The Economics of Orkney's Fishing Industry

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1. Executive Summary

Orkney's fishing industry is worth over £13.81million to the Scottish economy, with an average vessel GVA of £67,600 and responsible for approximately 297 full time equivalent positions. The economic benefits of Orkney's fishing industry extend beyond vessel owners and operators and into the wider community. Upstream and downstream industries in the form of suppliers, buyers, and wholesalers benefit from the activity of the fleet, and council investment in fishing quota -worth £2.225million- has helped fund a variety of projects including the Housing Build Project and the Scapa Flow Oil Port. The economics of the industry contributes directly to fisher economic decision-making, with increased competition within the fleet, stagnant market prices, and restricted management legislation threatening the economic (and environmental) sustainability of the industry.

Contents

2. Introduction

Orkney's fishing industry is an important contributor to the local economy, with an average vessel GVA of £67,600 and responsible for approximately 297 full time equivalent positions. The economic benefits of Orkney's fishing industry extend far beyond vessel owners and operators and into the wider community. Upstream and downstream industries in the form of suppliers, buyers, and wholesalers benefit from the activity of the fleet, and council investment in fishing quota -worth £2.225million- has helped fund a variety of projects including the Housing Build Project and the Scapa Flow Oil Port.

The benefits of Orkney's fishing industry are felt beyond Orkney. In 2014 the industry contributed £13.81million through direct, indirect, and induced effects to Scotland's national economy.

When compared to the average Scottish under 10m pot and trap vessel, Orkney's pot and trap industry overperforms, earning 96% more fishing income and landing 27% more per day at sea. However, the average Orcadian pot and trap vessel also earns an average of 27% less per tonne landed and 104 more days at sea than the average under 10m Scottish vessel.

Indicators suggest that the economics of Orkney's pot and trap fleet is well-balanced, with healthy return on investment ratios. However, stagnant market prices, alongside high levels of competition within the fleet and restrictive fisheries access laws mean the long-term economic sustainability of the industry is thrown into doubt. The link between sustainable fishing behaviour and industry economics should not be ignored. Understanding the economic values that influence a fisher's decision-making process may help promote more economically and environmentally sustainable management decisions.

3. Methodologies

This report combines economic and sociological data, to give a thorough overview of the state of Orkney's fisheries, its influence on the local economy and community, as well as the opportunities and threats to its future. As such, it draws upon both qualitative and quantitative data, collected through both primary and secondary sources. As this report relies on a range of resources (including national datasets, sociological texts, and interviews with members of the community) an effort has been made to ensure the robustness of the findings. To do this, this report adheres to the following codes of best practice and industry guidelines:

- UK Fisheries Economics Network, 2012, *Best Practice Guidance for Fishing Industry Financial and Economic Impact Assessments*
- Mackinson, S., Mangi S., Hetherington, S., Catchpole, T., Masters, J. 2017. *Guidelines for Industry-Science Data Collection: Step-by-step guidance to gathering useful and useable scientific information*. Fishing into the Future report to Seafish. 65p. June 2017.
- Fisheries and Agriculture Organisation, no date. *Methods for Studying the Cultures of Small-scale Fishing Communities.* Available at: www.fao.org/docrep/0040Y1290E/y1290e07.htm#bm07

Fifty-three interviews were carried out, thirty-four of which were with active fishers and seven of which with fishers who had left the industry. Each interview was conducted using a series of open-ended questions, designed to touch upon the core themes of the project (economic values, decision-making processes, and economic linkages), while allowing interviewees to bring up their own views and concerns organically, to ensure their unique experiences were not lost. Each interview was recorded, and transcribed and analysed using the qualitative analysis software NVivo 11 Pro. At the end of each interview, interviewees were asked to recommend someone else who might be interested in being contacted to take part in the study. This 'snowball' method of accumulating contacts within the industry not only ensured maximum coverage of individuals who were contacted, but also gave insight into the personal connections within the industry.

All interviews were analysed using NVivo 11 Pro, the methodology of which involved a cyclical process of coding and analysis. Key themes in each interview were assigned a unique code, which could then be compared with codes and themes from other interviews. When potentially important or interesting relationships between these themes were analysed, further coding occurred. Data was subject to a cycle of transcription, analysis, exploration of the results, and further analysis.

This report takes care to explore the decision-making process behind economic behaviour within the fishing industry. Interviews with fishers enabled the various factors influencing their personal operations to be uncovered, allowing common factors such as convenience, tradition, and socio-cultural relationships to be identified. These are explored throughout the report.

3.1. Economic Data Collection

Economic data on the Orkney fishing fleet was collected both through primary sources (in the forms of interviews and questionnaires) and also through secondary sources. Data from Seafish as well as economic profiles generated by Highlands and Islands Enterprise was used to supplement the primary data. In the interest of data protection, economic data is provided as a series of averages, and in cases where the sample size was so small that anonymity could not be ensured, it is omitted (as is the case for the pelagic fishery). Despite this, this report is still able to prove a relatively detailed and comprehensive view of the economics of Orkney's fishing industry, looking at both the income of the vessels, as well as the economic impact of the fleet on supporting industries and the local communities.

3.2. Key Concepts

Economics is largely concerned with how and why individuals make decisions, and the preferences, values, and assumptions they express with their choices (Fishburn, 1968). The decisions and behaviours of individuals are vital when it comes to understanding an industry or an economy. In the case of Orkney's fishing industry day-to-day decisions such as who individuals sell to, who they buy from, what, when, and how they fish affect not only the short-term success of the industry but influence its long term economic and environmental sustainability. Understanding the economic and social concepts behind economic decision-making is vital to understand how Orkney's fishing industry behaves and responds to internal and external forces.

3.2.1. Traditional Economics & Utility Theory

Traditional economic theory is based upon three assumptions: 1) all individuals are rational in their decision-making, 2) individual choices conform with utility theory (in that a customer will choose the option that provides them with the greatest amount of satisfaction), and 3) the opinions and beliefs of individuals changes, and updates as new information becomes available. While many of today's economic tools have been founded on these beliefs, traditional economics is not always suitable when analysing economic trends or behaviours as its core assumptions are often incorrect. Other more

modern schools of thought -such as Behavioural Economics- acknowledge this shortcoming and attempt to understand the 'non-rational' economic decisions underpinning human activities.

3.2.2. Behavioural Economic Theory

Behavioural economics debunks traditional economic theories in its acceptance that not all decisions made by consumers are informed by utility theories, nor is it always possible for our decisions to be rational. Heuristic behaviour (e.g. rules of thumb) can lead to individual biases in decision-making processes.

Behavioural economic theory allows us to account for factors and influences not usually associated with traditional economics. Johnson (2017) draws upon the works of Roelvink et.al. (2015) to say that "economies… should not be seen as autonomous markets…. but… the internally diverse products of particular histories, cultural systems, social relations, and deliberate human (and non-human) action" (Johnson, Dalton, and Masters, 2018). Thus, it becomes apparent that traditional economic tools are insufficient when attempting to create a comprehensive understanding of local economies.

Behavioural economics allows for the influence of society and culture on individual decision-makers and does not assume rationality in individuals. Behavioural economics acknowledges how society, culture, psychology, and emotional factors influence every day decision making, and when used to examine Orkney's fishing industry allows us to see how concepts such as culture and identity influence economic behaviour and decision-making (see Table 1, below).

	ECONOMIC	SOCIAL	CULTURAL
ECONOMIC	-Who to buy from -How much quota you buy	-Who to sell to -How much to pay your crew	-What to fish -Use of foreign vs domestic workers
SOCIAL	-	-Relationships with other fishers	-Relationships with non-fishers
CULTURAL	-	-	-Transmission of knowledge and skills within the industry

Table 1:- A matrix demonstrating how economic, social, and cultural aspects are capable of influencing different behaviours and decisions within the fishing industry.

3.2.3. Legislation, Behavioural Economics, and Orkney's Fishing Industry

Understanding the factors -both internal and external- that influence a fisher's ability and decisions to fish gives us an insight into the challenges and opportunities for fisheries' sustainability. Throughout this report the factors influencing the decisions made by fishers at different stages of the supply chain are explored. The landscape of Orkney's fishing industry today is markedly different from what it was 100 years ago. The advent of on-board engines and the discovery of new markets (see section 10.4) have allowed fishermen to diversify their fishing activity, targeting new grounds and new buyers and increasing their income. Ultimately, however, the financial success of the industry -and individual vessels and fishermen- is dependent on its catch and the price it is able to sell the catch for. There are hundreds of factors influencing an individual's decision of what to fish (and thus what to earn) but ultimately these factors can be divided into three broad categories:

1. Availability- the physical presence of the species.
2. Accessibility – the ability of a fisher to access the species. Factors in this category can be physical (having the correct gear, having a larger boat, weather patterns, being physically able to access the species), or intangible (having access to quota, having the knowledge of how to catch the species).
3. Market- the ability to sell the catch for a profit. Factors influencing the market include the existence of a market, the market price, and the routes to the market.

The economics of Orkney's fishing industry -and of individual fishers- has been heavily influenced by the introduction of fisheries management policies affecting the factors *accessibility* and *market*. Initiatives such as quota and licences have reduced the number of species fishers are legally allowed to catch, while policies and legislation on seafood landings and markets have made pursuing some (traditionally high-value) species such as mackerel uneconomical due to high transport costs. Not only does this have serious implications for the economics of the industry, with many fishers forced to increase their fishing effort for the same returns, but it also has environmental and social consequences. An inability to diversify the fleet and explore new fisheries has led to a concentration of effort onto brown, velvet, and green crabs, lobsters, and scallops. The increased competition within the fleet has forced many fishers to leave the industry (see report *The Continuity of Orkney's Fishing Industry*) putting the long-term continuity of the industry into jeopardy (see section 13).

