes for lifting the tubs off the vessels.

Once land-based de-heading is successfully automated, it may also be possible to adapt the technology for vessel-based, but this is expected to be a longer-term potential development. The eventual choice will be driven by technology and economics, i.e. prices for small whole versus tailed prawns.

Waste

The move towards more tailing on land will increase another current challenge for scampi processors: with only the tail used for scampi, there is two thirds of the prawn left to dispose of. The nature of the current waste stream will change from being mainly shell to more protein contained within the head.

At present, the disposal of 'waste' from scampi production is a net cost to processors: heads may be sent to France for stock (cost neutral) and shells sent to Donegal or Scotland for further processing. The full potential value of this material is not yet realised. One Killeel processor has invested in an aerobic digester to stabilise the waste. A pilot project, in association with Scottish biotech start-up, Cuantec⁴⁰, sees some of this waste transported to Scotland for the extraction of chitin for use in producing a biofilm as a plastic packaging alternative⁴¹.

The only fish waste processing plant in Ireland is at Killybegs, home to Ireland's pelagic processing centre. In 2016 the Killybegs fishmeal and oil plant was redeveloped at a cost of €30million by owners UFI and the Norwegian pelagic processing conglomerate, Pelagia⁴². It is now termed a 'marine ingredients plant' in line with the ethos that processing by-products are not waste, but a useful protein source for animal and aquaculture feed.

Norwegian expertise is also evident in Ireland's ongoing investment in the production of higher value marine ingredients. Bio-marine Ingredients Ireland (BII) is increasing capacity at its Co. Monaghan facility producing protein hydrolases for nutraceuticals⁴³. Ulster University researchers are also working with the company to develop dietary supplements for humans (discussed further in section 4.2.1).

Waste disposal is a common issue for NI seafood processors. Most fish waste is taken by road across to Killybegs, with the transport cost roughly matching the price paid for the material. The scale and type

⁴⁰ <https://www.cuantec.com/>

⁴¹ A video describing the process:

<https://www.bbc.co.uk/programmes/articles/tHFYSpx65nL83LTrvHFdPy/plastic-s-fantastic-alternative-how-a-delicious-crustacean-could-hold-the-key-to-reducing-the-pollution-clogging-up-our-oceans>

⁴² <https://www.feednavigator.com/Article/2016/10/12/Irish-fishmeal-plant-redeveloped-to-the-tune-of-30m>

⁴³ <https://www.feednavigator.com/Article/2020/07/30/Irish-marine-ingredients-company-secures-5m-investment>

of landings into Northern Ireland does not make a plant like that at Killybegs, which requires large volumes of homogenous waste, feasible.

One NI start-up is producing high-end pet food from fish trimmings and outside NI, companies such as Sea Minerals in Fleetwood are promoting the use of crushed scallop shells (from nearby AM Seafoods) as aggregate rather than going to landfill⁴⁴.

The varied nature of landings and scale of processing at NI ports makes economies of scale in waste difficult to achieve (Nephrops shell & heads, scallop shell, crab shell, whitefish trimmings and pelagic processing waste), particularly for processors working individually. The relatively close proximity of most processing facilities around the NIFHA ports creates the potential for a collective approach to increasing value from by-products. This should link with and underpin the development of NI's marine biotechnology sector (see section 4.2.1).

2.6 Summary

The NI seafood processing sector includes around 30 micro/small enterprises and 16 medium-scale enterprises, of which about half are not specialist fish processors, but produce a range of products.

The scale of all but the largest processor, are dictated by the availability of local landings. Some growth may emerge from increased landings into NI ports resulting from the final Brexit deal and improvements to Irish Sea stocks. But the greatest potential for growth comes from sourcing raw material additional to local landings (from aquaculture or imports to the region).

The largest processor illustrates this; it has outgrown the dependence on local landings and now brings in most of the raw material it uses. The availability of space to expand and an experienced local labour force were key factors in the business choosing to grow in NI compared to its other production sites. Adding more value in the shellfish processing sector is likely to come from:

- improved efficiencies through automation (Nephrops)
- supplying high value markets (scallops) and
- adding value through developing convenience products (crab).

The above developments will require support in quality management, innovation, investment, marketing and training.

⁴⁴ <https://www.shellrecycling.co.uk/crushed-scallop-shell/>

3. Ancillary sectors

Ancillary sectors are those providing goods and services to the fishing fleet and as such contribute indirectly to the employment and turnover associated with Northern Ireland's fishing fleet. The following information is derived from consultations, company accounts and online searches.

3.1 Fleet supplies

The supply of goods to the fishing industry includes vessels, fuel, equipment (fishing gear and more general equipment) and provisions.

Fibreglass fishing boats are constructed by enterprises in Kilkeel (which also carry out vessel repair), but larger vessels, i.e. most of the over 10m fleet are sourced from outside of Northern Ireland.

Fuel is the main operating cost in fishing, particularly for trawl fisheries. Depending on the price, fuel costs account for between 15 and 25% of income in Nephrops trawl fisheries⁴⁵. The supply of marine diesel and engine oil to the NI industry is by a small number of companies that are associated with the three NIFHA ports, but also supply other sectors such as agriculture, domestic and commercial heating oil. It is therefore difficult to determine the proportion of the company activities associated with the fishing & seafood sector, particularly as employment is relatively small compared to turnover for this sector. A conservative estimate is made of 4 FTEs related to supplying the NI fleet across the four fuel supply companies identified.

The gear supply sector in Northern Ireland is limited in scale with around ten persons involved in the sale (e.g. KTS and PO-operated chandlery) and the construction of fishing gear. A handful of trawl makers located at NI ports are commissioned by vessel owners to construct trawl nets. Most gear materials are imported from the larger manufactures (Swann-net Gundry and KT Nets based in Killybegs) or further afield, but there is a continuing need for localised expertise as demonstrated by the Northern Ireland Gear Trials Project⁴⁶.

Local businesses also supply provisions of food and stores to the fleet to support the crew during fishing trips. There is also growing demand for provisioning from the guard vessel sector (see section 4.1.1), which can involve much longer 2-3 month trips. This is an important revenue stream for local shops in and around the fishing ports.

In addition to gear and provisions, the fishing fleet requires the supply of some specialist electronics marine electronics for navigation and communication. While the manufacture of this equipment is outside of NI, two companies (SIRM and I-Fish) are based at Kilkeel harbour and supply and install this equipment with local employment estimated to amount to six FTE.

3.2 Vessel services and repair

Fishing vessels undertake demanding work in harsh environments and so the physical structure of vessels requires regular maintenance and sometimes extensive repair. The complex specialist

⁴⁵ Seafish Economics of the UK Fishing Fleet 2019. <https://www.seafish.org/document/?id=c0640cf9-a9c8-4d03-8c35-6f7a966ad056>

⁴⁶ A six-year project to design and trial trawl gear to reduce by-catch in the Nephrops fishery, where too much whitefish by-catch (e.g. cod and whiting) risks a premature closure if insufficient quota.

equipment aboard modern fishing vessels also requires regular servicing by a range of engineering trades: mechanical, electrical, hydraulic, refrigeration and ICT support.

An essential contributor to the ancillary sector is NIFHA itself which employs 21 people across the organisation and reported an income of £2.2million in 2018, which included £818,000 in EU and government grants. Of the remaining £1.3m in revenue, 50% came from landing and market dues, 17% from ice sales, 13% from slipways, 9% from rent and 7.5% from berthing dues. With relatively few non-NI vessels making landings into the NIFHA ports, other than at Ardglass where ROI vessels land during Irish Sea herring season, the great majority of income is dependent on the local fleet and the scale of its landings that is possible due to fishing opportunities. Ice sales are reducing as more vessels and processors establish their own supply, while revenue from non-fishing vessels and visiting vessels has increased berthing dues and revenues from slipways despite the reduction in NI fleet numbers.

The two Producer Organisations (ANIFPO and NIFPO) based in Kilkeel and Portavogie provide market and administrative services e.g. quota management as well as providing representation and information dissemination along with numerous other duties. There are also local businesses providing professional services to the many fishing businesses such as accountants and insurance brokers.

There are marine engineering companies and sole traders associated with each NIFHA fishing port, with a cluster of engineering and vessel construction & repair companies evident in Kilkeel. This cluster is in part due to Kilkeel hosting the largest fleet and the three slipways being in high demand for vessel maintenance and repair for the local fleet and visiting vessels. On average, 55% of the engineering / boat repair services are delivered to vessel owners originating from outside of Northern Ireland (ROI and GB) (SIB, 2016).

The companies that form the Kilkeel cluster have built a reputation for high quality work representing good value for money (further aided by NIFHA keeping charges low). An InvestNI-funded initiative, Kilkeel Harbour Works⁴⁷, is aiming to support growth in these sectors by promoting Kilkeel as ‘an industrial and maritime centre of excellence’. Around 12 companies, along with public agencies and Belfast Met (as training & skills provider), form the current group that employs over 100 people and has a group turnover of over £20m, with 75% of sales to customers outside NI⁴⁸. Although this grouping does not include all of the companies in the ancillary sector located at Kilkeel harbour, it illustrates that this sector is not fully dependent on the local fleet.

As with the largest seafood processors, some companies have grown beyond the market provided by the NI fleet to supply services to fishing fleets from elsewhere in the UK and Ireland. For some, such as the boat builders located in the port, customers also come from other European countries. The use of the harbour by these various businesses and their dependence on the NI fleet varies by the particular vessel service sector with some having a high reliance on the fleet and some having a high reliance on port infrastructure (Table 3).

⁴⁷ <https://kilkeelharbourworks.com/>

⁴⁸ The higher ‘export’ sales of 75% is like due to the inclusion of guard vessel enterprises and boat builders that have a higher % of customers from outside the NI fleet than the boat repair/engineering, which is estimated at 55%.

Table 3 Service sector reliance on local fleet and port infrastructure

Sector	Reliance on NI fleet	Reliance on port infrastructure
Boat repair	Moderate – est. 45/55	High – slipway, adjacent land
Boat construction	Low – some NI commissions	Moderate – occasional access required
Engineering	High – most from local fleet	Low –only to access vessels
Equipment supply	High – 80% local feet	Low –only to access vessels
Electronics supply	High – est. 90% NI trade	Low –only to access vessels

The engineering skills base is a big reason for the Kilkeel cluster’s success, but several consultees stated that recruiting suitably qualified personnel has been difficult in recent years. However, the most significant constraint to growth mentioned by these companies continues to be the port infrastructure. The availability of slipway space and space adjacent to the slipways limits the number of vessels that can be serviced at any one time (Figure 7). Non-local vessels are less inclined to wait what can be several weeks for a space on the slipway and are likely to go elsewhere, e.g. facilities in Donegal.

The physical capacity of the slipways means that the largest vessels in the fleet must already go elsewhere (including Killybegs⁴⁹ or further afield such as Denmark for the pelagic vessels) for repairs and maintenance that requires access below the water line. With the trend towards larger vessels for both fishing fleets and guard vessels (see section 4.1.1), the physical limitations of the slipways will increasingly limit the potential market available to the vessel services in addition to the available space adjacent to this infrastructure. These capacity issues are considered further in section 5.5.

Figure 7 Slipways in use at Kilkeel harbour



Source: R. Cappell

⁴⁹ E.g. <https://mooneyboats.ie/>

In terms of competition for vessel repair services in other NI ports, Belfast Harbour has a range of engineering companies that serve the large-scale commercial shipping sector, but facilities do not cater to the maintenance and repair of smaller vessels such as demersal and inshore fishing vessels. Bangor, while hosting a small number of inshore vessels, is very much focused on the leisure boating sector. Warrenpoint's recent masterplan (2018-2043⁵⁰) shows that it will continue to accommodate leisure craft and the mussel dredgers using the port, but its focus is on the expansion of bulk cargo facilities.

Outside Northern Ireland, the availability of maintenance and repair facilities for the fishing fleet around the Irish Sea is also limited. Howth's focus on tourism and recreational boating makes it increasingly difficult to use slipway facilities for commercial vessel repair as industrial noise and spraying is constrained. Several anchorages are used by marinas for recreational vessels and other Irish ports along the east coast where small commercial fleets are based (Clogherhead, Balbriggan or Skerries) do not provide any comparable repair facilities.

Across the Irish Sea, Whitehaven in Cumbria has established a small cluster of businesses⁵¹ associated with a newly-build 200m² boatshed and a 45 tonne boat hoist. This facility is targeting the servicing of leisure craft associated with the 400-berth marina rather than commercial vessels. A tourism and coastal activity centre is also being built along with marine environmental improvement schemes⁵².

Further north, Kirkcudbright on the Solway is home to a significant fleet, specializing in scallop dredging. Some ongoing repairs to the local dredge fleet are undertaken on site and a couple of companies offer fiberglass repair, but it lacks the infrastructure to attract many visiting vessels. Troon is home to the Ayr commercial fleet, but is more focused on attracting leisure vessels to its marina than visiting commercial vessels.

Our consultation with the businesses involved in the fleet service sectors supports the findings from earlier reviews that identified a market opportunity for NIFHA to increase revenue by attracting visiting vessels seeking these services and to support its tenants in growing their businesses. This will need port infrastructure investment as well as investment in the education & training of the workforce and in marketing to promote vessel services.

⁵⁰ <https://warrenpointport.com/wp-content/uploads/2018/04/27550-WARRENPOINT-Port-Masterplan-Brochure-WEB2.pdf>

⁵¹ <https://www.ukmel.co.uk/whitehaven-boatyard>

⁵² <https://www.newsandstar.co.uk/news/18612965.huge-redevelopment-starts-whitehaven/>

4. Other port-based industries

4.1 Current sectors

4.1.1 Offshore development support

Offshore developments (e.g. pipelines, cables, energy platforms, wind farms and potentially aquaculture) require both vessel and port-based services. These are each described below with further details on Marine Renewables Development in the Irish Sea provided in **Appendix C**.