4. Introduction to Orkney and the Orcadian Fishing Industry

Orkney is an archipelago of over 70 islands located off the northern tip of Scotland. Approximately 20 of these islands are permanently inhabited. Orkney has a higher employment rate than the national

average- 83.7%, compared to 79.9% (Highlands and Islands Enterprise, no date). Traditionally, Orkney's economy was based around the primary industries of fishing and farming, however in recent years industries such as renewable energy, and tourism have expanded. Public administration is the highest employer within Orkney, providing around 36% of all jobs. Orkney's economic landscape is dominated by small firms, and 70% of its working population are employed by businesses with fewer than 50 employees (Highlands and Islands Enterprise, no date)

A study commissioned by OIC and Highlands and Islands Enterprise revealed that many primary industries are overrepresented within the Orkney economy- that is, they are well above the activity levels of that particular industry in the UK as a whole (Cogentsi, 2012). Orkney's fishing industry is the most notable example of this, as Orkney earns more than ninety times more from fishing than the average UK community (Cogentsi, 2012).

5. The Global State of Fishing

Over the past 20 years, fish has been the largest traded food commodity in the world- a trend that is thought to be the result of increased incomes in developing countries as well as a rising global population (Terazono, 2018). Between 1950 and 2014, the world population increased from three to seven billion, and fish capture and production tripled in size during this same period (Johnson, Dalton, and Masters, 2018). In 2014, fish consumption exceeded 20kg per person- with over 50% of this coming from farmed fish (Johnson, Dalton, and Masters, 2018). Increased focus on fish as being a good source of protein and a method of ensuring food security has led to a number of international initiatives promoting sustainable fishing and aquaculture practices (HLPE, 2014). The growth of the aquaculture sector (estimated at 5.3% per year) has influenced the wild fish market by keeping the prices of fish and other seafood products relatively low through the supply effect and the competition effect (HLPE, 2014).

Fish is a widely traded product, with over 70% of all seafood or seafood products being subject to international trade competition. There is a high degree of heterogeneity across the global markets, reflecting cultural tastes and preferences (Johnson, Dalton, and Masters, 2018). Europe is both the largest exporter and importer of fish, with a total value of exported fish and fish products of over £35billion and an import value of £43billion (Johnson, Dalton, and Masters, 2018). See section 10.1 for more information on Orkney's markets.

Exporters			Importers		
	2004	2014		2004	2014
	£millions			£millions	
China	4778	15105	**United States of America**	8614	14628
Norway	2975	7778	**Japan**	10483	10687
Viet Nam	1759	5780	**China**	2250	6120
Thailand	2923	4726	**Spain**	3759	5076
United States of America	2772	4423	**France**	3006	4802
Chile	1800	4214	**Germany**	2019	4467
India	1014	4034	**Italy**	2810	4439
Denmark	2567	3430	**Sweden**	936	3443
Netherlands	1765	3279	**United Kingdom**	2024	3339
Canada	2510	3242	**Republic of Korea**	1620	3075

Table 2:- Top ten importers and exporters of fish and fishery products in 2004 and 2014. Data from Johnson, Dalton, and Masters, 2018.

5.1. Company Structure in Orkney's Fishing Industry

The majority of Orkney's fishing fleet consists of small private vessels (average length 9.6m (Seafish, 2017)) operating as either sole traders or partnerships (meaning there is no legal distinction between the boat, the business, and the owner). There are a handful of larger companies operating within the fleet as private limited companies, the majority of which are private limited with share capital. These larger companies allow a degree of separation between the skippers/owners and the vessel itself as it is classed as a separate legal entity, thus there is less financial risk associated with these businesses although there is more complex administration.

There is a high degree of organisation and inter-connectedness within Orkney's fishing industry. Many individuals are involved with multiple businesses or organisations, reflecting the close ties within the Orkney fishing industry and the community as a whole- see report *The Continuity of Orkney's Fishing Industry* and *The Culture of Orkney's Fishing Industry*. These connections are best illustrated using the connections between the directors and secretaries of private limited companies. Figure 1 maps the connections between named directors and secretaries (marked as grey nodes) associated with private limited Orkney fishing companies (marked as red nodes) with the connecting lines denoting a relationship between the two.

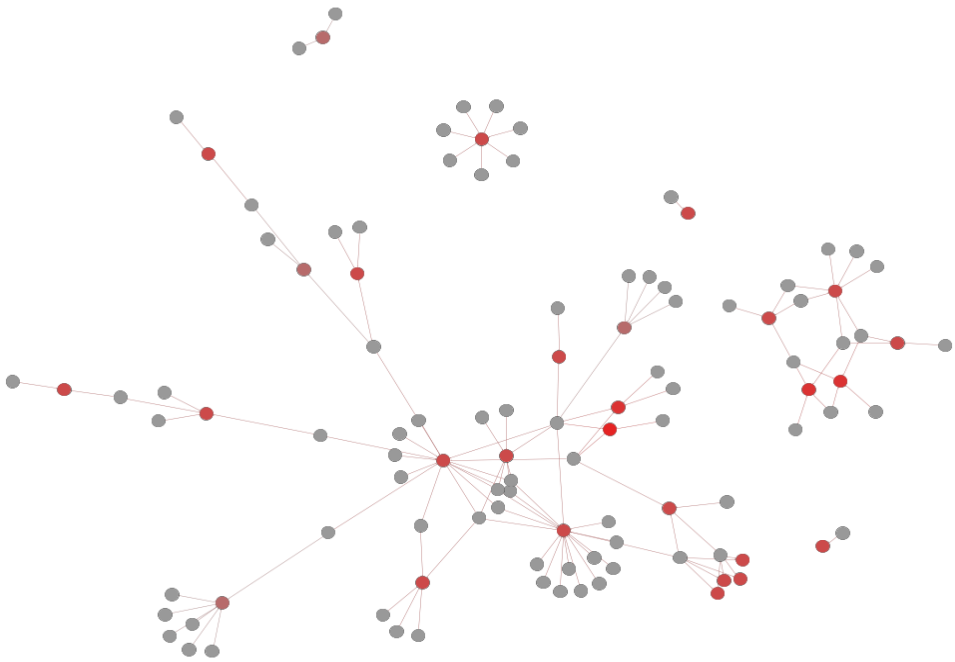


Figure 1:- Node map of the relationships between private limited companies within Orkney's fishing industry. Red nodes denote businesses while grey nodes denote named directors and secretaries of the business. Data gathered from www.companycheck.co.uk

As the map shows only four private limited companies are totally independent from all other private limited companies operating within Orkney, with all the other companies sharing at least one director or secretary with another company.

These close relations within the industry extend to the smaller vessels run as sole traders or partnerships, reflected in their membership of associations such as Orkney Fisheries Association and Orkney Sustainable Fisheries. These connections make Orkney's fishing industry versatile and able to adapt to change with their high degree of co-ordination and communication. However, it also demonstrates the fragility of the industry in that the loss of one company has potential repercussions throughout the industry. This will be discussed further in the report *The Unacknowledged Inputs of Orkney's Fishing Industry* and *The Cultural Values of Orkney's Fishing Industry.*

6. Value of the Industry

Data collected annually by Seafish provides us with an insight into the economics of Orkney's fleet. The GVA (Gross Value Added) for each vessel in Orkney averaged £67,600 (£333,500 for demersal vessels and £56,500 for pot and trap vessels) between 2008-2016. The average total income for an Orkney fishing vessel is £165,000 per year for the same period (£904,000 for demersal vessels and £115,000 for pot and trap vessels).

6.1. Value of the Industry- Income

The fleet has 297.37 full-time-equivalent positions within Orkney's fleet- 105.4 of which are from demersal vessels, with the remaining 152.15 from the pot and trap fleet. This gives the fleet an average fishing income per FTE of £63,400 thousand (£44,400 thousand for the pot and trap fleet, £107,600 thousand for the demersal fleet) (Seafish, no date).

	All Vessels	**Orkney's Demersal Fleet**	**Orkney's Pot and Trap Fleet**
Total Fishing Income (£million)	18.78	10.59	7.01
Total Income (£000) (Average per Vessel)	171.43	934.14	121.03
Fishing Income (£000) (Average per Vessel)	165.01	902.02	115.85
Non-Fishing Income (£000) (Average per Vessel)	6.42	32.11	5.18
Fishing Income per FTE (£000)	63.14	107.64	44.43
Fishing Income per kW day at Sea (£)	6.95	10.18	5.24

Table 2:- Average income for Orkney's fishing fleet for the period between 2008-2016.

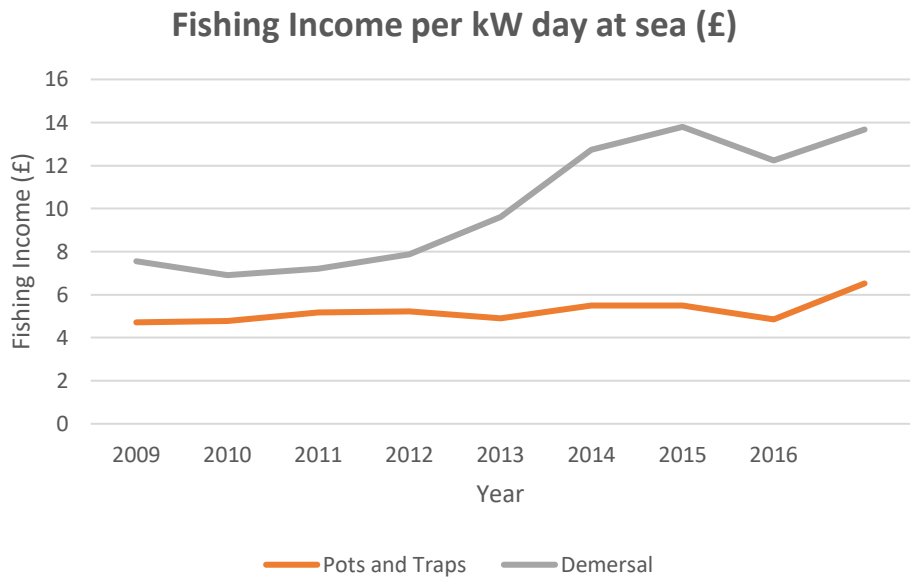


Figure 2:- Fishing income per kW day at sea (£). Data from Seafish, no date.