Vessel services

There are three offshore vessel service companies based out of the NIFHA ports and these continue to show significant growth. Two companies are directly associated with the NI fishing fleet and the third is part of a group that also provides engineering and repair services. Invest NI has provided a range of support to this emerging sector. It reports that contracts for guard vessel and survey work resulted in a turnover of £7m in 2019 (see section 5.2), growing to over £10m in 2020 and with the potential to grow to around £20m per annum, creating opportunities for coastal communities associated with the NIFHA ports⁵³. These NI companies are now providing services well beyond the Irish Sea into the North Sea, Norway, the English Channel and even providing expertise to the burgeoning offshore sector in the US.

The demand for guard vessel work was initially seen as a useful addition income for fishing vessel operators and crew, but has grown to be considered by some as competition with the fishing sector for vessel time. The companies associated with the fleet have sought to address through employing vessels from elsewhere in the UK. In the future guard work is likely to continue to be a useful support system for fishing operations. But as the offshore services sector develops, more specialization is evident as the nature of the work and vessel requirements differ. The companies have made substantial investments to enhance technology, safety and crew accommodation to operate ex-fishing vessels as dedicated guard vessels. Vessel owners are in some instances pooling their fishing opportunities onto fewer fishing vessels to free-up a vessel for specialization in guard duties.

As with the fishing fleet, the harbours place some restrictions on the vessels that these NI companies would ideally invest in for guard work. Larger vessels can be deployed further offshore, in more challenging conditions, for longer periods and have more space for crew comfort, which is important for contracts that could last several weeks.

Port services

A recent assessment of NI wind farm development found that developments around the coast are unlikely to emerge in the short term due to expected objections [and consequently NI waters were excluded from the recent licensing round], but developments were more likely to progress with future technologies such as floating wind farms that could be positioned further offshore. (DoE, 2019)

While wind farm development off the Northern Ireland coast appears to have stalled, the commitments made by the ROI (e.g. 5GW of wind farm capacity off the Irish Coast by 2030) mean that there is a lot of marine renewables activity in the Irish Sea. This requires major port capacity for assembly and installation, as is serviced by Belfast and the private port of Mostyn in North Wales (see **Appendix C**). Small ports also play an important role in the full lifecycle of offshore developments from initial surveys, through installation, operation and decommissioning. Developers have invested substantially in

⁵³ Invest NI Business Development Executive pers. comm.

Operation and Maintenance Facilities (OMF) in certain ports that are strategically located to service the turbine arrays.

The Sustainable Kilkeel 2020 report identified Kilkeel and Portavogie show good prospects for hosting OMF for Irish Sea developments. It states that the single most important factor for Kilkeel in relation to developing its economic output is the upgrading of the harbour facilities so that it can service larger fishing vessels and those associated with the Operation & Maintenance activities of the offshore renewable energy industry (SWC, 2012). It remains the case that the constraints posed by the harbour are likely to impact future development of the offshore services sector in addition to the fishing sector.

Future development of the NIFHA ports should take the potential opportunities in port-based services to Irish Sea offshore wind farms into account, at least in terms of space and port capacity that would enable the developers to invest in operation and maintenance facilities. Given the growth in guard vessel services described above, the NIFHA ports could be promoted as hubs for offshore support.

4.1.2 Tourism

Tourism in Northern Ireland has grown into a £1billion industry. The continued growth in 2019 was largely driven by holiday trips with 14% more holiday visitors than 2018⁵⁴. Holidays by NI residents was a significant contributor, which became critical to the sector in 2020 with travel restrictions due to Covid. 2019 tourism employee jobs showed a 9% increase to over 70,000 and accounted for 9% of all employee jobs in Northern Ireland. In 2015 tourism in NMDDC was worth £47.7 million to the local economy and supported almost 5,000 jobs, and these are likely to have grown significantly in line with the growth seen in the rest of NI. Accommodation and food service enterprises across the district grew by 9% from 2016 to 2019 (NMDDC, 2020).

NIFHA ports already contribute to the tourism product in their localities with visitors attracted to the boat activity at the ports and the provision of fresh seafood. Aside from sea angling trips, there are currently very few tourism-related facilities or targeted promotion. A search for the three NIFHA ports on the Discover Northern Ireland website reveals no results for Portavogie and a single listing for Ardglass Golf Club, which has become a popular stop for overseas golfers. For Kilkeel, beyond a visit to the Nautilus Centre, simply encourages visitors to Kilkeel harbour to “Enjoy a walk along the Harbour to the quayside and watch the fleet landing their catch.”⁵⁵

The NMDDC tourism strategy sets a vision of ‘Newry, Mourne & Down is a premier, year-round mountain and maritime destination in Ireland recognised for its EPIC experiences in outdoor adventure, its rich tapestry of cultural heritage, myths and unique stories, and its authentic local life.’ This recognises that ‘visitors today are seeking deeper, authentic and memorable experiences that allow them to connect emotionally with the local destination and community culture (NMDDC, 2017) There are clearly numerous linkages and future opportunities for fishing and seafood within the development of tourism in the district.

The Mourne Coastal Route is being marketed as general touring destination with a focus on outdoor activities. The Gateway to the Mournes project is being proposed for Belfast Regional City Deal funding. It includes tourism-related infrastructure investment of £36m centred around gondola ride into the

⁵⁴ <https://tourismni.com/facts-and-figures/tourism-performance-statistics/ni-annual-and-quarterly-tourism-performance/>

⁵⁵ <https://discovernorthernireland.com/things-to-do>

Mourne mountains and is currently subject to Outline Business Case to consider the proposed schemes.

Balancing the interests and needs of tourism with working ports is notoriously difficult to achieve. Ensuring the safety of visitors around a dynamic environment involving heavy machinery requires visitor management and harbour operators find it is often simplest to exclude visitors. However, there are examples of new port developments catering to tourist visitors. For example, Brixham's new fish market was designed to include public viewing areas with safe entry and exit points for the public as well as organised fish market tours⁵⁶. This does not often result in additional significant revenue for the port, but contributes to the tourism potential of the locality and increased visitor spend in the local community.

It is beyond the scope of the FSDP to suggest that future port investment include specific attractions, but plans for any development should recognize the potential benefit to tourism and ensure adequate provision for visitors. Through good planning (see 5.3 below) the ports can better capitalize on the ports' interest to visitors and marketing can ensure mutual benefit fishing & seafood and tourism.

4.2 Other potential sectors requiring port infrastructure and services

4.2.1 Marine biotechnology

The EU has termed marine biotechnology the “blue bioeconomy”, relating to economic activity associated with the use of renewable aquatic biological resources to make products. Examples of such products include novel foods and food additives, animal feeds, nutraceuticals, pharmaceuticals, cosmetics, materials (e.g. clothes and construction materials) and energy. Businesses that grow the raw materials for these products, that extract, refine, process and transform the biological compounds, as well as those developing the required technologies and equipment all form part of the blue bioeconomy (EUMOFA, 2018). The EU's Blue Bioeconomy Forum produced a roadmap to support the development of the sector across the EU (EC, 2020). This, along with a number of project examples is provided in **Appendix D**.

Marine biotechnology development in Northern Ireland is currently limited to academic research and collaboration with ROI initiatives. The Nutrition Innovation Centre for Food and Health (NICHE) at Ulster University is involved with a number of research projects on bioactive ingredients. It is working with Bio-Ingredients Ireland (BII) based in Co. Monaghan, to increase the valorisation of fish waste (such as salmon trimmings or low value species such as blue whiting) through protein extraction. BII carries out the processing and NICHE carries out the clinical trials⁵⁷.

Ulster University has been involved with an EU funded project called MARISURF⁵⁸, which aims at exploring the potential of marine bacteria to produce surface-active compounds that could be exploited in various industrial sectors. These explorations utilise NI's expertise in bio-medical research and while derived from marine resources, has no direct connection with the seafood sector.

Looking ahead to potential commercial activity is difficult in an emerging field, but if it is to valorise marine resources and help to address waste as part of the circular economy, it is expected that development would be associated with the main materials landed into Northern Ireland.

⁵⁶ <https://brixhamfishmarket.co.uk/brixham-fish-market-tours/>

⁵⁷ P Allsopp, NICHE pers. comm.

⁵⁸ <http://www.marisurf.eu/>

The largest and most consistent volumes of seafood waste in NI relate to shellfish fisheries (Nephrops, crab and scallop). By-products derived from crustacean shellfish include chitin (an abundant structural polymer that can be used in films and coatings) and chitosan (a sugar used in medicine) that can be extracted from crustacean exoskeletons. NI's main scampi processor is currently shipping Nephrops shell waste to a Scottish biotech start-up, Cuantec, which has partnered with Waitrose to develop a chitin-derived biofilm for food packaging.

For bivalve shellfish (scallop, mussel, oyster) waste shell can be crushed for use as aggregate or soil enhancer, but also further refined as material for heterogeneous catalysts, blended cement manufacture, concrete aggregate, ceramics and plastics additives, biofilter medium and biomedical applications. Their biological–natural origin and the high calcium carbonate content with a trace amount of other mineral elements makes them highly favourable for cement production, heterogeneous catalysts and hydroxyapatite manufacture for biomedical and wastewater treatment applications (Hart, 2020).

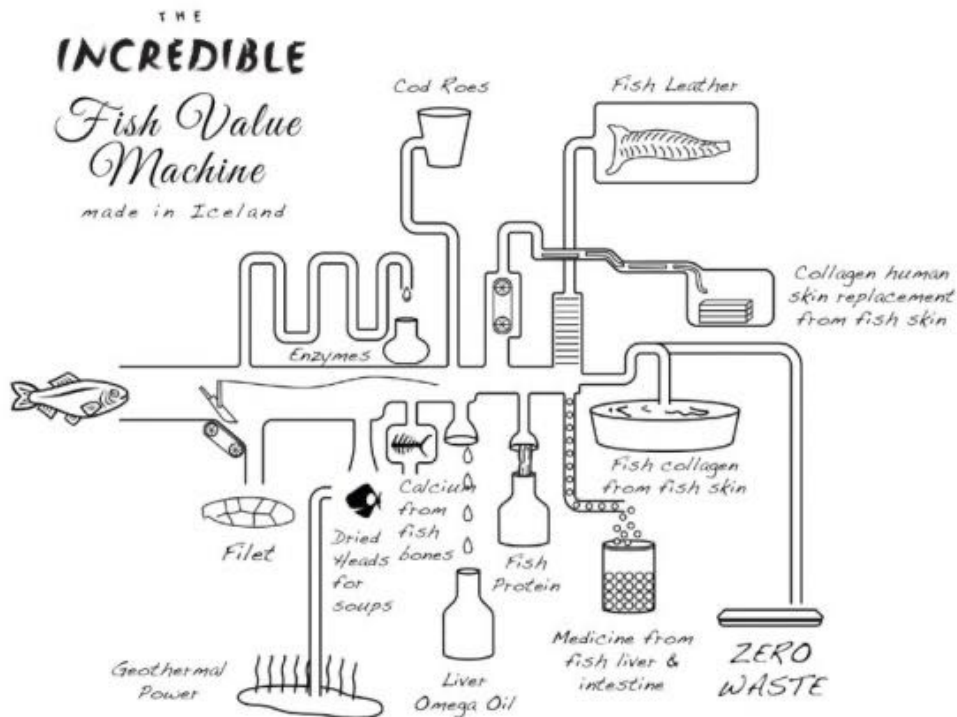
There is a lot of research exploring the potential of seaweeds beyond the traditional alginate production. There is also work looking at combining algal properties with shellfish properties⁵⁹, which further expands the possibilities for NI's marine resources in biotechnology. It can be assumed that the commercialisation of NI-based marine biotechnology is likely to be connected to the seafood sector's main waste streams, but it is difficult to predict the shape and scale of the sector. It is more useful to consider what actions are needed to support the emergence of this sector in NI.

Iceland's Ocean Cluster, is a grouping of seafood and marine-related businesses based in offices at a refurbished net loft in Reykjavik harbour⁶⁰. It promotes the concept of 100% utilisation of marine resources, as illustrated in Figure 8, with Iceland's largest seafood export, cod, also providing the raw material for food additives, enzymes, collagen and fish leather resulting in zero waste. A survey of companies based in the Ocean Cluster found that 70% had collaborated with other companies in the OC and the concept is being replicated in North America and Scandinavia.

Figure 8 The incredible fish value machine

⁵⁹ <https://biomarketinsights.com/crab-shell-and-seaweed-based-fibres-could-be-made-into-medical-materials-researchers-say/>

⁶⁰ <http://www.sjavarklasinn.is/en/>



Source: icefish.is

Kverva⁶¹ is a private Norwegian investment company connecting to a range of marine resource industries such as the processing company, Pelagia, the bio-ingredients company, Nutrima, and the salmon company Salmar. These connections are highly beneficial in supporting applied R&D. The scale of these activities, involving some of the largest seafood sectors in the world, far exceeds what can be expected for marine biotechnology in NI, but it does show a private sector investment model that could be replicated at an appropriate scale.

Public sector support can facilitate linkages between operators to enable economies of scale and with researchers to help explore solutions to operational issues, such as seafood waste, and greater valorisation of raw material. It also enables resources to be allocated to R&D, which is often difficult for individual companies to justify or they simply do not have the time to progress side-projects outside of their core business.

QUB runs degree and post-graduate courses in pharmaceutical biotechnology and work with leading pharmaceutical companies.

4.2.2 Marine training and R&D

In addition to the need for R&D related to biotechnology described above, the wider marine economy is also in need of R&D investment as well as vocational training related to mechanical and electrical engineering and future skills requirements in the offshore renewables sector.