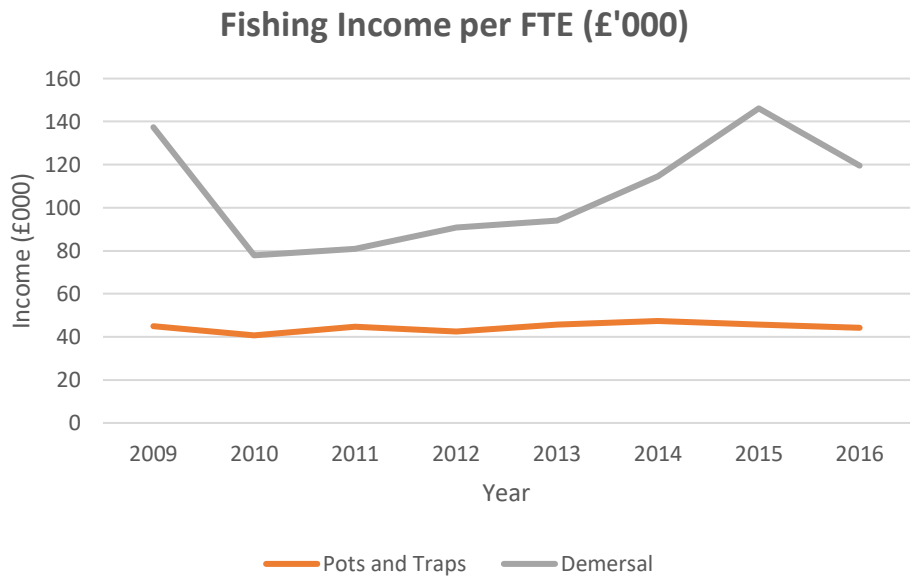


Figure 3:- Fishing income per FTW (£'000). Data from Seafish, no date.

6.2. Value of the Industry- Costs

The average net profit for an Orkney vessel is £11,500 (£56,000 for demersal vessels and £12,000 for pot and trap vessels). The total average cost of operating a vessel is £146,000 (£808,000 for demersal vessels and £98,000 for pot and trap vessels), including an average fuel expenditure of £34,700 per vessel (£200,800 for demersal and £19,700 for pot and trap vessels). Further breakdowns of the total cost can be seen in table 3:

	All Vessels	**Orkney's Demersal Fleet**	**Orkney's Pot and Trap Fleet**
Total Costs (£000) (Average per Vessel)	146.49	808.73	98.75
Total Fishing Costs (£000)	111.42	628.00	72.96
Total Vessel Costs (£000) (Average per Vessel)	35.07	180.73	25.79
Total Cost per kW Day at Sea (£)	6.18	9.10	4.48

Table 3:- Average vessel costs for Orkney's fishing fleet for the period between 2008-2016. Data from Seafish, no date.

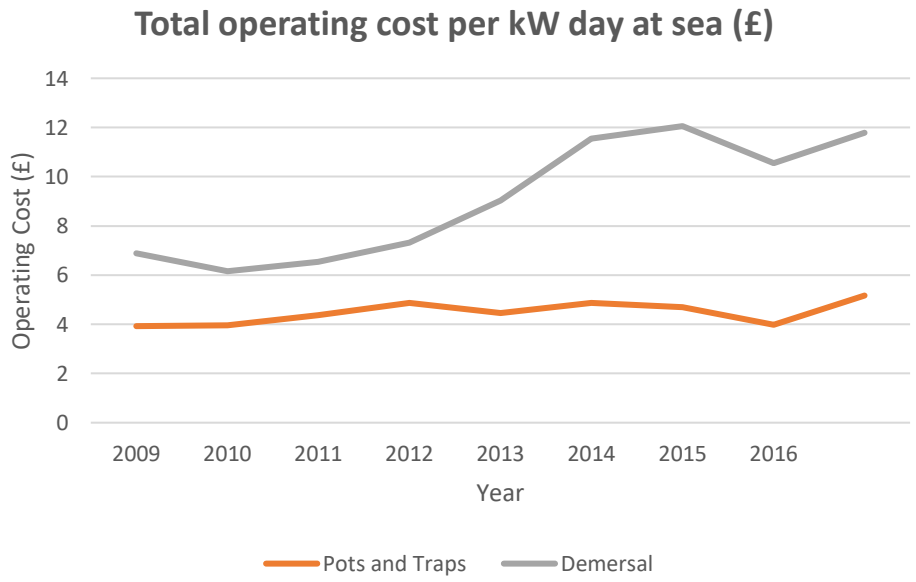


Figure 4:- Total operating cost per kW day at sea (£) for Orkney vessels. Data from Seafish, no date.

6.3. Value of the Industry- Profit

The average operating profit for a vessel in the Orcadian fleet is £24,940 (£125,00 for a demersal vessel and £22,000 for a pot and trap vessel), equalling an average operating profit per FTE of £9,100 (£14,900 for demersal vessels and £8,000 for pot and creel vessels):

	All Vessels	Orkney's Demersal Fleet	Orkney's Pot and Trap Fleet
Average Operating Profit per Vessel (£000)	24.94	125.40	22.28
Operating Profit per FTE (£000)	9.16	14.95	8.09
Operating Profit per kW Day at Sea (£)	1.05	1.46	1

Table 4:- Average operating profits for Orkney's fishing fleet for the period between 2008-2016. Data from Seafish, no date

The average net profit for an Orcadian vessel is £11,500 (£56,300 for demersal and £12,000 for pot and trap vessels).

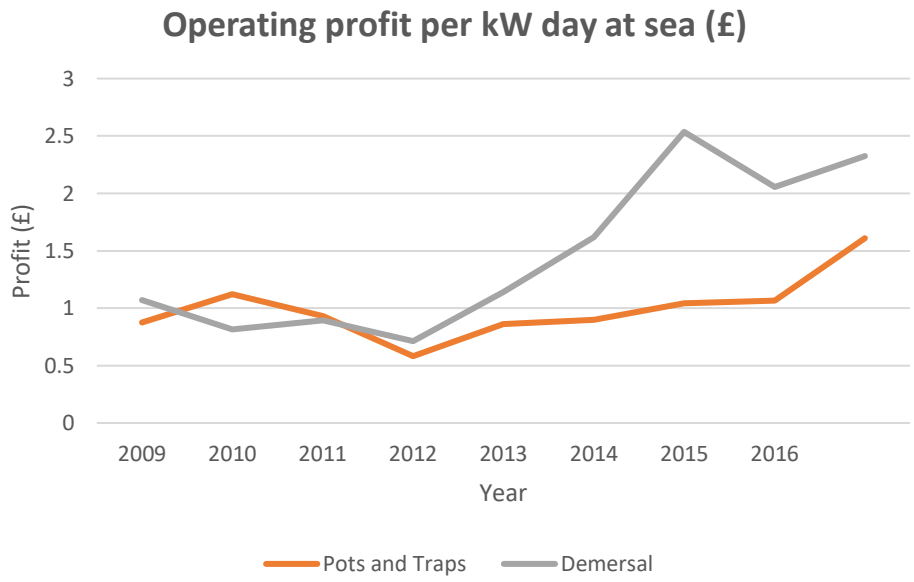


Figure 5:- Operating profit per kW day at sea (£) for Orkney Vessels. Data from Seafish, no date

6.4. Value of the Industry- Landings

Approximately 89% of landings into Orkney's ports are from the pot and trap fishery, which also accounts for the highest value of landings into the islands. In 2015 3,939 tonnes were landed into Orkney with a total value of £6,264,459. The next largest gear fishery (in terms of both tonnage and value) is *Other Passive Gears*. This contributed to the landing of 217.23 tonnes in 2015, with a total value of £671,062. Table 3 (below) provides a summary of the landings and values into Orkney according to gear type in the year 2015.

Gear Category	Sum of Landed Weight (tonnes)	Sum of Value (£)
Demersal trawl/seine	32.556	60,000.94
Dredge	108.429	215,046.61
Gears using hooks	65.063	89,731.82
Other mobile gears	34.211	125,215.23
Other passive gears	217.23	671,062.58
Pots and traps	3939.197	6,264,459.02
Grand Total	**4396.686**	**7,425,516.2**

Table 3:- Summary of the landings and values into Orkney in the year 2015 according to gear type. Data from https://data.gov.uk/dataset/fish-landings-to-united-kingdom-ports-2015

Orkney's crab fishery is the largest and most valuable of its fisheries. Three species of crab make up the majority of Orkney's crab landings: brown crab, velvet crab, and green crab. The majority of crab landings are brown crab, with 3,404 tonnes being landed in 2016, compared to only 80 tonnes of green crab and 393 tonnes of velvet crab (Scottish Government, 2017).

The average Orcadian vessel lands 0.61 tonnes per day at sea (3.12 tonnes for demersal vessels and 0.31 tonnes for the pot and trap fleet)- totalling a yearly average of 95.07 tonnes per vessel, or 564.19 tonnes per demersal vessel and 61.37 tonnes for a pot and trap vessel (Seafish, unpublished data). Orkney's pot and trap fleet lands an average of 39% less than the national average for pot and trap vessels -despite spending an average of 47 days at sea more than the national average. These landings have an average value per tonne of £1736.48 per vessel (£1905.54 for pot and trap vessels, £1600.05 for demersal vessels) (Seafish, unpublished data) (see table 6).

Orkney's pot and trap fleet lands a total average of 66% less than the national pot and trap fleet- breaking down as 49% lower landings per day at sea (tonnes), 19% lower landings per kW days at sea, and an average 39% lower average landings per vessel (tonnes). The average value of these landings per vessel is also lower by 8% (Seafish, unpublished data).

	Orkney's Pot and Trap Fleet	Orkney's Demersal Fleet	All Orkney Vessels
Landings Per Day at Sea (tonnes) (Average per vessel)	0.31	3.12	0.61
Landings Per kW Day at Sea (kg) (Average per vessel)	2.77	6.37	4.01
Landings (tonnes) (Average per vessel)	61.37	564.19	95.07
Landings (Fleet total)	3699	17507.86	6630.45

Table 5:- The average landings from 2008-2016 of Orkney's fishing fleet. Data from Seafish, no date.

6.5. Orkney's Pot and Trap Industry vs National Average[1]

Comparing Orkney's pot and trap fleet to national pot and trap vessel averages (both the national average of all pot and trap vessels and the average of under 10m vessels) provide us insight into fleet performance. When compared to the national average of all pot and trap fleet vessels Orkney underperforms in every category except *Days at Sea (days)*. The largest difference between the two fleets are in *Net Profit* and *Landings per Day at Sea*, with the average Orkney vessel earning 53% less and landing 49% fewer tonnes than the national average.

As the majority of Orkney's pot and trap vessels are under 10m (Seafish, no date) the Orcadian fleet has also been compared with the national under 10m pot and trap fleet. The Orcadian fleet in this instance performs above the national average for under 10m vessels in categories such as *Fishing Income (£000)* and *Landings (tonnes)*, with the average Orkney vessel earning 96% and landing 170% more than the average under 10m vessel. However, the *Average Price per Tonne Landed* for an average Orkney pot and trap vessel is 27% less than that of the average under 10m pot and trap vessel.

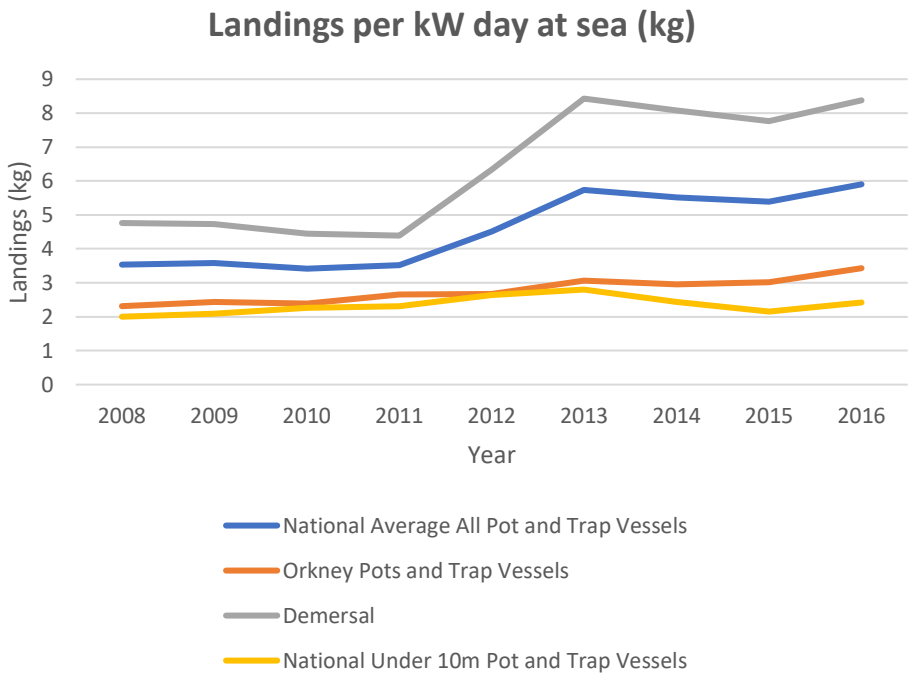
Comparing Orkney's pot and trap fleet in this manner gives us some understanding of overall fleet performance. However, neither analysis allows a truly accurate comparison due to the structure of Orkney's fishing fleet. Better insights may be gained through comparing Orkney's fleets to areas with similar fleet profiles, however limited data prevented with comparison.

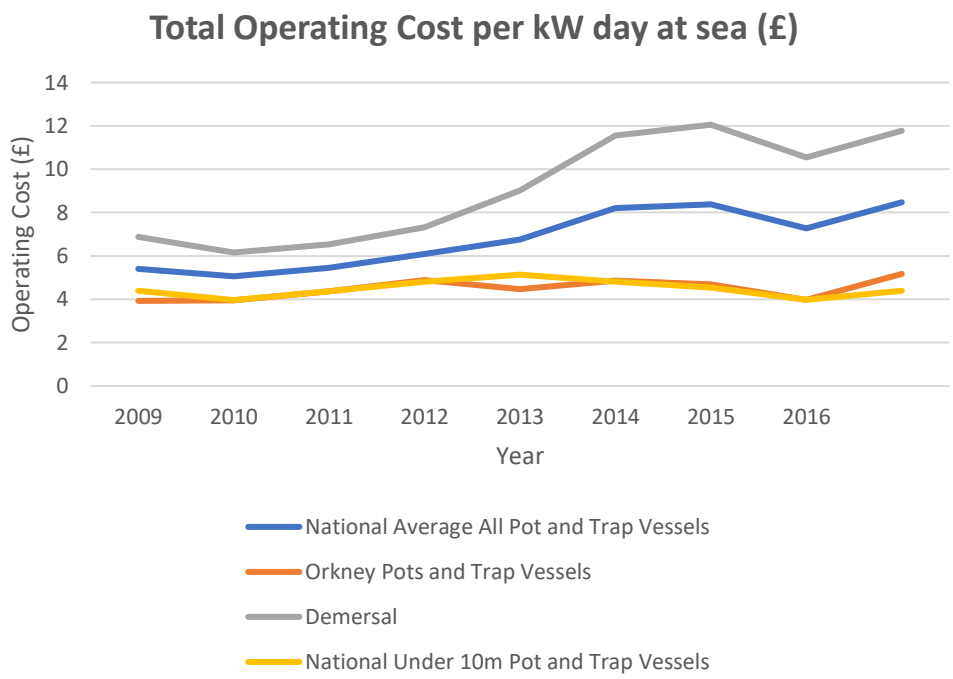
[1] The diversity of the national demersal fleet makes it inappropriate to compare to Orkney's demersal fleet, so comparisons between local and national fleets have been limited to the Pot and Trap industry.

		Orkney Pot and Trap Fleet (Average per vessel)	National Average for All Pot and Trap Vessels		National Average for Under 10m Pot and Trap Vessels	
			National Pot and Trap Fleet (Average per vessel)	Difference (%)	National Under 10m Pot and Trap Fleet (Average per vessel)	Difference (%)
Landings	Average price per tonne landed (£)	1905.5	2061.2	-8	2598.00	-27
	Landings (tonnes)	61.4	100.1	-39	22.76	170
	Landings per day at sea (tonnes)	0.3	0.6	-49	0.24	27
Income and Profit	Gross Value Added	56.6	89.3	-37	36.5	55
	Fishing Income (£'000)	115.9	174.7	-34	59.14	96
	Net Profit (£'000)	12	25.8	-53	9.7	24
	Operating Profit (£'000)	22.3	37.7	-41	19.6	14
Costs	Total Vessel Costs (£'000)	25.8	39.6	-35	11.4	126
	Total Fishing Costs (£'000)	73	105.4	-31	31.5	132
	Total Costs (£'000)	98.8	145	-32	42.9	130
Fleet Profile	Days at sea (days)	199.4	151.7	24	94.39	111
	Length (m)	9.4	11.5	-18	8.00	17
	Power (kW)	103.5	143	-28	80.00	29
	Registered Tonnage (GT)	14.2	24.3	-41	4.00	255
	VCU (unit)	83.8	116.3	-28	62.00	35
	Vessel Age (year)	24.2	24.8	-2	22.00	10

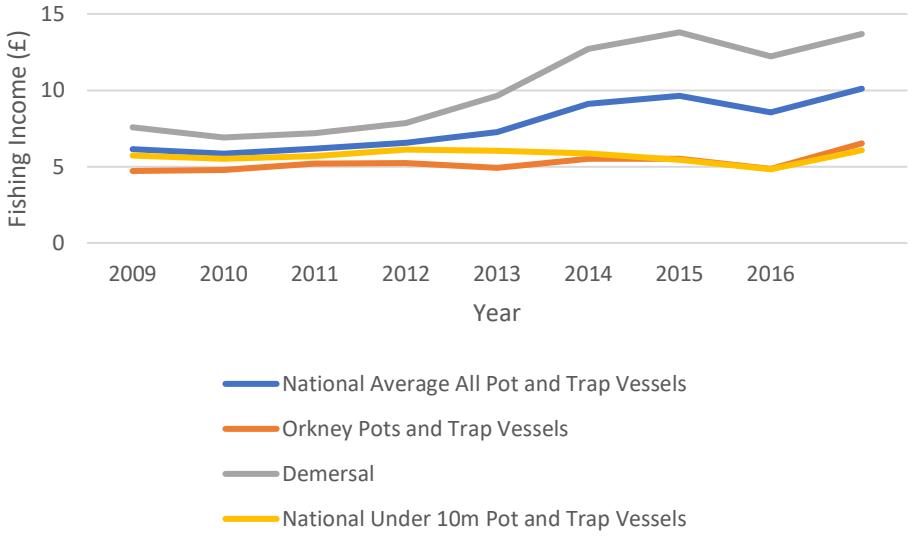
Table 6:- Comparison between the average values of an Orcadian pot and trap vessel, the national average for a pot and trap vessel, and the average under 10m pot and trap vessel for the period 2008-2016. Data from Seafish (no date)

The differences between the average landings, costs, and profits for the average Orcadian pot and trap vessel, an average vessel from the national pot and trap fleet and an average vessel from the national under 10m pot and trap fleet are relatively stable over time (all data from Seafish, unpublished):