⁶¹ <https://kverva.no/kverva-industri-2>

Queen's University Belfast has a 40+ year history of marine renewable energy research. In recent years, the expertise has extended to tidal energy research through £1m of CASE⁶² funding tandem tidal device testing, including a number of campaigns in Strangford Lough. The QUB Marine Group has also been undertaking research projects in offshore wind and floating solar.

Northern Ireland has a first-mover advantage in tidal energy as it was home to the world's first ever grid connected tidal turbine, the 1.2MW Seagen device in Strangford Lough. Delays in licensing the north coast tidal energy sites at Fair Head and Torr Head mean this expertise and advantage is eroding. Nevertheless, R&D in renewables continues in Northern Ireland (Figure 9) and could be encouraged to expand with the right government incentives⁶³.

Figure 9 Minesto Ocean Energy R&D platform, Strangford Lough



Source: minesto.com

Northern Ireland's tertiary education sector is more linked with commercial operators than ever before. Further Education Colleges work in partnership with regional employers to tailor courses to specific skill & knowledge requirements. For example, Southern Regional College is working with engineering companies to provide targeted courses that are tailored to the sectoral advantage in the region⁶⁴.

However, for the micro-enterprises that are typical of the seafood and other NIFHA port industries, a sector-wide approach is needed rather than bilateral arrangements. Although R&D is proven to be beneficial to company growth, micro-enterprises find it difficult to initiate or even engage with R&D. The authors of a 2020 study into the connection between R&D, innovation and productivity found the following (ERC, 2020):

- Despite resource and capability constraints within micro-enterprises, that curtail their ability to undertake R&D, investing in R&D has a strong and positive effect on enhancing the contribution of innovation to productivity and turnover growth.
- R&D investment undertaken inside the enterprise is positively associated with both product innovation and process innovation, however R&D acquired externally has no significant relationship with product innovation but is positively related to process innovation⁶⁵.

⁶² The Centre for Advanced Sustainable Energy (CASE)

⁶³ CASE Director pers. comm.

⁶⁴ NMDDC Economic Development pers. comm.

⁶⁵ *Product innovation* relates to improving or creating a new good or service. *Process innovation* relates to a new or significantly improved production or delivery method. This includes significant changes in techniques, equipment and/or software.

- There is a significantly lower level of productivity for Northern Ireland micro-enterprises than elsewhere in the UK, Ireland and the US.

The survey found that a greater % of micro-enterprises in Northern Ireland are family owned (78%) compared to 70% in the UK as a whole and only 58% in London. The authors conclude that '*as these small-sized firms are increasingly important in the development of the economy, how to improve their productivity and growth is, we believe, an essential policy priority*' (ERC, 2020).

Intertrade Ireland's Fusion programme⁶⁶ seeks to address some of these issues by providing linkages between academic and industrial partners on a bilateral basis. While the results illustrate the long-term benefits of such an arrangement, the employment of a graduate over 12-18 months is a significant investment by a small company and may be considered too much of a commitment for the micro-enterprises that characterise seafood and port-based industries. A collective programme may well be required to pool resources and to help address common problems.

4.2.3 Aquaculture

The aquaculture sector in Northern Ireland is of a modest scale, but is well-established and currently consists of a number of mussel and oyster farms, one salmon farm using marine cages and a number of trout farms at freshwater sites. It is considered here as a potential sector in terms of its future use of the NIFHA fishing ports, as connection with the port is currently limited to the diversification of a port-based seafood processor into oyster production, which has included establishing depuration facilities at its premises located in the port.

The global growth in aquaculture is expected to continue, but recent increases in UK production have been constrained for a range of reasons, mainly including licensing and production costs. Infrastructure is also identified as a constraint to some UK producers (Huntington & Cappell, 2020). However, it is not evident that a future demand for use of the NIFHA ports would develop from the existing NI sector as long as Warrenpoint Port were willing and able to continue to host the mussel boats.

As stated in section 2.5 on future seafood processing, the development of land-based recirculating aquaculture systems (RAS) for marine species is projected to contribute to future growth in the sector. A coastal location is beneficial for such systems to facilitate water replenishment, but these systems do not require port access and to date there has been no indication of an interest to development RAS in Northern Ireland⁶⁷.

There is growing interest in seaweed culture, producing algae for both food, biofuel, alginates and more innovative biotech products such biofilms, even as environmental mitigation (Seaweed for Europe, 2020). For the UK to date developments are limited to test sites and the feasibility of commercial scale developments is still being explored⁶⁸.

The most likely future demand for port infrastructure from aquaculture comes from the development of offshore aquaculture either as stand-alone sites or co-located within wind farms. Offshore aquaculture

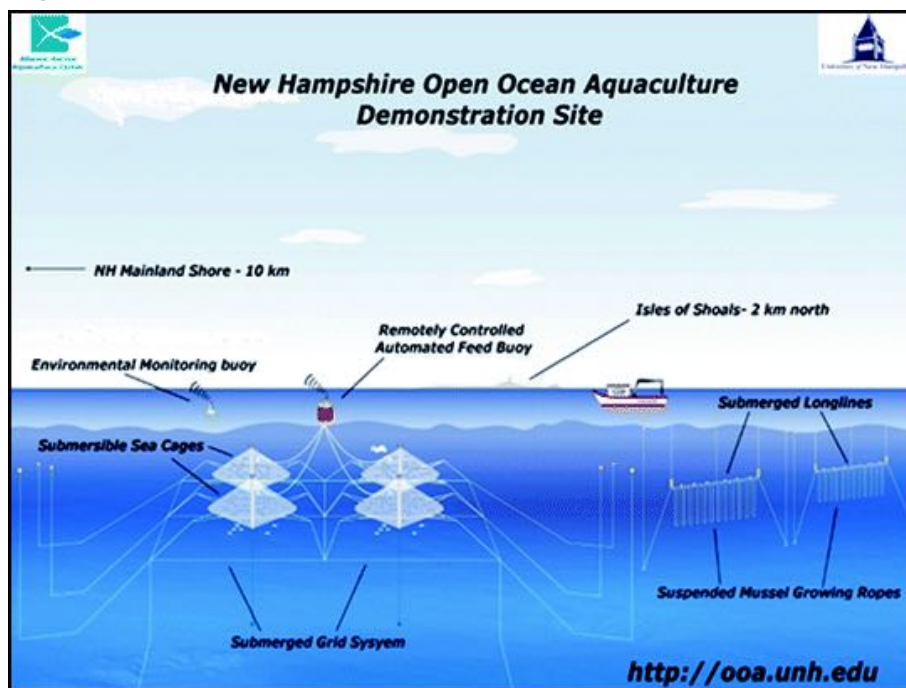
⁶⁶ <https://intertradeireland.com/innovation/fusion>

⁶⁷ A new RAS farm producing white-legged shrimp (*Litopenaeus vannamei*) in England is not coastal and supplies as live/fresh to top restaurants seeking a more sustainable option (see <https://flogrosystems.com/>). The production process is described in this video: <https://www.youtube.com/watch?reload=9&v=S7SQcCYPC4E>

⁶⁸ E.g. https://www.argyll-bute.gov.uk/sites/default/files/seaweed_farming_feasibility_study_for_argyll_and_bute_report_december_2019.pdf

systems (as illustrated in Figure 10) require servicing by vessels and port-based operations and maintenance facilities in much the same way that offshore energy does.

Figure 10 New Hampshire Open Ocean Aquaculture Site



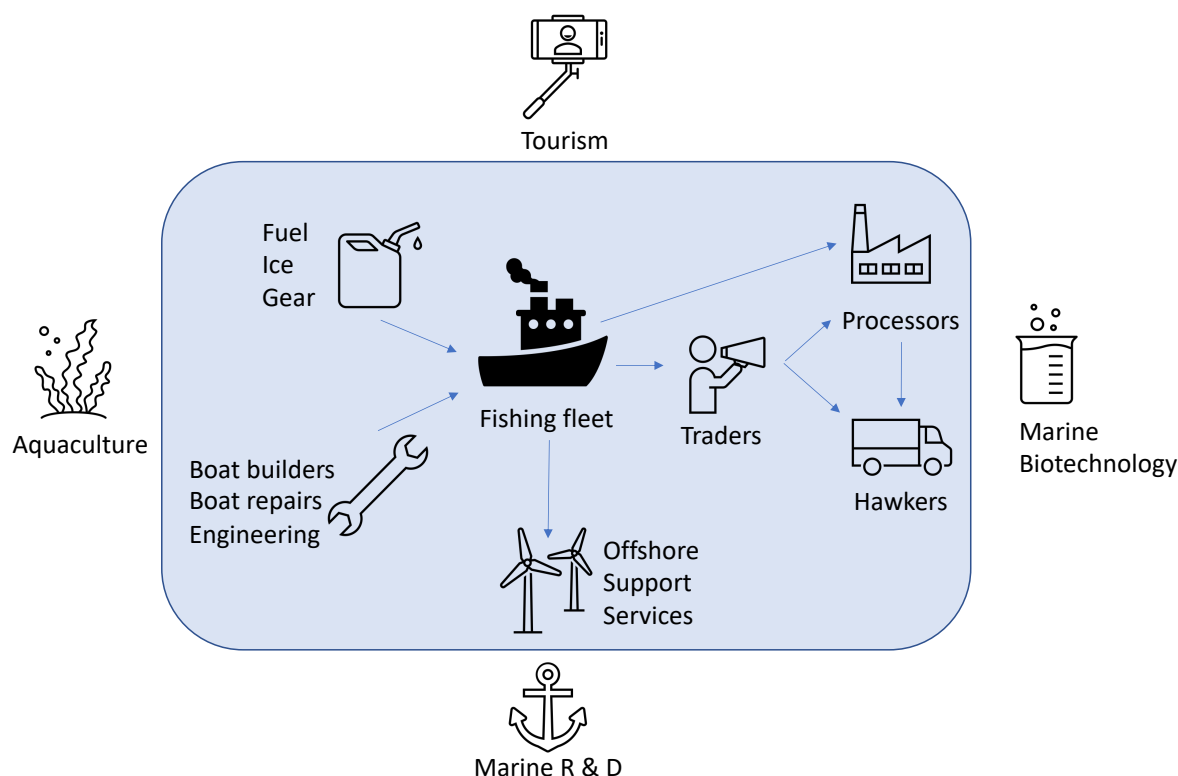
Source: Gosberg et al, 2017

5. Socio-economic contribution

5.1 Port Inter-dependencies

Figure 11 illustrates the main connections between current (light blue area) port-based economic sectors. Outside of the current sectors are shown four sectors considered in this report that have the potential to benefit from the NIFHA ports and its current sectors. There are of course many other interconnections between these sectors as well as with other local businesses and the local community. For most either directly or indirectly, there is a dependence on the fishing fleet.

Figure 11 Connectivity with current and potential port-based enterprises



5.2 Socio-economics of the NI seafood sector and NIFHA ports

A business census approach was taken by determining the turnover and employment for all businesses related to the NI seafood supply chain as well as other port-based businesses.

The **direct** socio-economic contribution to the economy by the seafood sectors 'fishing' and 'processing' is estimated based on published data from Seafish and DAERA respectively, supplemented by industry interviews and company accounts. Aquaculture, which would be considered a direct element of the seafood sector, is not included as it does not currently use the NIFHA ports⁶⁹.

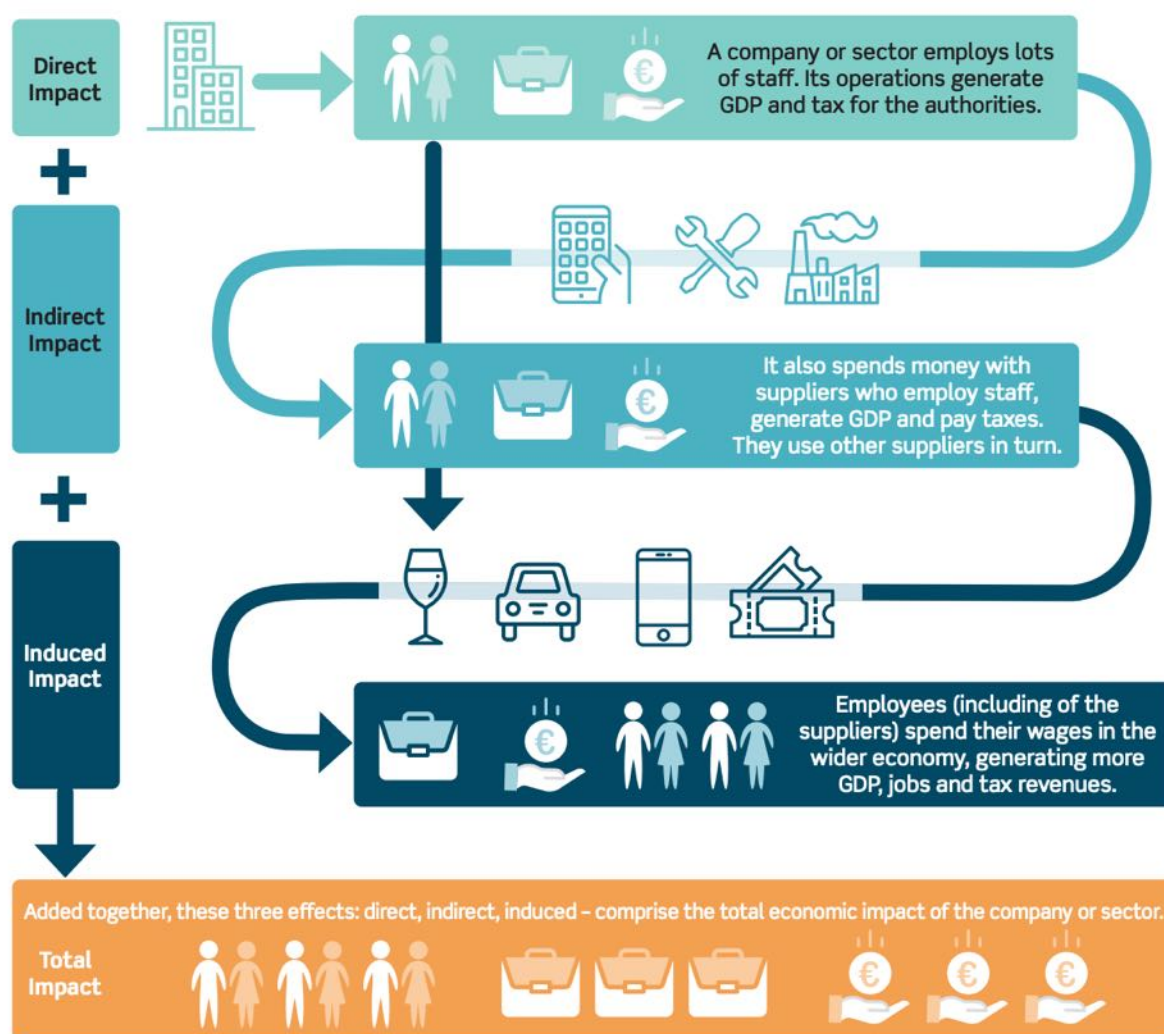
The **indirect** contribution comes from the 'upstream' ancillary sectors supplying goods and services to these direct sectors (fishing and processing) and from 'downstream' sectors that trade and transport the products coming from the fishing and processing sectors. Another emerging sector that makes a

⁶⁹ With the exception of one processor conducting depuration of farmed shellfish at their port-based premises.

significant contribution to the port economy is the offshore services sector. This is also indirectly linked to the fishing sector as the fleet & crews are still the main assets used by this sector, although some specific investment in assets is also evident for this sector. There is no published data specific to these indirect sectors and so data was derived from industry consultation and published accounts.