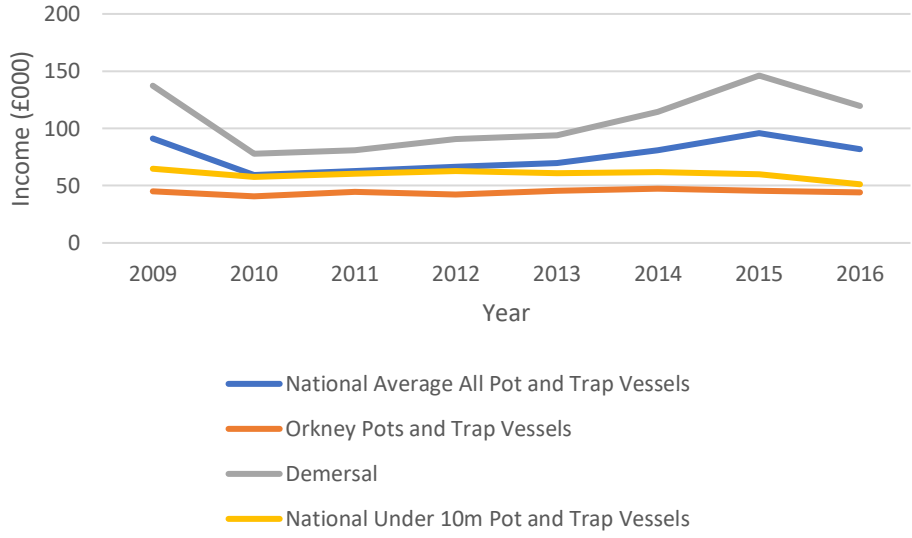




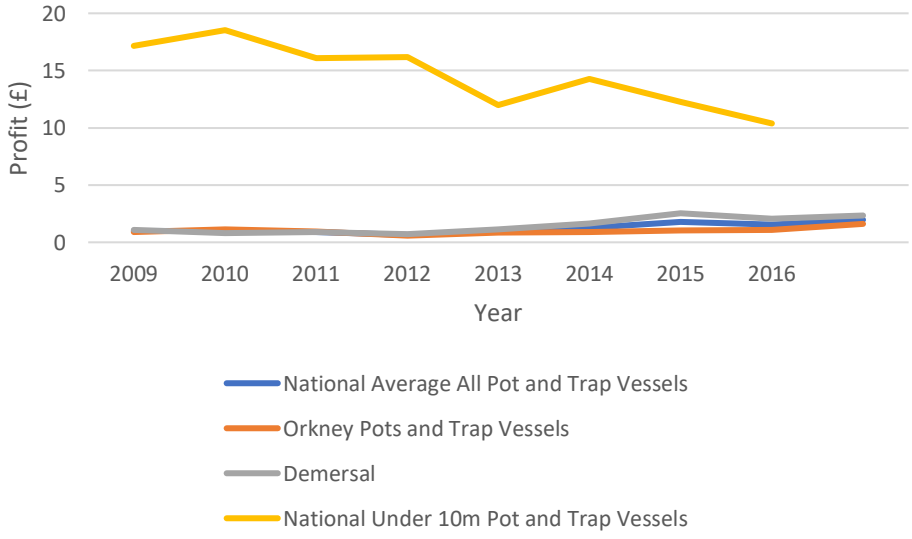
Fishing Income per kW day at sea (£)



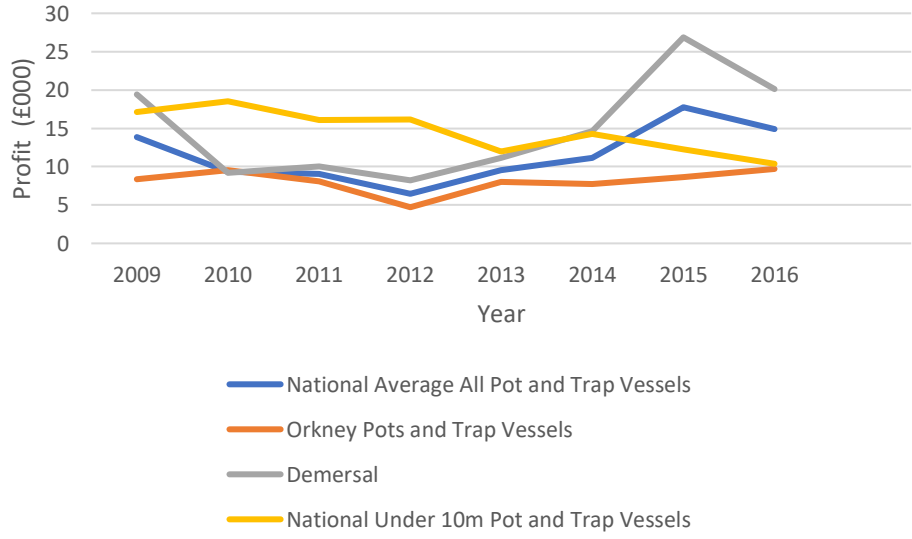
Fishing Income per FTE (£'000)



Operating profit per kW day at sea (£)



Operating profit per FTE (£'000)



6.6. Employment in Orkney's Fishing Industry

In 1972, 83 individuals were employed by fishing, all of whom were men. In the fisheries processing sector, 48 men and 61 women were employed. 34 men were employed in boat building and repair, and 1 woman (Highland Development Board, 1972). Today there are just over 100 individuals directly employed on fishing boats within Orkney (all men), and 126 full-time equivalent positions created through the fishing industry's downstream sectors (see section 10). The majority of individuals working as skippers or crew within Orkney's fishing industry do so on a full-time basis, but recently there have been more and more individuals becoming part-time fishers in order to minimise their financial risk (personal observation, 2018).

The majority of crew within Orkney are paid through shares, with the average total expenditure on crew being 34% less than that of the national average (£48,000 compared to £63,000 per vessel in 2016) (Seafish, not published).

7. Economic Indicators of Orkney's Fishing Fleet

In 2014 a Scientific, Technical and Economic Committee for Fisheries (STECF) identified a number of indicators which could be used to measure the balance between the fishing capacity and the fishing opportunities of fleets by member states (COM, 2014). The seven indicators cover a range of factors including the biological health of a stock, the composition of the fleet, and the economics of the fleet. As these indicators have been designed to be used on a national-level to draw comparisons between Member States, only four of the indicators can be used comfortably at a smaller-level to assess the state of Orkney's fishing industry. Of these, two are economic (the return on investment and the ratio between current revenue and break-even revenue). These two indicators provide us with a small insight into the state of Orkney's fleet, helping us to understand whether it is over or undercapitalised.

Other indicators from industry bodies provide additional insight into the overall health of Orkney's fishing fleet. The annual fleet survey carried out by Seafish uses six fleet performance indicators to assess the current state of the industry in comparison to previous years, with data available specifically for the Orkney fleet (Seafish, not published).

7.1. Return on Investment (ROI)

The ROI compares the long-term profitability of a fishing fleet to other available investments. Also known as capital productivity, ROI allows profits to be measured in relation to the capital invested- with good investments denoted by higher rates of return (STECF,2015). Overcapitalisation of the fleet is signified by the ROI being lower than alternative low-risk, long term interest rates available elsewhere- signifying an imbalance. A ROI (or net profit) of <0 and that is also less than the alternative investment opportunity, then there is a long-term economic inefficiency.

Orkney's creel and pelagic fleets both have ROIs of >1, indicating that they are profitable and there are no current economic imbalances (nor have there been for the past five years), and are consistently greater than the ROI from an alternative low risk and long-term investment- with a higher rate of return of 3.86% and 0.19% for the creel fleet and the pelagic fleet respectively.

7.2. Ratio between Current Revenue and Break-Even Revenue

This indicator compares the current revenue of a fishing fleet with the revenue that would be required to cover both the fixed and variable costs of a business to enable it to break even (the 'Break-Even Revenue'). For the creel fleet the BER value is 2.4, above the threshold of >1, suggesting there are no short-term economic imbalances. Indeed, the result suggests that the fleet is currently under-capitalised- potentially due to fisheries management restrictions preventing diversification within the fleet. Due to the small volume of data the BER could not be calculated for the pelagic fleet without anonymity being compromised.

7.3. Seafish Indicators

Seafish uses six economic indicators to measure fleet economic performance over time by measuring changes in values reported by the fleet against the values reported in previous years.

Five of the six indicators for the whole fleet showed positive changes between 2008 and 2017, while one showed negative changes -see table 8. Generally, the economic trends displayed by both the pot and trap fleet and the demersal fleet mirror each other, showing how both are vulnerable to the same market forces.

	Change in Indicator Value Since 2008	
Seafish Indicator	**Pots and Traps**	**Demersal**
Landings per kW day at sea (kg)	48%	76%
Fishing Income per kW day at sea (£)	38%	81%
Total operating cost per kW day at sea (£)	32%	71%
Operating profit per kW day at sea (£)	84%	118%
Fishing Income per FTE (£'000)	-2%	-13%
Operating profit per FTE (£'000)	16%	3%

Table 7:- Seafish economic indicators for Orkney's fishing fleet. Indicators show the % of change between 2008 and 2017, with positive growth indicated by green and negative growth indicated by red. Data from Seafish 2018 (no date). Data for the indicators *Fishing Income per FTE* and *Operating Profit per FTE* are unavailable for 2017, so table displays difference between 2008 and 2016.

7.4. Economic Indicator Summary

STECF's indicators suggest that -economically speaking- Orkney's fleets are balanced and performing well. The Return on Investment of the industry remains consistently higher than that of a low-risk and long-term alternative investment, while both the creel and demersal fleets have a healthy Break-Even Ratio. Fleet performance indicators from Seafish show that fleet landings per kW day at sea, fishing income per day at sea, and operating profits per day at sea and per FTE have increased. Despite this, fishing income per FTE has decreased by 2% (for the pot and trap fleet) and 13% (for the demersal fleet). This may be due to the increase of the total operating cost per kW day at sea.

8. Upstream Industries

Upstream industries consist of all those industries and businesses without which Orkney's fishing fleet would be unable to function. There is a great range of upstream industries, but the most important ones include fuel suppliers, bait suppliers, engineers, and chandlers.

In general, upstream industries associated with Orkney's fishing industry are more resilient than their downstream counterparts. Upstream industries tend to have a diverse customer base so are not as reliant on the fishing industry as their only source of income. The growth of other maritime industries such as aquaculture and marine renewable energy within Orkney has benefited upstream industries. The local chandler Sea Gear Supplies estimates that over half of its profits are from these emerging industries, replacing the fishing industry as its main customer base (personal communication, 2017).

8.1. Deciding on Suppliers

The decision-making process for fishers in deciding who to buy from in upstream industries varies depending on the type of supplies being bought. How fishers decide who and where to buy from is influenced by the characteristics of the product, including:

- The price of the product (including the variation in different prices from different suppliers and transport costs)
- The quantity needed of the product
- The variation in quality between products

Other factors include how urgently the product is needed and how frequently it is used. Products with low price variations between suppliers and/or that need to be purchased regularly tend to be bought from local suppliers (e.g. fuel). Products that are irregular purchases can be bought from a wider range of suppliers depending on the individual preference of the fisher, which tends to be related to perceived value for money (which in turn is influenced by perceived quality, convenience, and personal relationships). Irregular purchases include gear such as creels or nets (see Section 8).

Many fishers in Orkney choose to buy local whenever possible both for convenience (avoiding expensive transport costs and longer delivery times) as well as to support their local community. However, there are limitations to what Orkney suppliers hold, so in some cases it is necessary for fishers to buy from elsewhere. One fisherman talks about how he decides where to buy various supplies from:

> *Usually [Sea Gear Supplies is] handy. You can get most things you want. If there's something [they don't] have... I usually just order off the internet. ASAP or Landing Marine, you ken. So... I... just phone them up and they post it up and it's here the next day. If you want something in a hurry, ken, they can get it here the next day. If I'm needing something for the engine or something. It'll be here the next day, to wherever I am. I've had stuff put to Burghead and stuff put to Lochinvar.*

Occasionally a fisherman's decision on who to buy from in upstream processes can be influenced by downstream industries- e.g. bait. Many wholesalers and processors in the downstream industries also supply bait to the industry. One fisher speaks about his arrangement with his buyer and bait supplier:

> *My supplies? It depends what kind of supplies we are speaking about. Bait- to do the job- I get me bait from McNeil's Shellfish. He takes up tonne, two tonnes of bait in his lorry when he comes up he supplies bait, which is very good I like it. So me local buyer supplies me bait. And then he just deducts the bait you use then off your payslip then, which is far better, you know where you stand. You know?*

8.2. Gear Suppliers

Fishing gear is a fairly irregular purchase with a high degree of variation between suppliers in terms of quality. As a result, fishers often exhibit strong preferences and loyalty to their suppliers. Interviews with those working in the creeling sector reveal that the perceived quality of a creel is the major factor in deciding who to buy from, while price is often a secondary consideration. One fisher talks about how a change in the quality of his normal creel supplier ultimately forced him to look elsewhere for his gear suppliers:

> *Oh well that has to be Gael Force Stornoway creels I work with, from Stornoway. They don't make them anymore because it ended up being no viable because it used to be fishermen made the creels. Older fishermen and that made the creels for the fishermen, but then they hired in Polish workers and all that cheap labour and that and the creels were poorly made and that and they just wernae worth ... Now they just buy them from some foreign place I don't know where it is, a lot of the creels now, and sell it to here like made in China or Japan or wherever, I don't know. And they just buy them in that way and charge you a big price for them….*

Within Orkney there are two creel-makers operating on a relatively small scale. These local creels have a price of £60-90 per creel, higher than the market average. However, some local fishers are happy to pay more as they perceive these creels to be of better quality. Many of the fishers who buy local justify the extra cost, saying the better quality means they replace fewer creels over time and also save on transport costs from Scotland (see Section 9). Local manufacturers are also able to provide a more customisable service to their customers because of his smaller size and local nature. Fishers are able to specify the size of creel they like and make modifications to suit their boats and their fishing patterns. One fisher says:

> *There's a guy down in Holm who makes the frames. Its… everybody it says its more expensive, but you're paying no freight on it. Each creel is £5 to get home if you're buying them on the mainland, so you're saving £5 right away, plus [his creels are] better made. And if there's something wrong you can go chap on his door and say 'that's no right'…*

The ability to adjust and modify gear as well as a personal service encourages loyal customer relationships. One fisherman has worked closely with his gear supplier for years as they allow him to make specifications on his equipment, allowing him to maximise his fishing effort. He describes the arrangement:

> *Boy makes them all to me. Same Boy who's done them for... I don't know, ever since I've started he's made stuff for me, so now, I kinda have my own design in it as well, ken I've altered it a few ways I want it made every time I get it made I alter it a different way. Cause I've kinda gotten an idea of what fishes best, so I'm kinda altering it every time.*

Another important source of upstream products is generated form the fishermen themselves. Local forums such as the Facebook group *Orkney Merkit Place* allows individuals to buy and sell items within the local area. This method is frequently used by fishermen to sell any old or unwanted gear. Often those who express interest in fishing gear or post enquiries for gear are younger or part-time fishers who are trying to establish themselves. The items bought on *Orkney Merkit Place* tend to be replaced with higher quality gear as the fisher becomes more established.

8.3. Fuel Suppliers

Along with bait, fuel is one of the most regular purchases made by fishing vessels. The average vessel in Orkney's fleet spends £34,720 a year on fuel (£200,830 for demersal vessels and £19,740 for pot and trap vessels) (Seafish, unpublished data).

Within Orkney there are two sources of fuel: Highland Fuels or Orkney Marine Oil. Highland Fuels is a commercial supplier while Orkney Marine Oil is a social enterprise company set up within Orkney to provide fuel for commercial vessels at the same price throughout the islands. OMO has a number of fuel tanks that provide both low sulphur and marine diesel based in Kirkwall, Stronsay, Westray, Longhope, Stromness, Burray, and Tingwall. In 2017 there were 26 members of OMO, the majority of which were based in Kirkwall.

OMO's fuel tanks have hugely benefited Orkney's fishing industry- particularly in the isles. One fisher describes how the creation of OMO's fuel tank system has enabled him to spend more time fishing:

> *Fuel, we just get ours down the pier there. Just the tank at the end of the pier. There's fuel up there. Ehh some people use the local fuel sources. We just get ours at the pier. Not that long they put it there, not that many years, but it's been a grand thing. You don't have to wait for the wagons coming, you get it timed for the wagons coming, you just get it when you like. You get a key, you swipe it, you put your fuel in it, and they send you the bill. It's a grand set up, Aye.*

OMO allows vessels in the outer islands of Orkney to have regular access to fuel at a cheaper rate than they would normally have. The average cost of marine diesel (gasoil) has been steadily rising since

2000, with the average price per litre reaching around 55.51p in 2018 (slightly less than the peak of 70.74p in 2012) (see Figure 6a). However, the average amount an Orcadian vessel spends on fuel has declined by 51% between 2008 and 2016- potentially due to the decision to fish closer to the coast to minimise business expenses (see figure 6b).

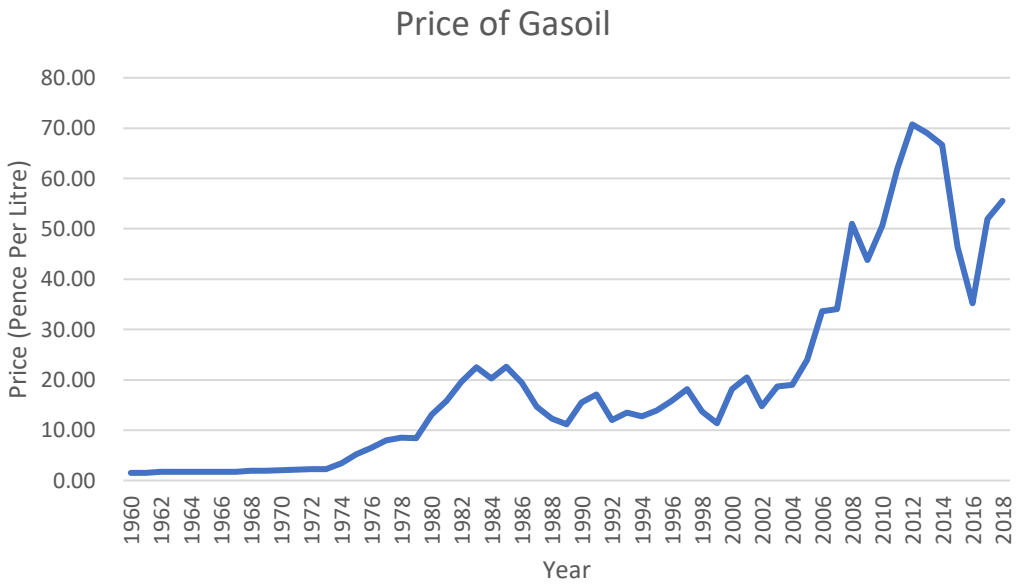


Figure 6a:- The price of marine oil between 1960-2018. Data from Department for Business, Energy, and Industrial Strategy, 2018.

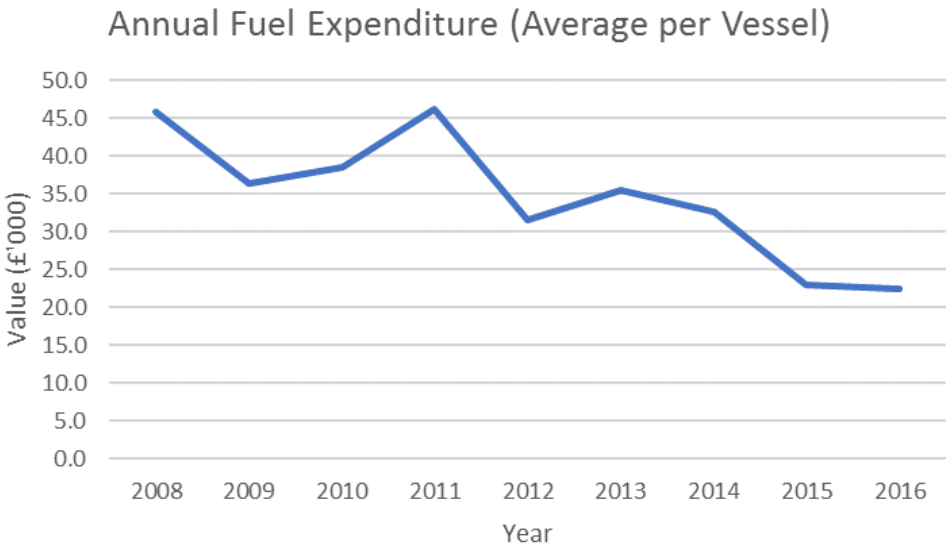


Figure 6b:- The average annual expenditure on fuel by an Orcadian fishing vessel. Data from Seafish (unpublished).