Figure 12 describes how these direct and indirect sectors are linked and considered when assessing the economic impact of these activities. In addition to direct and indirect impacts on the economy, the impact of spend from employee wages in the wider economy, the induced impact, can also be included to determine total impact. The values calculated in this report reflect the direct impact of the fishing and seafood sector and port-based businesses, but do not include indirect or induced expenditure. The business case for investment in the sector under the FSDP will consider the total impact of proposed investment compared with a 'Business As Usual' scenario.

Figure 12 Economic Impact Assessment



Source: Oxford Economics, 2019

Table 4 presents a breakdown of the enterprises, employment, turnover and GVA per sector for each NIFHA port and other areas. This was collated using published data sources (2019 unless otherwise stated), interviews, company accounts and research to identify the enterprises in each sector. Association with a specific port is based on a business being located within 5 km of that port.

Further details and notes on the methodology and data sources are presented in **Appendix F**.

Table 4 Socio-economics of the NI seafood sector and NIFHA ports

		Ardglass	Kilkeel	Portavogie	Other	Total	source	notes
Fishing fleet	enterprises	40	88	48	141	317	MMO	1
	jobs (FTE)	126	401	143	234	905	seafish/STECF	
	turnover	£ 6,174,018	£ 16,732,257	£ 7,119,220	£ 14,622,924	£ 44,648,419	seafish/STECF	
	GVA	£ 3,314,414	£ 8,823,988	£ 3,836,398	£ 8,209,271	£ 24,184,072	seafish/STECF	
Processing	enterprises	4	10	2	8	24	Poseidon	
	jobs (FTE)	57	440	6	142	645	Poseidon	
	turnover	£ 7,951,848	£ 61,382,684	£ 837,037	£ 19,828,431	£ 90,000,000	DAERA	2
	GVA	£ 2,766,559	£ 21,355,894	£ 291,217	£ 6,898,588	£ 31,312,258	seafish/STECF	3
Other downstream	enterprises	6	10	3	5	24	Poseidon	
	jobs (FTE)	14	73	10	55	152	Poseidon	
	turnover	£ 323,134	£ 2,370,843	£ 1,813,713	£ 2,887,199	£ 7,394,889	seafish/STECF	
	GVA	£ 112,423	£ 824,849	£ 631,016	£ 1,004,497	£ 2,572,785	seafish/STECF	4
Ancillary	enterprises	3	17	4	1	25	Poseidon	
	jobs (FTE)	9	99	15	8	131	Poseidon	
	turnover	£928,490	£ 16,670,200	£1,547,483	£ 1,335,602	£ 20,481,775	Poseidon	6
	GVA	£ 443,611	£ 4,879,725	£ 768,438	£ 409,834	£ 6,501,608	NISRA	5
Other NIFHA port (offshore services)	enterprises	0	4	0	0	4	Poseidon	
	jobs (FTE)	0	16	0	0	16	Poseidon	
	turnover	£1,051,854.81	£3,330,873.55	£1,168,727.56	£1,402,473.08	£6,953,929	Poseidon	7
	GVA	£ 299,791.19	£ 1,737,981.20	£ 333,101.32	£ 399,721.58	£ 2,770,595	NISRA	5
Total	enterprises	53	129	57	155	394		
	jobs (FTE)	206	1029	174	439	1849		
	turnover	£ 16,429,345	£ 100,486,858	£ 12,486,181	£ 40,076,629	£ 169,479,012		
	GVA	£ 6,936,799	£ 37,622,438	£ 5,860,170	£ 16,921,911	£ 67,341,318		

Notes:

- 1 Enterprises = fleet numbers. Turnover is fishing income (non-fishing income part of 'other port services')
- 2 Breakdown of turnover (DAERA data) based on FTE derived from Poseidon consultation/business accounts
- 3 GVA per FTE from STECF proc data
- 4 GVA as % of turnover in processing sector
- 5 GVA per FTE per NI district (NISRA data)
- 6 Kilkeel turnover from Kilkeel Harbour Works data minus turnover from non-ancillary member companies
- 7 Turnover is a combination of offshore services company turnover plus fleet non-fishing income (Seafish)

The total estimated direct impact from fishing and seafood processing in Northern Ireland comes from 341 enterprises with a turnover of £135m (£90m processing, £45m fishing) and 1,520 FTE jobs (875 in fishing and 645 in processing). These result in an estimated GVA of £55.5million.

Other port-based sectors contribute a further £34.8m in turnover and 300 jobs to the NIFHA port economies. Nearly 400 companies provide direct contributions to the fishing, seafood and fishing port economies that amount to £169.5million in turnover, 1,849 FTE jobs and £67.3m in GVA. Three quarters of this comes from enterprises located at and around the three NIFHA fishing ports⁷⁰. The surrounding districts of Newry, Mourne and Down (Ardglass & Kilkeel) and Ards & North Down provide an even larger proportion of fishing fleet employment, including in the pelagic sector (operating from Belfast and beyond, but crewed by County Down fishermen) and many of the under 10m vessels operate along the County Down coastline.

Figure 13 and Figure 14 show the turnover and employment per port for each sector, illustrating that:

- The majority of seafood turnover and employment is located in and around Kilkeel with enterprises located around the harbour creating more than £100m in turnover and over 1,000 jobs. Overall turnover is six times larger than for Ardglass and five times more are employed in these sectors in Kilkeel.
- Kilkeel is a hub for seafood processing and for the ancillary sector with its cluster of engineering and boat repair businesses.
- Processing accounts for 61% of the turnover in Kilkeel and nearly half of the turnover in Ardglass.
- The majority of sector employment in Ardglass, Portavogie and other areas results directly from the fishing fleet.
- Portavogie in particular is reliant on the fleet itself for turnover (57%) and employment (82%).

⁷⁰ 60% of business are located in and around the NIFHA ports. The great majority of those in other areas are the under 10m fishing fleet dispersed around the NI coast.

Figure 13 Turnover per seafood sector per port (%)

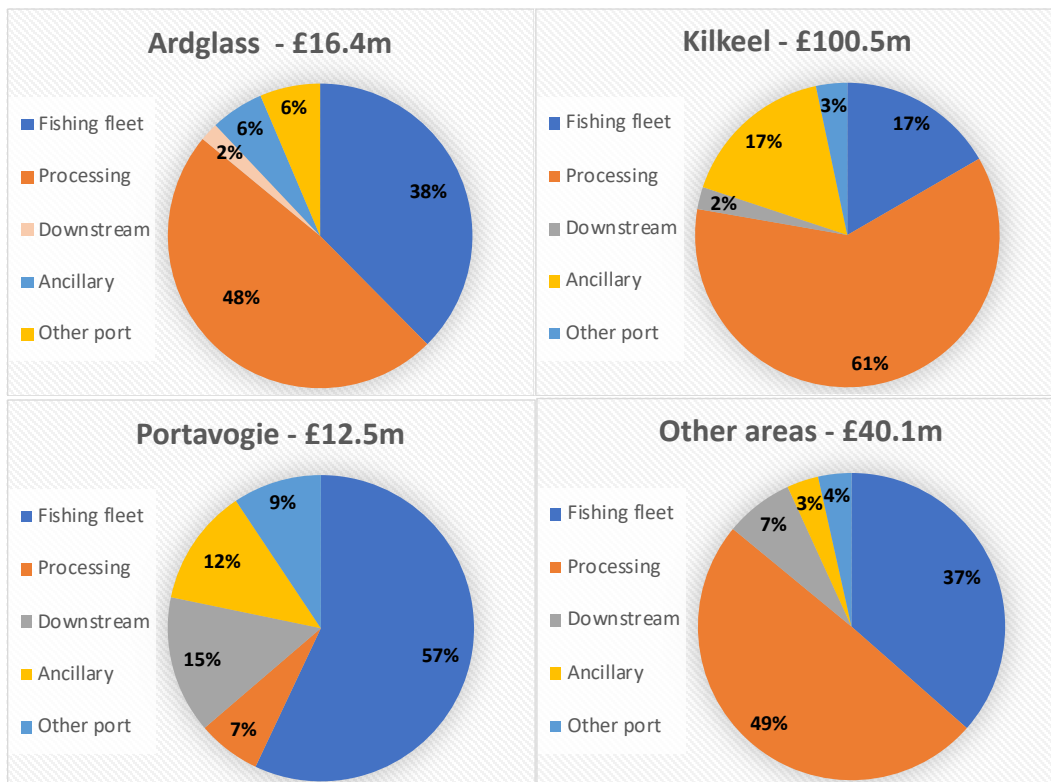
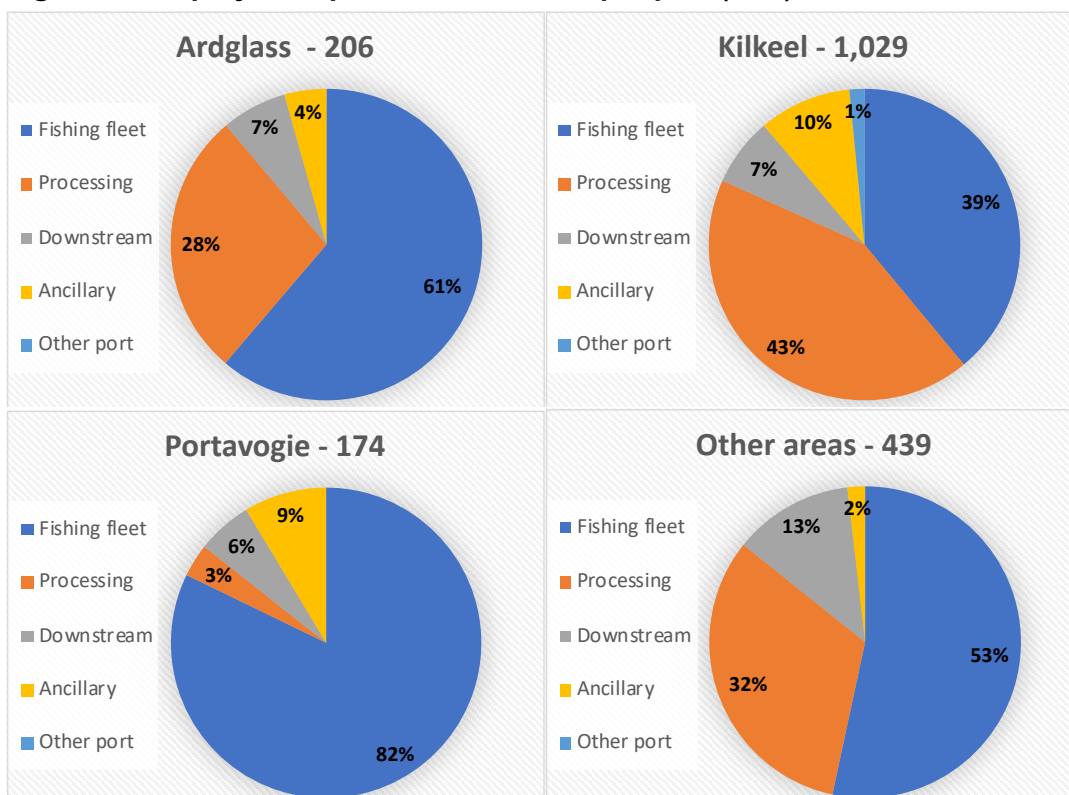


Figure 14 Employment per seafood sector per port (FTE)



5.3 Comparative contributions

This section considers the figures calculated above within a local and regional context. Newry, Mourne & Down District Council (NMDDC) includes both Kilkeel and Ardglass; Ards & North Down Borough Council (ANDBC) includes Portavogie. The wards containing the ports are all within the top quartile in terms of employment deprivation and among the 30% most deprived based on the Northern Ireland Multiple Deprivation Measure (NISRA, 2019).

The Mournes District Electoral Areas (DEA), which includes Kilkeel, had 1,600 registered businesses in 2020, indicating that the 129 business associated with Kilkeel port account for 8% of enterprises. Downpatrick DEA, which includes Ardglass had 775, indicating that the 53 business associated with Ardglass port account for 7% of enterprises. These immediately illustrate the significance of fishing and seafood to the local economy.