The market price for fish and shellfish does not match the rising cost of fuel. Vessel operational expenses increase while the market price for the catch remain relatively stable (see figure 7). One fisher describes the situation:

The cost of fuel is constantly rising. In ten years its [went] from about 14 to 32p per litre, yet the price of shellfish remained the same.

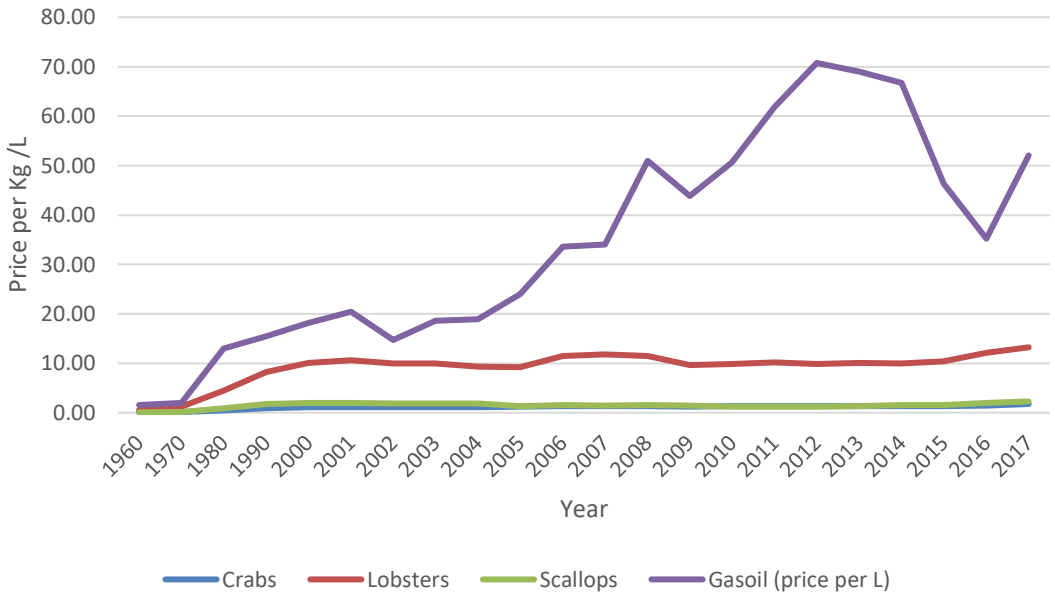


Figure 7:- The average market price per kilo for crab, lobster, and scallops (data from Marine Management Organisation, 2017) compared with January prices for fuel (data from Department for Business, Energy, and Industrial Strategy, 2018)

9. Orkney Infrastructure & Transport Links

Orkney's location provides a logistical challenge for the fishing fleet in getting their catch to market. While there are several airports open throughout the archipelago the ferry links between Orkney and Scotland remain the sole method of freight movement. There are four ferry crossings that connect Orkney to Scotland:

- Kirkwall to Aberdeen (also connecting Orkney to Shetland)
- Stromness to Scrabster
- St Margaret's Hope to Gills Bay
- Burwick to John O'Groats (only operational during summer months)

Movement by ferry between Orkney's islands is fairly frequent, with the exception of this being the ferry to North Ronaldsay, which runs once every week. The rest of the time the island is serviced by its airlinks. There are nine inter-island ferries, all of which are owned and operated by Orkney Islands Council. Kirkwall is the major hub for inter-island ferries, servicing the islands of Shapinsay, Sanday, Stronsay, Eday, Westray, Papa Westray and North Ronaldsay. The islands of Rousay, Egilsay, and Wyre

are connected to the mainland by a ferry based in Tingwall, while Stromness is home to a ferry service that visits Hoy and Graemsay. Hoy has a second ferry service, which also visits Flotta, which is based in Houton. Many islands also have private charter services available, however this is aimed more towards the passage of individuals instead of goods.

While the links between the islands are fairly regular they are still restrictive. All of Orkney (with the exception of Kirkwall and Stromness) has a rating of 1 in the Scottish Index of Multiple Deprivation[2]- the lowest possible rating. The quality of seafood is directly related to its freshness and as such the ability for a fisher to transport their catch regularly and quickly is vital in order to achieve a good price. Fishers based on the outer isles face additional costs and logistical challenges associated with their remote location, while those based on Orkney's mainland have the opportunity for more flexibility with how they transport their catch to market. However, this flexibility is often associated with extra costs depending on the route used. One fisher explains:

> *So [when] I put it down to Aberdeen it costs me £80-90 to put it down. You ken? So it's a lot cheaper putting it through Scrabster for me. Carriage is quite a bit on it, you ken? You ken, unless your shipping a decent amount.*

To mitigate these costs many fishers either store their catch at sea until they can ship it at a cheaper rate or they will send the catch to a local wholesaler who will incur the cost for them. One fisher interviewed used a wholesaler based in the North of Scotland, so he only had to pay minimal transport costs over to Scrabster. However, the wholesaler only operates on certain days so sometimes he is forced to use the more expensive route of Kirkwall to Aberdeen. He describes the arrangement:

> *It goes away, I get it away [to Scrabster] with Northwards Monday, Tuesday, Wednesday, Thursday, and then if I put stuff away on a Friday morning I have to put it via Aberdeen, because they don't, [my wholesaler] doesnae run. They only run Monday, Tuesday, Wednesday, Thursday from Scrabster to Fraserburgh.*

10. Downstream Industries

Within the fishing industry, downstream industries can be defined as any industry involved in the supply chain after the fisher has sold their catch. The most important downstream industries for Orkney's fishing industry include buyers (which can be individuals, processors, or wholesalers) and transport. Unlike the upstream industries, downstream industries within Orkney are more vulnerable to fluctuations of landings and market values as they are generally unable to diversify as much as upstream industries. Recent years have seen a large expansion in Asia's live crab market driving up

[2] Available online at: http://simd.scot/2016/#/simd2016/BTTTFTT/9/-4.0000/55.9000/

prices for crab and threatening the long-term survivability of local processors (see Section 10.3). Transport routes to and from Orkney pose a logistical challenge to many downstream industries, all of which use the local ferry links rather than air freight (see section 9).

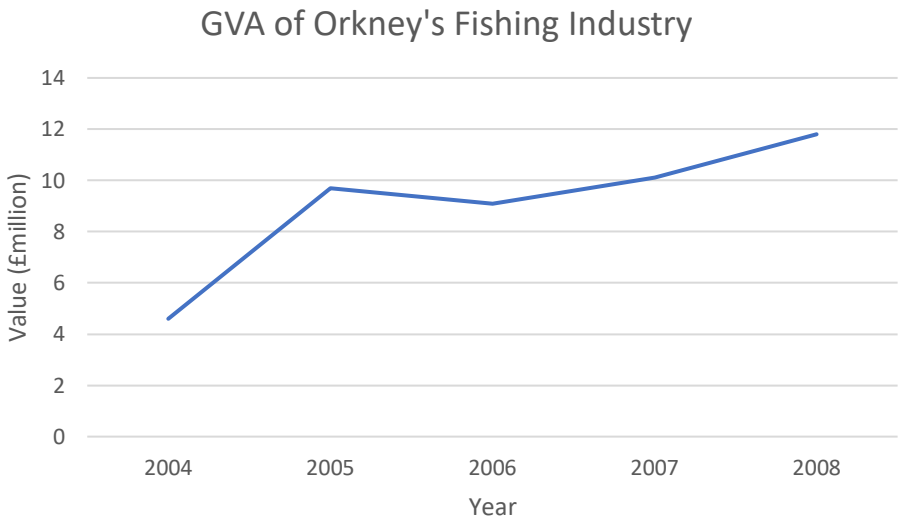


Figure 7:- The Gross Value Added of Orkney's fishing industry. Data from Cogentsi, 2012.

10.1. Buyers & Markets

Traditionally much of Orkney's catch has been transported to southern Europe- particularly Spain and Portugal which are the main markets for the velvet crab *Necora puber* (Orkney Fisheries Association, personal communication). On a global scale Asia accounts for almost two thirds of global fish consumption with the Chinese and Indian markets rapidly expanding as their wealth increases (HLPE, 2014). The growth of these markets has had far-reaching consequences throughout Europe, and Orkney is no exception. High prices for live crab to be shipped to China drive fishers to sell to wholesalers rather than to their traditional buyers who cannot compete with such a high price- see section 10.4.

The brown crab market is also one of Orkney's oldest, reflected in the presence of two crab processing factories in the archipelago, that between them, process over 80% of the landings (Orkney Sustainable Fisheries Ltd, 2017). The rest of the landings are held in storage ponds, or in boxes at sea, before being shipped live to markets by vivier lorry.