'Agriculture, forestry and fishing' accounted for £164 million of sales for the NMDDC region. The £23m in turnover by the fleets fishing out of Ardglass & Kilkeel accounts for 14% of this. However, in terms of sales, 'Advanced engineering and manufacturing', which would include the electrical and mechanical engineering by other port-based businesses, is more significant with £658m of sales in 2019 (NMDDC, 2020). The ancillary sector, providing vessel services to the fleet, mostly in Kilkeel accounts for around 3% of this.

The NMDDC local development plan estimates that the fishing fleet and fish processing sector provide 1,920 jobs in the district. The fishing fleet supports 1,300 jobs and a further 620 jobs in the fish processing sector. (NMDDC, 2018)⁷¹.

In NMDDC, 73,000 are employed, 15,000 are self-employed and 75% of these are in the private sector (Invest NI, 2020). The seafood sector therefore accounts for 2% of overall employment for the district and 3% of private sector employment. These figures illustrate the regional importance in both economic and social terms of the economic activity associated with the NIFHA ports.

At a more local level, the contribution is of course far more significant with the seafood sector providing significant employment in the DEAs associated with each of the three NIFHA ports. Employee jobs in The Mournes DEA, which includes Kilkeel, were 8,153 in 2017 (NISRA, 2017), indicating that the 1,029 FTEs in enterprises at Kilkeel port is around 13% of employment.

For the Downpatrick DEA, including Ardglass there were 7,762 jobs recorded in 2017 with 92% of these being in services. The 206 jobs identified around Ardglass harbour represent 3% of the DEA total, but they represent 35% of non-service sector employment, which is important for diverse employment options in the area.

Portavogie is within the Ards Peninsula DEA where 3,170 employee jobs were reported in 2017 with 81% in the service sector. The 174 jobs directly associated with the port therefore represent 5.5% of employment and 29% of non-service sector jobs in the DEA.

It is also useful to compare these figures with another local port, Warrenpoint, where a recent economic impact assessment reported 150-200 on-site workers and a port user GVA of £25million (Hogg, 2017). Direct comparisons should be treated with caution given the different approaches taken, but overall this illustrates that Warrenpoint (the second largest port in Northern Ireland) has a considerable throughput

⁷¹ These figures are larger than the values in the previous section for Ardglass & Kilkeel as other fishing and processing activity occurs in the district and the total includes induced expenditure (the spend by seafood sector employees in the local economy) which is not included in the values presented above.

of £6.2bn, which does generate local social and economic benefits. However the far greater number of enterprises associated with the NIFHA ports create comparatively more GVA and far more employment.

5.4 Economic Development Policy

The economic development policies for the areas in which NIFHA ports are located shows that local authorities (NMDDC for Ardglass and Kilkeel, ANDBC for Portavogie) recognise the potential for economic development from the maritime sectors making up the blue economy:

- ANDBC's Integrated Tourism Regeneration and Economic Development Strategy 2018-2030 is summarised by the phrase 'Blue Green, Creatively Connected' which looks to expand the blue and green economies of the Borough.
- NMDDC's Regeneration and Economic Development Strategy (2020-2025) proposes to 'Support Entrepreneurship, Business Growth and Innovation, including through efforts to stabilize and develop existing sectoral strengths in Advanced Manufacturing and Engineering' and 'Agri-food & fishing' as well as supporting new and emerging sectors. 'Investing in Regeneration and Modern Infrastructure is another strategic priority.

Recent job losses in foreign-owned companies brought about by the Covid-19 crisis, including those seen at Collins Aerospace in Kilkeel, reinforces the risk posed by a reliance on Foreign Direct Investment (FD) and highlights the importance of support to indigenous industries like fishing and local SMEs such as those surrounding the NIFHA ports.

More specific to proposed developments at and around the ports, new Local Development Plans (LDPs) set the overall planning framework to support economic and social needs. These will be 'in line with regional strategies and policies, including recommendations and preferred options for the use of land for economic development and business use' (NMDDC, 2020). ANDBC and NMDDC are in the process of developing LDPs to steer planning in their regions to 2030.

NMDDC's Preferred Options Paper recognizes the Kilkeel harbour development as a strategically important project for the district and that 'there is a need to consider whether existing zoned land will be adequate to meet potential increased demand as a consequence of improved infrastructure over the Plan period'. It also states that 'in considering the impact of the Kilkeel harbour development project the LDP will also be mindful of the district's secondary fishing port of Ardglass and its redevelopment plans...both Kilkeel and Ardglass are key harbours and the LDP will seek to support the economic growth of both ports.' (NMDDC, 2018).

ANDBC's Preferred Options Paper from March 2019 sets out intentions that are not specific to locations as yet, but it does recognize the importance of Portavogie when proposing the designation of the undeveloped coast as a Coastal Area where development would be restricted: 'The policy would provide scope for regionally significant proposals that, due to operational requirements, have to be located in the coastal zone, such as any future expansion proposals for Portavogie Harbour, the second largest commercial fishing port in Northern Ireland' (ANDBC, 2019)

The LDPs for NIFHA port locations that will steer local planning decisions up to 2030 are still to be finalised, but the preferred options produced by the councils give a strong indication that planning would support proposed development associated with the harbours.

5.5 Port Development

The Stage 1 report assessed the capacity of the NIFHA ports in terms of the current and expected future needs of the fishing fleet. Below we consider the port needs of the seafood and other port businesses described in this report. Those needs include accessibility and sufficient depth of water, as well as the availability of land within the harbour estate for existing businesses (processing and vessel repair) to expand and for new sectors to become established (e.g. offshore Operation & Maintenance Facilities or marine biotech linked with waste treatment facilities).

Water

For the vessel servicing and repair sector, port capacity is a direct constraint to both the potential market available to the companies (limited by port access, water depth and slipway dimensions) and the amount of customers it can service (limited by space availability on the slipways).

The vessel servicing and repair sector is mainly based in Kilkeel. The Economic Appraisal of Kilkeel Harbour Development considered the following options for increased boat repair capacity (SIB, 2016):

- Synchro-lift and repair/decommissioning facility
- Dry-dock / additional slips
- External Harbour with dry-dock & slips

The synchro-lift option was considered the minimum works necessary to increase the capacity of the engineering / boat repair services of the harbour. A cost of £1.45 million was estimated for this option (£1m for synchro-lift and £0.45m for hardstanding areas). A cost of £3.75 million is estimated for the dry-dock, additional slips and hardstanding. It is not clear how accurate these cost estimates are, especially given they are to an extent integrated into the external harbour option. It is also unclear that a dry dock is feasible as a stand-alone option as it is assumed that the external harbour would create the additional space required.

The economic appraisal determined that the synchro-lift option would provide a relatively modest 20% increase in capacity. This appears to be due to the limited utility the 100t specification given, which would enable only the smaller vessels (est. 12m and below) to be moved. If a larger specification synchrolift⁷² were combined with a well-designed transfer system and hard standing area, more and larger vessels could be accommodated. This would increase the resulting benefits to the engineering and repair sector, which may then reflect a positive net present value (NPV) as was estimated for the dry-dock option.

The most appropriate specification and design for vessel servicing should be outlined along with the resulting costs. The scope of the outline design and costing work that was recommended in the Stage 1 report could be expanded to include outline design and cost of servicing infrastructure. This would enable its integration in port design and any cost savings to be identified.

Land & buildings

NIFHA's 2018 annual report stated that "NIFHA has, with the exception of one location in Portavogie, no available space to rent in any of the three harbours, which generally reflects the high level of demand

⁷² <https://syncrolift.com/> give examples of several different ship lift systems, most with substantially more capacity than 100t. Boat hoists are an option for smaller vessels, e.g. the 75t lift in Killybegs: <https://mooneyboats.ie/yard-facilities/boat-lifting/>

for good property.” NIFHA-owned land & building assets (see **Appendix B** for maps of NIFHA-owned port areas) remain close to full capacity. NIFHA plans to develop small business units at the Parkgate site in Portavogie and there are possible plans for the privately-owned fish factory buildings in Ardglass harbour.

The landside extent of the Ardglass and Portavogie harbour estates both have the space available for landside development. Portavogie requires investment to upgrade property assets and to future-proof development space against coastal flooding. Ardglass has several existing sites that could support quayside development, but much of the properties are not NIFHA-owned, making it difficult to integrate these into harbour development plans.

Kilkeel harbour estate lacks sufficient space for businesses to operate effectively and to enable expansion. This is to be partly alleviated through granting quayside access for some privately-owned land behind the fish market⁷³. These plans only partly address some of the landside constraints in Kilkeel and result in this element of the port’s future landside development being outside NIFHA’s direct control.

Figure 15 Satellite view of Kilkeel harbour and surrounding land



Source: googlemaps

The potential opportunities identified for port-based industries and the blue economy as a whole indicate that more land-side space is needed in the long term, particularly at Kilkeel if it is to take full advantage of increased port capacity. Achieving all the potential benefits of port infrastructure development requires full consideration of the landside needs in terms of space, buildings and access. A South East Coast Masterplan developed in 2013 includes Kilkeel (DSD, 2013), but the focus is on the town centre of Kilkeel, rather than port-related aspects.

⁷³ NIFHA Chief Exec pers. comm.

A port master planning exercise would be highly beneficial to each port development project to (a) ensure consistency with local and regional development plans; and (b) engage with the numerous public agencies associated with these sectors.

At its core, a port masterplan will nearly always include a map, setting out the physical extent of plans for change. The map should result from a detailed process of strategic thinking that delivers the best possible contribution to commercial growth, the local economy, and the local environment whilst working with a practical understanding of the risks and constraints facing the port (BPA, 2019). The FSDP Stage 1 and 2 reports provide much of that strategic thinking.

The port masterplan can factor in the practical constraints facing the port (land use, transport etc.) and help to determine the optimal use and configuration of available land. A port masterplan should form part of the environmental and technical studies to be undertaken for the proposed port development projects, even though the time horizon would be much longer than these individual projects.

6. Conclusions & Recommendations

6.1 Conclusions

Seafood Trade

A substantial NI/GB seafood trade includes NI imports of the 'big five' (salmon, tuna, shrimp, cod and haddock) that are most popular with UK consumers. Beyond this internal UK market, Northern Ireland exports about twice as much seafood (£61.7m in 2019) as it imports (£31.1m). The EU is its largest seafood market, including significant cross-border trade with Ireland on all species landed by the NI and ROI fleets.

For processed fish, GB is the destination for 46% of sales and sales into ROI are only 8%, while exports to the rest of the EU are more significant at 27% of total sales. Trade into France Spain and Italy is dominated by high value shellfish (*Nephrops*, scallops, crab and lobster). Export markets to Asia, particularly for crab, have also grown substantially in recent years.

Processing sector

In 2018 Northern Ireland's Food & Drinks processing sector was estimated to have a turnover of £5.2 billion, of which fish processing accounted for 2% with an estimated turnover of £90million (DAERA, 2020). This latest data shows a 39% increase for fish processing over the last ten years and is likely to be an underestimate of the total turnover by the seafood processing sector, which is dominated by micro-enterprises.

Of the 71 seafood processing establishments licensed by the FSA in Northern Ireland, 26 (37%) are based in and around Kilkeel, 8 at Ardglass and 9 in Portavogie. Official figures report 633 employed in fish processing in 2018, but a review of available recent accounts for those businesses gives a total of more than 700 employed.

NI's contribution to UK production of scampi and exports of whole langoustine is considerable, with raw material for NI processors coming both from direct landings and from the rest of the UK and Ireland. The scampi processing sector has seen growth following a period of consolidation, with the largest processor continuing to invest in Kilkeel as its centre for UK scampi production as the site allowed for expansion and, most importantly, offered a skilled local workforce.

Growth in other seafood processing sub-sectors is constrained by the ability of NI processors to compete for available raw material. New local raw material sources could emerge in the short term with recovery of Irish Sea whitefish stocks, specifically haddock, and in the long-term through the development of the aquaculture sector in Northern Ireland.

NI processors face other common issues including labour (costs and availability) and waste. In the long-term labour challenges, particularly for the prawn fleet, should be addressed through automation, which is actively being explored by some processors and such innovations should be supported.

Economies of scale in dealing with varied waste streams (*Nephrops* shell & heads, scallop shell, crab shell, whitefish trimmings and pelagic processing waste) are difficult to achieve. The relatively close proximity of most processing facilities around the NIFHA ports creates the potential for a collective approach to increasing value from by-products. Moving towards a circular economy should link with and underpin the development of NI's marine biotechnology sector in using seafood by-products.

Consumer trends indicate that there will be increasing demand for the seafood landed into NI ports from continental Europe's higher spending seafood consumers and emerging markets such as Asia, that have the volume of consumers willing to pay a premium for high value seafood products.

A focus on quality for NI's key shellfish products is consistent with a growing interest in provenance, linked to responsible sourcing. Northern Ireland producers should be able to capitalise on this interest with supply chains that involve relatively short distances and few transactions.

Ancillary sector

All NIFHA ports host businesses that supply goods and services to the fishing fleet. Local businesses supply fuel, fishing gear (assembly rather than fabrication), specialist electronics and general provisions to the local fleet. The fleet spend on these operational costs supports several local businesses and associated employment.

But it is in the supply of vessel servicing and repair where NI businesses have grown beyond the needs of the local fleet. 55% of turnover by these businesses supplying a range of engineering and boat repair/construction services comes from vessels outside NI. The availability of maintenance and repair facilities for the fishing fleet around the Irish Sea is limited and Kilkeel has built a reputation for good quality work at a reasonable cost. These businesses also supply services to the processing sector and other companies making up the NI seafood sector. Recruiting suitably qualified engineers has been difficult in recent years.

The fleet service companies are dependent upon the port's infrastructure, which the companies making up the cluster in Kilkeel identify as the most significant constraint to growth. The availability of slipway space and space adjacent to the slipways limits the number of vessels that can be serviced at any one time. With the trend towards larger vessels for both fishing fleets and guard vessels, the physical limitations of the slipways will increasingly limit the potential market available to the vessel services

Other port-based industries

Offshore developments (e.g. pipelines, cables, energy platforms, wind farms and potentially aquaculture) require both vessel and port-based services.

NI offshore vessel service companies have grown from being a provider of useful additional income to the fishing fleet, to become a sector in its own right providing services and expertise well beyond the Irish Sea. Invest NI has identified that with future offshore renewable developments and its established track record, the NI sector could double to more than £20m per annum. Given the growth in guard vessel services, the NIFHA ports could be promoted to Irish Sea developers as locations operation and maintenance facilities.

As with the fishing fleet, harbour capacity restricts the size of vessels that these NI companies would ideally invest in for guard work. Larger vessels can be deployed further offshore, in more challenging conditions, for longer periods and have more space for crew comfort, which is important for contracts that could last several weeks.

Other potential sectors requiring ports and related services

Blue economy sectors that could be associated with the NIFHA ports include tourism (currently evident to a very limited extent), aquaculture, marine biotechnology and other maritime training and R&D.

Balancing the interests and needs of tourism with working ports is notoriously difficult to achieve, but plans should recognize the potential benefit to tourism and ensure adequate provision for visitors.

The most likely future demand for port infrastructure from aquaculture comes from the development of offshore aquaculture (stand-alone sites or co-located within wind farms) requiring servicing by vessels and port-based operations and maintenance facilities in much the same way as offshore energy.

Marine biotechnology, training and R&D associated with the ports is likely to emerge from linkages with commercial partners, e.g. processors seeking solutions to waste streams or the vessel services cluster seeking targeted training. Workspace and support for business incubators (as seen with Iceland's Ocean Cluster) would help to kick-start these sectors in the NIFHA ports.

Port Capacity

Economic sectors within the blue economy present many future opportunities. NIFHA ports require sufficient port capacity and land-side space to enable the private sector to take up those opportunities.

Ardglass and Portavogie harbour estates have the space available for landside development, but Portavogie requires investment to upgrade property assets and to future-proof development space against coastal flooding. There are several existing sites that could support quayside development in Ardglass, but several properties on the estates are not NIFHA-owned, making it difficult to integrate these into harbour development plans.

At Kilkeel, a cluster of seafood processing and vessel service enterprises is evident. These account for the majority of turnover and employment, but growth is limited by port capacity. The port capacity needs of the boat repair and offshore services are similar to the fishing sector, namely increased accessibility and water depth to accommodate larger vessels. More land is required in Kilkeel that is adjacent to the port for current enterprises to grow and for new sectors to establish.

The future needs of current and potential port-based businesses are difficult to specify, but a lack of space in Kilkeel and multiple ownership of Ardglass harbour properties are clear constraints to future development.

6.2 Recommendations

1. Include the specification of boat repair infrastructure (boat lifting and transfer) in the ToR for the Kilkeel Harbour Outline Design and Cost work to be commissioned.
2. NIFHA should look to acquire land adjacent to Kilkeel harbour and properties within Ardglass harbour for future development of the harbour estates.
3. The technical studies should include port master-planning to ensure the needs of current and potential port-based sectors are given due consideration.

Appendix A: References

ANDBC (2018) Ards and North Down Borough Council Integrated Strategy for Tourism, Regeneration and Economic Development. <https://www.ardsandnorthdown.gov.uk/business/integrated-strategy-2018-2030>

ANDBC (2019) Ards and North Down Borough Council Local Development Plan 2030 Preferred Options Paper. <https://www.ardsandnorthdown.gov.uk/images/assets/ANDBC-POP-Consult-17-May-2019.pdf>

BPA (2019) Port Master Planning: Planning for the future. British Ports Association & ABP Mer. https://www.britishports.org.uk/system/files/documents/port_masterplanning_-_planning_for_the_future_0.pdf

DAERA (2020) Size and Performance of the NI Food and Drink Processing Sector <https://www.daera-ni.gov.uk/publications/size-and-performance-ni-food-and-drinks-processing-sector>

DoE (2019) Offshore Renewable Energy Strategic Action Plan (ORESAP) Progress Report <https://www.economy-ni.gov.uk/sites/default/files/publications/economy/ORESAP-progress-report-to-March%202019.pdf>

DSD (2013) South East Coast Masterplan <https://www.communities-ni.gov.uk/publications/south-east-coast-masterplan>

EC (2020) Blue Bioeconomy Forum: Roadmap for a blue economy <https://op.europa.eu/en/publication-detail/-/publication/7e963ebb-46fc-11ea-b81b-01aa75ed71a1/language-en/format-PDF/source-115609569>

ERC (2020) The interrelationship between R&D, Innovation and Productivity: Evidence for micro-enterprises. Dr Hoang Minh Luong and Professor Nola Hewitt-Dundas. Queens University Belfast / Enterprise Research Centre. April 2020.

EUMOFA (2018) Blue Bioeconomy: Situation Report and Perspectives. https://www.eumofa.eu/documents/20178/84590/Blue+bioeconomy_Final.pdf/aa20747f-55b8-4c85-bdae-63c67245cdfa?version=1.0

EUMOFA (2019) Norway Lobster in the EU. Price Structure in the Supply Chain.

Gosberg et al (2017) Technological Approaches to Longline- and Cage-Based Aquaculture in Open Ocean Environments. In Aquaculture Perspective of Multi-Use Sites in the Open Ocean https://link.springer.com/chapter/10.1007/978-3-319-51159-7_3

Hart, Abarasi (2020) Mini-review of waste shell-derived materials' applications <https://doi.org/10.1177/0734242X19897812>

Hogg (2017) Warrenpoint Harbour Authority Economic Impact Assessment. Ryan Hogg for Warrenpoint Harbour Authority.

Huntington & Cappell (2020). English Aquaculture Strategy. Final Report. Produced by Poseidon Aquatic Resources Management Ltd for the Seafish Industry Authority.

Invest NI (2020) Newry, Mourne & Down Council Briefing Sept. 2020

NISRA (2017) Business Register and Employment Survey 2017. <https://www.nisra.gov.uk/statistics/annual-employee-jobs-surveys/business-register-and-employment-survey>

NISRA (2019) Northern Ireland Multiple Deprivation Measure (NIMDM) 2017 Results by DEA. <https://www.nisra.gov.uk/publications/nimdm-2017-dea-results>

NMDDC (2017) Newry, Mourne and Down Tourism Strategy (2017-2022) https://www.newrymournedown.org/media/uploads/nmd_tourism_strategy_20172022.pdf

NMDDC (2018) Newry Mourne and Down Local Development Plan 2030 Preferred Options Paper. https://www.newrymournedown.org/media/uploads/nmd_local_development_plan_2030_pop_medium_web_version.pdf

NMDDC (2020) Newry Mourne and Down Regeneration & Economic Development Strategy 2020-2025 https://www.newrymournedown.org/media/uploads/nmd_regeneration_economic_development_strategy_2020-2025.pdf

Oxford Economics (2019) The Economic Impact of the Seafood Sector. Oxford Economics Report to BIM. Main report August, 2019. <http://www.bim.ie/media/bim/content/publications/fisheries/ports-2020/BIM-Economic-Impact-of-Seafood-Sector-report-main.pdf>

Poseidon (2018) Cappell, R., Huntington, T., Nimmo, F., and MacNab, S. UK scallop fishery: current trends, future management options and recommendations. Report produced by Poseidon Aquatic Resource Management Ltd.

Seafish (2019) State of the Nation. Report on Consumer Seafood Buying Preferences <https://www.seafish.org/insight-and-research/consumer-research/>

Seafish (2020) Economic Performance of the UK Fishing Fleet

Seaweed for Europe (2020) Hidden champion of the ocean: Seaweed as a growth engine for a sustainable European future. <https://www.seaweedeurope.com/hidden-champion/>

SIB (2016) Economic Appraisal of Options for the Development of Kilkeel Harbour. Strategic Investment Board report for Kilkeel Strategic Partnership.

STECF (2020) Annual Economic Report on the EU Fishing Fleet. Report STECF 20-06.

SWC (2012) Sustainable Kilkeel 2020: Scoping Study. South West Regional College Innotech Centre for Invest NI

UUEPC (2019) Belfast City Region Future Skills Needs. Ulster University Economic Policy Centre

Appendix B: NIFHA Fishing Port Maps

Figure 16. Ardglass harbour area, source: NIFHA

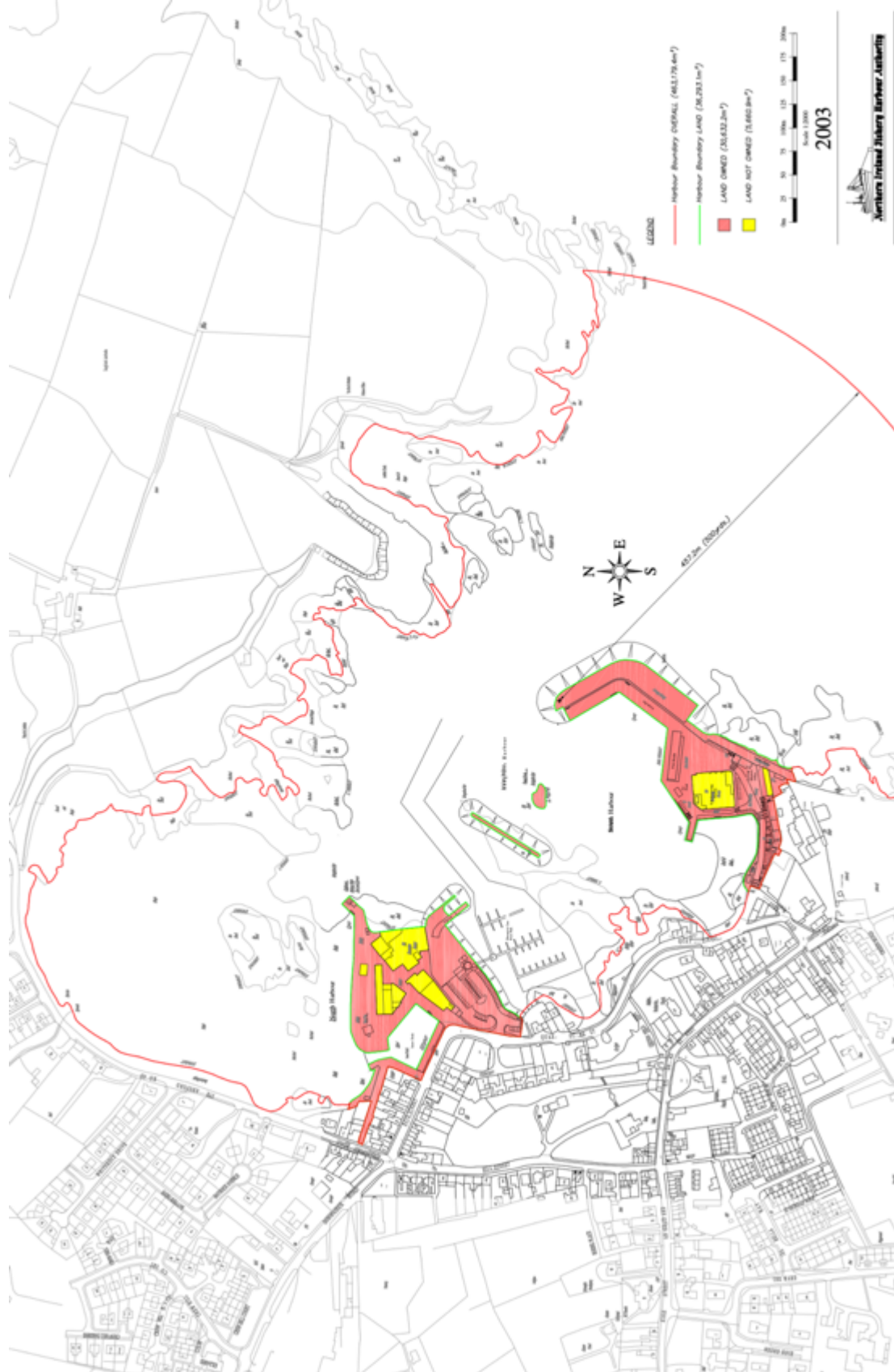
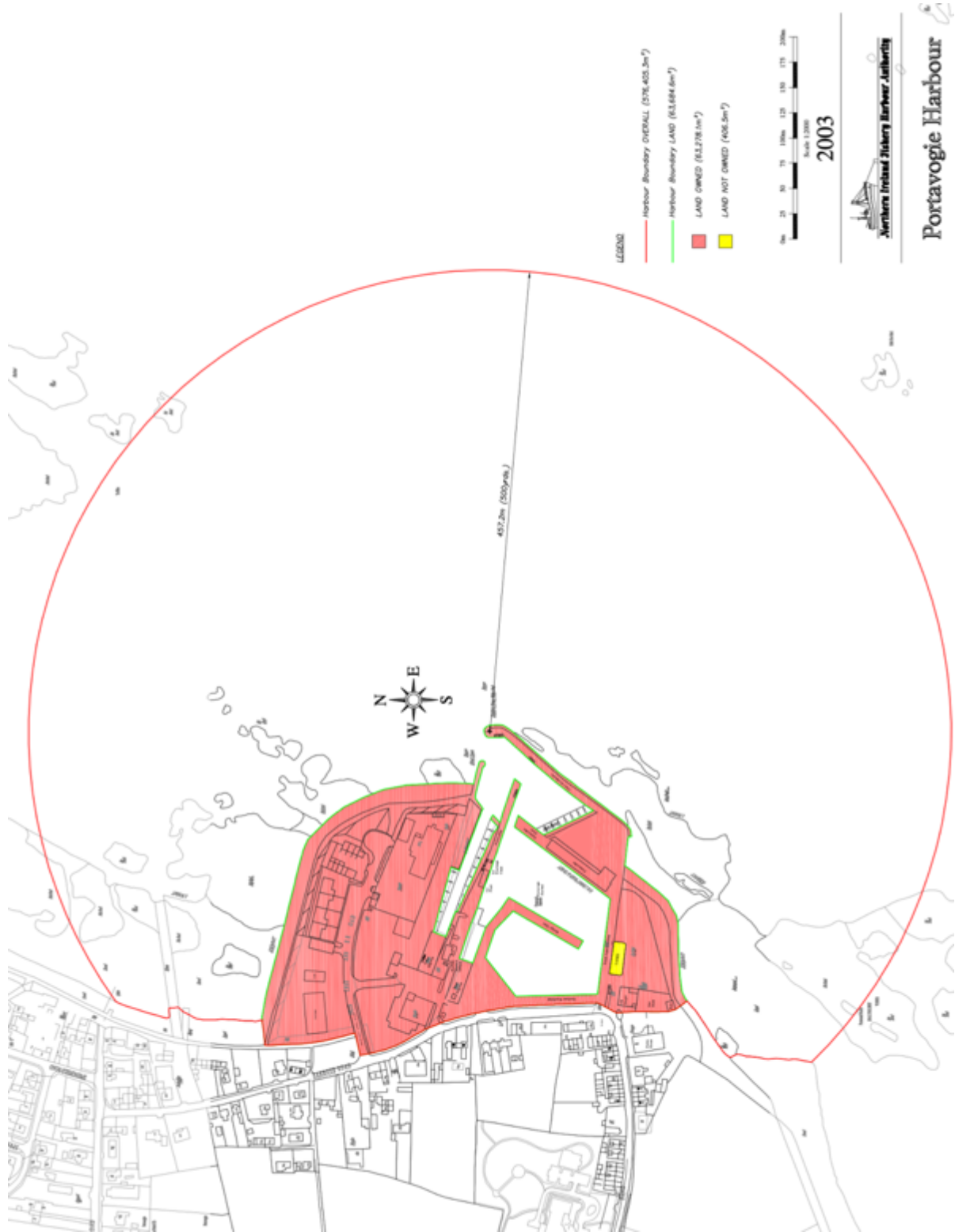


Figure 17 Kilkeel harbour area. source: NIFHA



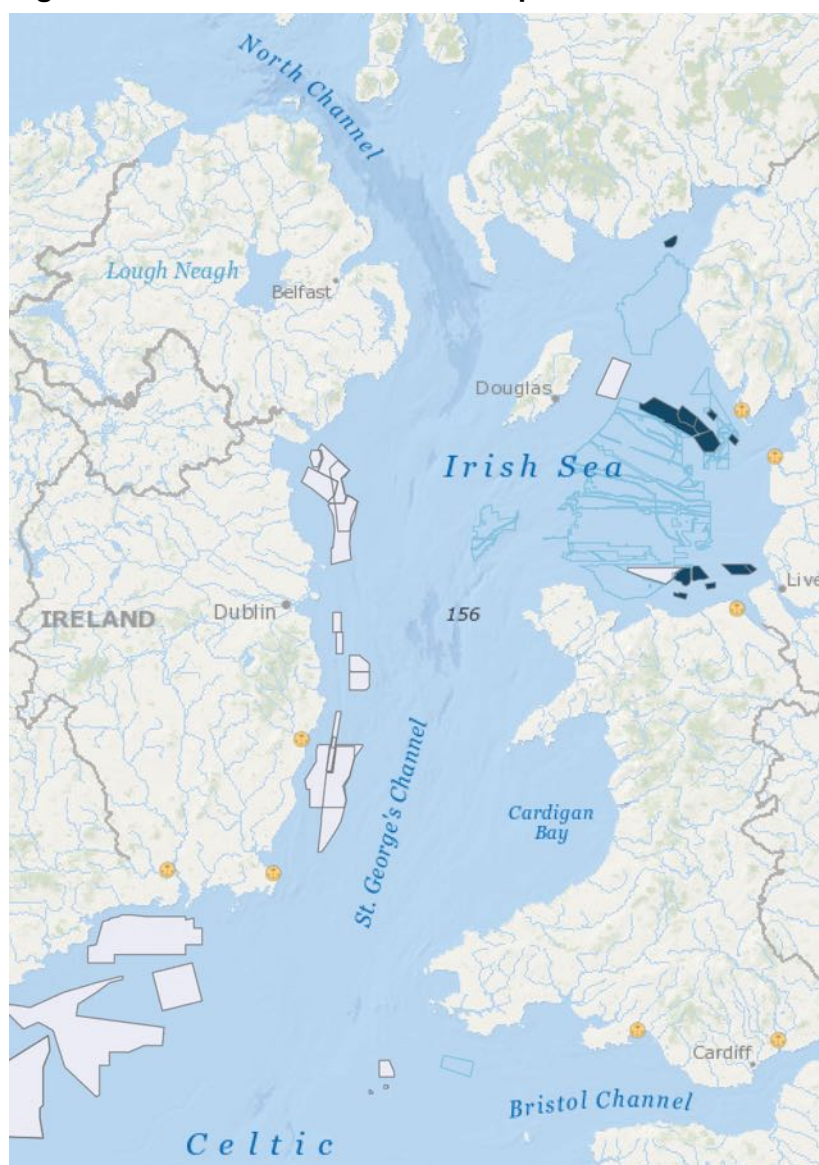
Figure 18 Portavogie harbour area. source: NIFHA



Appendix C: Marine Renewable Energy in the Irish Sea

This section identifies some of the known and potential activities in and around the Irish Sea and gives examples of proposed and existing operation and maintenance facilities (OMF). Figure 19 shows the sites that are both operational, under construction and licensed. Construction has to date been in English waters in the Eastern Irish Sea (dark blue) with more in the planning stages (light grey) for this area and more recently in the Western Irish Sea in Republic of Ireland waters in response to Irish government commitments of 5GW of offshore wind capacity by 2030. Not all of the prospective developments shown are expected to progress through planning and become operational.

Figure 19 Offshore wind farm developments in the Irish Sea



Source: <https://www.4coffshore.com/offshorewind/>

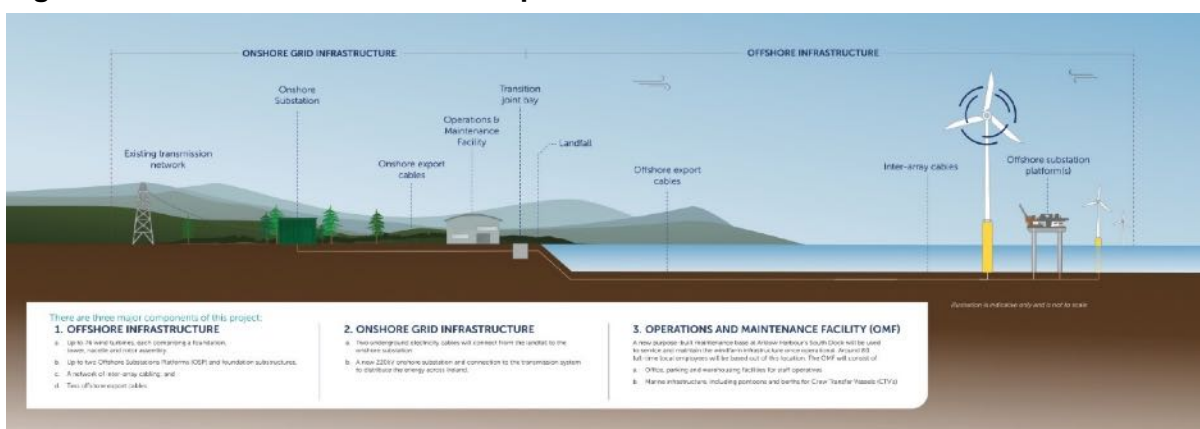
The assembly and installation of these huge offshore developments requires the large-scale port capacity and facilities evident available at Belfast. In 2012 Belfast Harbour invested £53 million to develop a greenfield site into a dedicated offshore wind terminal with the support of Ørsted A/S, an

offshore wind developer. The development of the port has been successful, handling approximately 305,000 tonnes of wind farm components in 2017⁷⁴.

Offshore wind farm developments also require operation and maintenance facilities at convenient locations, as exemplified by the Beatrice Windfarm base at Wick harbour in Scotland, resulting in £15million investment that created 65 jobs during its construction, and 90 jobs for long term operational roles across the 25-year lifecycle of the offshore wind farms in the region⁷⁵. To support the Arklow Bank Wind Farm⁷⁶ SSE plans include a new purpose-built maintenance base at Arklow harbour that will support around 80 full-time local employees and consists of:

- Office, parking and warehousing facilities for staff operatives
- Marine infrastructure, including pontoons and berths for Crew
- Transfer Vessels (CTV's)

Figure 20 Offshore and onshore components of Arklow offshore wind farm



Source: SSE Renewables

Another example is the privately owned Port of Mostyn in North Wales (Figure 21). In addition to being a windfarm construction port, Mostyn also hosts the OMF for RWE Npower's North Hoyle, Rhyl Flats and Gwynt-y-Mor windfarms, creating jobs for the duration of their 25 years operational lifespan.

Figure 21 Gwynt Y Mor OMF at Port of Mostyn & wind farm locations



Source: PortofMostyn.co.uk

⁷⁴ <https://www.offshorewind.biz/2018/02/19/belfast-harbour-offshore-wind-terminal-sets-record-in-2017/>

⁷⁵ <https://www.beatricewind.com/wick>

⁷⁶ <https://www.sserenewables.com/offshore-wind/projects/arklow-bank/>

Appendix D: Blue Biotech Projects

The EU terms biotechnology that uses marine-derived materials the Blue Bioeconomy and in 2018 EUMOFA reviewed activities across Europe (EUMOFA, 2018). At the end of 2019 the EU's Blue Bioeconomy Forum produced a roadmap to help address 14 identified challenges (Table 5).

Table 5 Way forward for the Blue Bioeconomy

Challenges	Solutions
Policy Environment, Regulation	
Licences / Permits	Simplify licence and permit applications ~ Harmonise regulatory and legislative requirements ~ Improve clarity about activities through the establishment and adoption of standards ~ Provide clarity on the status of underutilised marine biomass ~ Create one-stop-shops where businesses can obtain (free) advice on regulations in blue bioeconomy sector and product requirements ~ Work towards the harmonisation of marine spatial planning and multi-use
Novel food and feed	Offer support for applications under the Novel Food Regulation ~ Conduct the necessary studies for the authorisation of more types of biomass ~ Ensure the accuracy and consistency of the EU novel food list ~ Provide necessary support to novel food applicants
Ecosystem services	Valorise ecosystem services ~ Take stock of ecosystem services pilots and support their deployment ~ Secure high-level support for payments for ecosystem services and create cohesion between Common Agriculture and Common Fisheries Policies ~ EU strategy for an institutional framework for ecosystem services across European seabasins ~ Incorporate marine ecosystem services into macro-regional strategies, projects and initiatives ~ Ensure that ecosystem valuation studies become an integral part in decision models for specific marine management decisions
Finance and business development	
Understanding finance	Increase understanding of investment landscape for projects and businesses ~ Provide blue bioeconomy start-ups with advice on business and financing
Investment mechanisms	Promote uptake of existing funding mechanisms and set up new ones to support projects and start-ups ~ Establish investment funds for blue bioeconomy ~ Provide additional support to SMEs in the blue bioeconomy sector
Skills and qualifications	Ensure availability of skilled and qualified human resources ~ Upcoming sectors and start-ups require more flexible skilled people (including basic business skills)
Consumers and value chains	
Consumer acceptance	Increase consumer awareness and acceptance ~ Improve understanding on the value of blue products ~ Define a communication strategy to raise consumer awareness of blue products ~ Design more supportive regional policies on blue sector ~ Support the blue sector advocacy groups in the EU

Side products	Increase the valorisation of rest raw material from fisheries and other aquatic biomass ~ Enforcement of the landing obligations given by the EU Fisheries policy ~ More research on use of underused fish and other marine biomass ~ Develop regionally: pilot plants for proof of concept at semi-industrial scale; bio-refineries as 'lighthouse' projects to encourage further investment
Production costs	Support the reduction of blue production costs ~ Provide partial coverage of R&D costs for entrepreneurs in the blue sector ~ Planning and building of clusters of blue production in the EU with biorefineries and other production / research facilities ~ Provide investment in silos and biorefinery facilities that can stabilise the input into processing industries
Logistics and seasonality	Support solutions for biomass processing ~ Support further scientific research on: impact of seasonality on biomass characteristics; crops and harvesting optimisation; logistical challenges and pre-processing techniques (biomass specific) ~ Set up knowledge exchange on developing system of distributed production of marine biomass ~ Open data platform with data (e.g. from ongoing monitoring of water quality)
Science Technology and Innovation	
Researcher-industry dialogue	Facilitate dialogue and cooperation between research and industry ~ Develop measures to incentivise researchers / companies to collaborate ~ Launch exchange programmes for students and staff in industry
Marine exploration	Support solutions for marine exploration ~ Facilitate exploration of marine environment
Research infrastructures	Support a network of research infrastructures ~ Mapping: optimise use of research infrastructures ~ Reduce gap of qualified people for running and maintaining research infrastructures – especially engineering profiles ~ Build a European blue bioeconomy ecosystem ~ Build research infrastructure and financial tools to sustainably use / operate (joint) facilities
Access to data	Promote open data and access to research findings ~ Define structure of an open access results database, making use of existing data structures (e.g. EMODnet, EOSC) ~ Construct an open access results database

Source: EC, 2020

Below we present some examples with two UK bio-tech companies followed by some EU collaborative projects supported through Horizon 2020 and the €3.7billion Joint Undertaking with Bio-Based Industries (bbi-europe.eu).

Marinatex <https://www.marinatex.co.uk>

MarinaTex, the 2019 winner of the James Dyson Award for innovation, was created as a final year project by Lucy Hughes at the University of Sussex. Studying Product Design, Lucy developed an interest in utilising waste products and looking to nature for inspiration. She got in contact with MCB Seafoods, a fish processing plant and wholesaler in Newhaven. A tour of the plant identified various waste streams to work with including offal, blood, crustacean & shellfish exoskeletons and fish skins & scales. After researching the different waste streams it became apparent that the fish skins and scales had the most potential locked up in them due to their flexibility and strength enabling proteins. This is combined with agar from red algae to produce a flexible film for packaging, which is expected to be in commercial production by 2021.

Marine biopolymers <http://www.marinebiopolymers.co.uk>

MBL was formed at the end of 2009 with the aim of becoming a leader in multi-component extraction of natural polymers from seaweed. There is a growing global demand for natural materials whose origins are clear and whose use is both safe and effective.

Currently based near Ayr on the South West coast of Scotland, the company is located to use the many types, and abundant quantities, of seaweed species indigenous to Scottish coastal waters that are used for our target seaweed components. Their focus is on extracting high value components from brown seaweeds (*Laminaria hyperborea* and *Ascophyllum Nodosum*) for use in a range of applications, primarily “human” ones such as food and pharmaceuticals, but also in different industrial application areas as well, where the use of natural polymers is growing fast.

Although the longer term aim is to extract a range of components, the starting point is alginate, typically the largest single component in brown seaweeds, and a well-established, versatile and safe natural polymer.

Blueshell <http://www.marinebiotech.eu/blueshell>

An EU research project led by University of Ghent and including Dublin Institute of Technology. The overall aim of BlueShell is to explore different aspects of bioactivity in fermented/hydrolysed shellfish by-products which can serve as a basis for new high-value products aiding a sustainable supply of safe, health promoting foods.

Currently about 70% of annual shellfish production ends up as by-products. Apart from use in chitin/chitosan, this marine biomass is used to either make fertilizer/low value products or is sent to landfill, incinerated or dumped at sea. BlueShell will address this problem by exploring 3 typical shellfish by-products; shrimp shells, crab shells and defect mussels, for potential (bio)active compounds targeted at the sustainable supply of safe, healthy foods.

Hydrolyzed by-products are thus far limited to **brown crab** and Blueshell has attempted the production of a proteinaceous powder using different enzymes that gave various protein-yields.

Aquabio Pro-FIT <https://www.aquabioprofit.eu/>

In Norway a consortium of 12 partners, is working together to explore how to utilise hundreds of thousands of tons of marine sidestream products such as fish heads, backbones and intestines that are currently discarded and instead convert them into ingredients for food, feed and other products in high-

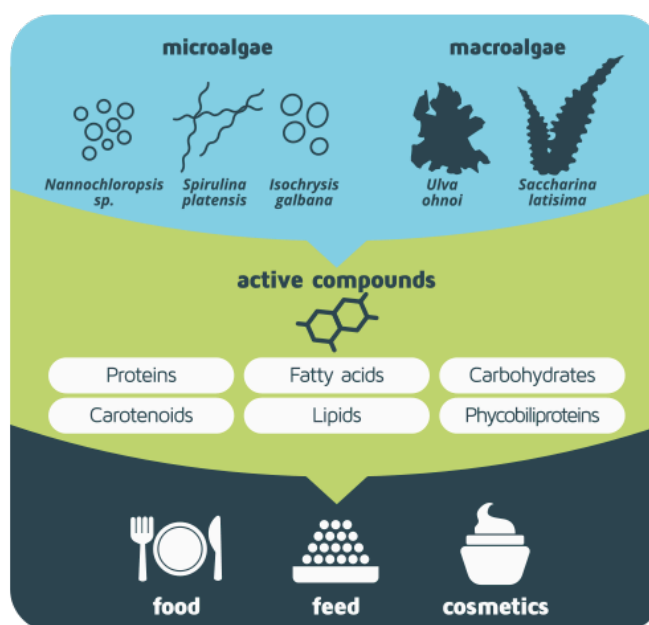
value markets. AQUABIOPRO-FIT focuses on 6 types of ingredients that can be isolated from the side streams for applications in food, feed, cosmetics and pharmaceuticals:

- marine protein concentrates,
- ω -3 rich phospholipids and oils,
- bioactives (proteins, oligopeptides, amines, nucleotides and pigments),
- collagen,
- minerals and
- tunicate meal fractions (protein rich and cellulose).

The end products will include: supplements for help improved athlete performance, anti-anxiety and anti-depression remedies and improvements to body pH balance, skin health and hair growth.

Biosesea <http://biosea-project.eu/>

The overall objective of BIOSEA is the development and validation of innovative, competitive and cost-effective upstream and downstream processes for the cultivation of 2 microalgae (*Spirulina platensis* and *Nannochloropsis* sp.), and 2 macroalgae (*Ulva ohnoi* and *Saccharina latissima*) to produce and extract at least 6 high value active principles at low cost (up to 55% less than with current processes) to be used in food, feed and cosmetic/personal care as high-added value products. The **innovation** is from applying them on algae or in combination with other techniques for recovery of multiple compounds from the same feedstock, which will require technological adjustment & optimizations.



Source: biosea-project.eu

Appendix E: Future Fuels

The Stage 1 report (Appendix D) introduced the subject of how a future fishing fleet may be fuelled in a decarbonised future. This is further developed below to account for recent developments, the linkages between other maritime sectors and to explore the implications for future port infrastructure.

Fishing vessels are currently fuelled by marine diesel oil. With a net zero carbon target by 2050 set by the UK Government⁷⁷, however, a transition to 'clean fuels' can be expected across all sectors, driven by UK and NI government commitments.

In marine transport, 2020 saw the global adoption of International Maritime Organisation (IMO) caps on sulphur levels in the fuel oil used by all marine vessels⁷⁸. The marine industry and refineries have adapted to supply of low sulphur fuel to meet the targets set. However, the net zero carbon target will require a fundamental shift away from fossil fuels.

A critical question is which fuel will be most readily available? And this directly links with developments in the renewable energy sector. As set out in **Appendix C**, on renewable energy, the Irish government has set a target of 5GW of offshore wind by 2030⁷⁹, much of it located in the Irish Sea. With this comes the challenge of how to link this supply to energy demand. This is being addressed on multiple fronts with inter-connectors to the larger energy market of Britain, enabling export, but also through developing storage solutions. Currently around a quarter of NI's wind generated energy is lost due to the supply exceeding demand. This percentage loss would grow significantly unless storage solutions are found. Hydrogen is one such storage solution.

The medium term may see a transition phase with the increased use of biofuels and synthetic fuels in existing combustion engines and the introduction of hybrid power systems, switching to electric when feasible to do so.

In the longer term, marine transport, like land-based transport, is expected to adopt carbon-free fuels such as hydrogen and ammonia⁸⁰, combined with electrical systems. There are already research and development projects looking into how these new fuel systems can be applied in the fishing sector. In Japan, a prototype vessel is being designed powered by a hydrogen fuel cell⁸¹.

The incorporation of new technology will ultimately influence vessel design as new engines are developed and fuel storage solutions are found. Both hydrogen and ammonia have lower energy density than existing fuel oil. Compressed hydrogen gas is easy to store, but has eight times less energy by weight and liquid hydrogen, which must be stored at extremely low temperatures, is still four times less than diesel oil. Ammonia has only a third of the energy density of diesel oil. This has implications for the space required for fuel storage: both on land and at sea the potential need for more space on board vessels for future fuel storage.

⁷⁷ <https://www.gov.uk/government/news/uk-becomes-first-major-economy-to-pass-net-zero-emissions-law>

⁷⁸ <https://www.imo.org/en/MediaCentre/HotTopics/Pages/Sulphur-2020.aspx>

⁷⁹ <https://www.irishtimes.com/business/energy-and-resources/next-two-years-critical-for-ireland-s-offshore-wind-energy-sector-1.4429164>

⁸⁰ <https://www.motorship.com/news101/alternative-fuels/the-marine-fuels-for-the-motorships-of-the-future>

⁸¹ <https://fuelcellworks.com/news/japan-to-power-fishing-boats-with-toyotas-hydrogen-fuel-cells/>

Appendix F: Socio-economics of NI seafood sector and NIFHA ports

This section presents describes the methods used the results for the socio-economic analysis in more detail.

Method

A business census approach was taken by determining the turnover and employment for all businesses related to the NI seafood supply chain as well as other port-based businesses. This establishes a baseline against which the impact of investment proposed under the FSDP can be assessed.

We have collated information on turnover and employment from company accounts and from consultations with those seafood businesses (fishing, processing, traders, transporters, ancillary) as well as other port-based enterprises, namely offshore vessel services.

There was also consultation and data-gathering in relation to blue economy sectors (aquaculture, marine biotechnology, R&D, tourism) to explore their potential to develop and use of the NIFHA ports in the future. These sectors do not form part of the socio-economic analysis as there understood to be no significant contribution to the port economies to date.

The fleet data held by MMO and DAERA provided the number of vessels per type by port, while the FSA data on premises licenced to handle fish provided the basis for the number of enterprises within the processing sector, as well as downstream. Socio-economic data was derived from a range of sector-specific sources. The majority of data derives from 2019 and some from 2018. Values for the direct sectors (fishing and processing) could be derived from published data by Seafish and DAERA respectively. This was supplemented by industry interviews, online business searches and company accounts, particularly in the allocation of values between ports. For the indirect sectors, with no sector-specific data published, the values were estimated based on industry interviews, online business searches and company accounts. Data gaps were filled using relative values and where direct sector values were not available, e.g. GVA for the indirect sectors, regional values per employee are used. This is a weakness as GVA varies considerably by sector.

Direct impact

The **direct** contribution of the seafood sectors 'fishing' and 'processing' to the economy is estimated using the following socio-economic metrics:

- Number of enterprises
- Number employed (FTE)
- Turnover

- Gross Value Added (GVA)

Aquaculture, which would be considered a direct element of the seafood sector, is not included as it does not currently use the NIFHA ports (other than one processor conducting depuration of farmed shellfish at their premises).

Indirect impact

The indirect impact is effectively the contribution from sectors that are indirectly dependent on the seafood sector. This distinction is useful as these sectors still make a direct contribution to port economy and not all of the revenue to these businesses is derived from the local fishing and processing sectors: some traders bring in raw material from outside the port and vessel services are provided to non-local vessels.

Although every effort has been made to take the relationships between sectors into account, summing the totals of each sector may result in some double-accounting with overlap across supply chains. This is, however, minimized through considering specific sectors as direct or indirect instead of assessing each sector in terms of direct, indirect and induced.

This differs from the approach taken by Oxford Economics in its 2019 assessment of Irish fishing ports, which adapted Irish input-output tables to the local port economies based on survey responses. As in this report, it considers the fishing, processing and aquaculture sectors as direct, but it derived indirect and induced expenditure from the transactions by those direct sectors as set out in the input-output tables. 'For GVA, employment and wages, total indirect & induced impacts are calculated by summing those from the processing sector and a share of the indirect & induced impacts from the fishing and aquaculture sub-sectors (as indicated by survey responses showing the extent to which local processors account for their total sales). The remainder of the fishing/aquaculture sub-sectors' indirect impacts will already be accounted for in the indirect & induced impacts from the processing sub-sector' (Oxford Economics, 2019).

Induced impact (not included)

The induced impact is economic activity and employment supported by those directly or indirectly employed spending their income on goods and services in the wider economy. This typically includes jobs in retail and leisure outlets, companies producing consumer goods and in a range of service industries.

The induced expenditure is not included in this report as this is usually derived from input-output tables, but if required it could be estimated using the Oxford Economics values as proxies. The contribution from induced impact could be expected to be proportionately similar relative to direct impacts for the same direct seafood sectors.

Results

Table 6 Socio-economics of the NI fishing fleet per port

	Ardglass	Kilkeel	Portavogie	Other	Total		
over 10m	vessels	18	57	20	24	119	MMO, Jan 2020
	jobs (FTE)	110	378	122	147	757	seafish
	turnover	£ 4,570,218	£ 14,472,357	£5,078,020	£ 6,093,624	£ 30,214,219	seafish/STECF
	GVA	£ 2,363,299	£7,483,779	£2,625,888	£ 3,151,065	£ 15,624,031	seafish/STECF
under 10m	vessels	22	31	28	117	198	MMO, Jan 2020
	jobs (FTE)	17	23	21	88	149	seafish
	turnover	£ 1,603,800	£2,259,900	£2,041,200	£ 8,529,300	£ 14,434,200	seafish
	GVA	£ 951,116	£1,340,208	£1,210,511	£ 5,058,206	£ 8,560,041	seafish
Total	vessels	40	88	48	141	317	MMO, Jan 2020
	jobs (FTE)	126.426	401	143.14	234.318	905	seafish/STECF
	turnover	£ 6,174,018	£ 16,732,257	£7,119,220	£ 14,622,924	£ 44,648,419	seafish/STECF
	GVA	£ 3,314,414	£8,823,988	£3,836,398	£ 8,209,271	£ 24,184,072	seafish/STECF

Sources: MMO, Seafish, STECF

Over 10m

Allocation to ports: Others includes Greencastle and other ROI ports, 3 pelagics listed at Belfast (2) and Londonderry. 4 Kilkeel boats and 1 Portavogie boat listed to Scottish admin ports

Fleet assumed to consist of the following Seafish segments:

Area VII Nephrops over 250kW (41%), under 250kw (49%), UK scallop dredge under 15m (10%)

Data for the 3 pelagic vessels is based on STECF data

Under 10m

2 Kilkeel and 2 Portavogie boats listed to Scottish admin ports. 110 list Belfast as admin port

Figures based on Seafish under 10m ports and traps segment.