10.2. Deciding on Buyers

In situations where the market price of the catch fluctuates (either by season or over the course of several years) fishers tend to choose who to sell to based on the highest price offered (see section 10.3 for more on price variation). However, many of the fishers interviewed also based their decisions on who to sell to by their personal relationship with the seller: reliability and consistent prices encourage fishers to stay with a buyer in times of hardship. One fisher interviewed spoke about his existing buyer and how price has influenced his decision to stay with them:

> *I went to Whitelink, and I've been with Whitelink the whole time since. I have tried other ones, but never... got a... a poor price for it. I wasnae impressed with their prices, some of the other ones. You ken, so.... Whitelink prices seem to be quite good.*

Another fisher discussed the importance of trust when deciding who to sell to. Multiple interviews with fishermen revealed the general consensus that the shellfish market is opaque, with fishermen having virtually no control when it comes to the prices their catch is sold for (personal communication, 2017). One fisherman describes the process, comparing it to the process of selling beef cattle:

> *In the beef and that. It's all open. Ken, it's all there on display to the buyers. Sitting around a ring, looking at a big scale thing when they come into the big crush thing. They can read it. 'Oh, that's 944 kilos'. Then it comes bidding. Whereas [in the fishing industry] its hidden. You just get a text of a price and that's it. You understand? They just text you. Well, no[t] they day they land. It's after you landed you get the price of what you get per kilo, so it could be anything. Never -you know- kenning before you land….*

This opacity creates distrust within the industry but also promotes strong relationships between fishers and the buyers they perceive to be fair. Buyers who provide good prices for shellfish often have a loyal base of sellers and are able to attract other fishermen. A fisherman describes how the reputation for good prices attracted him to his current buyer:

> *I went to them because they were... you ken, because I trusted them, how they did the job grading the shellfish and that. You ken […] they did a very good job there […]*

In Westray the influence of price, reliability, and socio-cultural relationships in influencing decision making in the downstream industry is apparent. Westray is home to one of Orkney's two crab processors, Westray Processors LTD, which has been opened for over 40 years and whose shareholders largely consist of the Westray community. The increased demand from China has led to competition amongst buyers, with wholesalers transporting to China able to command a much higher

price than their Orcadian competitors, jeopardising the operation of the processor (see section 10.4 and 10.6).

In fisheries where the price is more stable -such as with scallops- factors such as convenience and reliability take a bigger role in the decision-making process. The king scallop (*Pecten maximus*) has a reasonably stable price range of around £3.80 with little seasonal fluctuation. In these situations, the markets, and the routes to them are well-established as are the relationships between buyers and sellers. One scallop diver that was interviewed had considered taking control of his product and selling directly to hotels and restaurants in London for a slightly higher price, but ultimately decided against it citing the financial security and relative ease of his existing arrangement:

> *…We always think- it's just as good to come in, for what you're saving, land on the pier and they're gone, and they're here, local, and nae hassle. And nae ….taking the day off to go and land them and- fighting for your money every- never getting paid. We land them here, they're gone, and we know we're gonna get paid next week.*

Other scallop divers interviewed described similar situations. Although they may be able to command a slightly higher price by selling directly to the find customer they would be taking on a greater deal of risk as well as decreasing the time they are able to spend fishing.

Those fishermen who choose to directly liaise with customers and organise their own selling and transportation often rely on the landings of other local boats to make the venture worthwhile. Local wholesaler Robert Smith receives catches from a range of Orcadian boats, while Fred Brown of Orkney Dived Scallops owns three boats which provide him with the volumes he needs to operate his wholesaling business. See section 10.5 for more on wholesalers.

10.3. Market Price vs Sustainability

Prices within the fishing industry vary according to demand, availability, and global market trends (such as exchange rates). There are two methods by which price is calculated: grading by size or grading by kilo. Which method a buyer uses often reflects the state of the wider market as well as their end customers (e.g. Michelin-starred restaurants or supermarket chains).

These price variations impact not only an individual fisher's earning power but also has consequences for the long-term sustainability of the fishery. When prices are set by the grade of the species (typically ranging from 'extra-small' to 'extra-large') fishermen are encouraged to catch larger, more mature individuals and leave or throw back smaller individuals. An owner of a fleet of scallop diving boats who gets paid according to size discusses the arrangement:

Yeah, paid by the sizes. So that's why we try to stick to the over 120mm…And in the space of 6 months, a scallop will double in price. You know, because they go from the £2.50 mark to the over £4 mark. And they put weight on. So in the space of 6 months they can double in price…. I keep trying to tell [my divers] -I've had this argument with scallop divers before- you know, in the space of 6 months it doubles in price. So... when they say 'Oh, cant do, cant do without it- we've got to keep going' if you said to them look, theres can have a fiver today, or in 6 months time you can have £10, they pick the £10 every time. And it is as simple as that. For a few months, they'd be worse off, but after that, they'd be better off.

The velvet fishery is an excellent example of how prices influences fisher behaviour. Originally buyers graded based on the size of crab, with extra-large velvets earning between £3.50-4.20 during the summer months. A change to buying 'all-in' (with price based solely on the total weight of the catch) dramatically altered the fishery and came close to destroying it. One fisherman describes what happened:

That changed the price of the velvet crab and everything, it all collapsed over night, I would say, prices and then instead of grading small, medium, and large, sized of velvets they just did an all-in price of them, everything mixed […] You didnae get three different prices for your product. If you had a quality velvet crab -extra-large we called them- you just got a pound a kilo- all year round. [Before] they were big prices. You could get up to... I had usually between £3.50-£4.20 through the summer for extra-large. I used to get a lot of them, instead of a pound all in.

The standardisation of the price of velvet crabs regardless of size altered how fishers fished- they were less likely to throw smaller crabs back into the sea, instead choosing to retain them with the goal of bringing up their final landing weight. The troubles with the velvet fishery were further compounded by a low market price for other shellfish which increased the pressure on the velvet fishery as other vessels tried to maximise their profits while minimise any losses. The same fisherman continues his story, saying:

The bigger boats, I can't condemn them for doing what they did, they came in about, they werenae risking their gear for low prices on lobsters and that oot by, 'cause you can lose creels in a storm, so they kept it all in by, safe, it wasnae worth their while being oot by. If they could get £2 a kilo for velvets all in, instead of £6 a kilo or £5 a kilo for lobsters, they might as well have four or five boxes of velvets everyday rather than try risking to get one box of lobsters.

Dramatic price variations are not unusual within the fishing industry- especially with shellfish such as crab and lobster which experience seasonal variation in prices associated with both quality and cultural holidays. Traditionally the summer months has seen lower prices associated with poor quality crab (the result of low survival rates from moulting) while winter commands higher price- see figures 8-10.

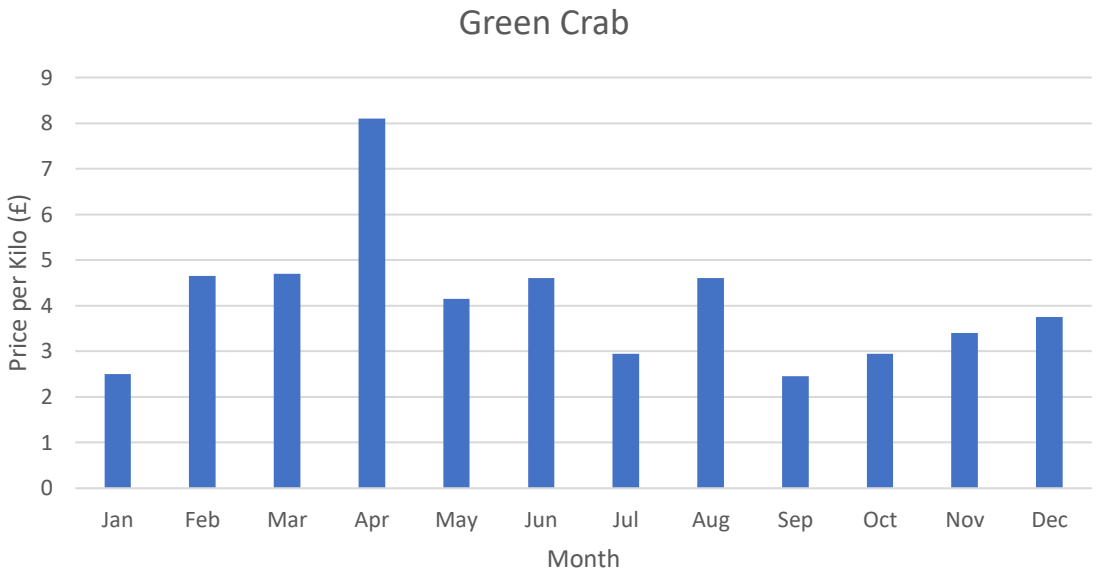


Figure 8:- The average monthly price of green crab from the period 2000-2005. Data collected from local wholesalers.

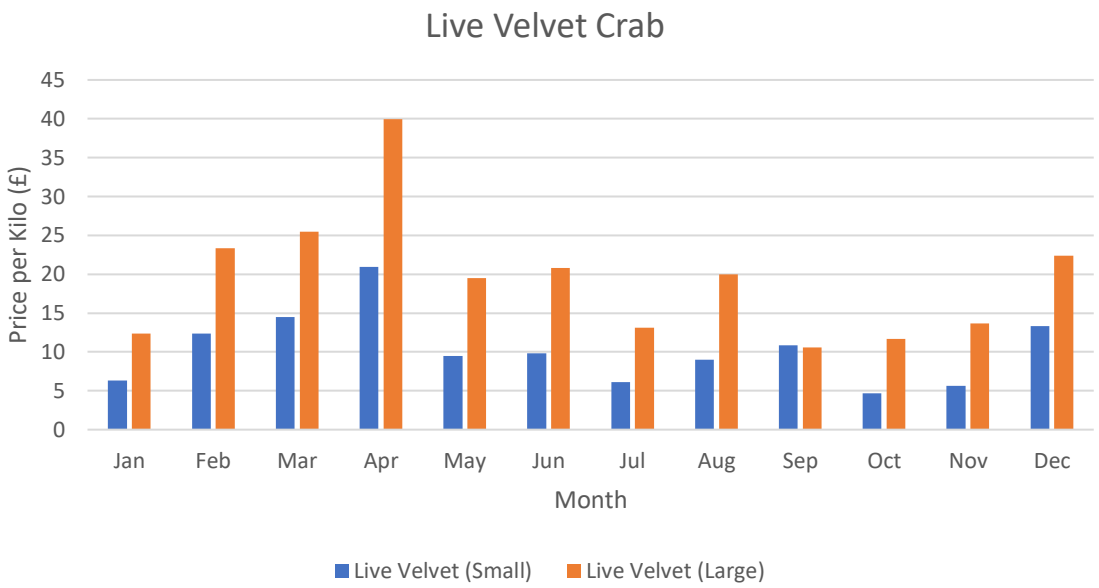


Figure 9:- The average monthly price of velvet crabs from the period 2000-2005. Data collected from local wholesalers.

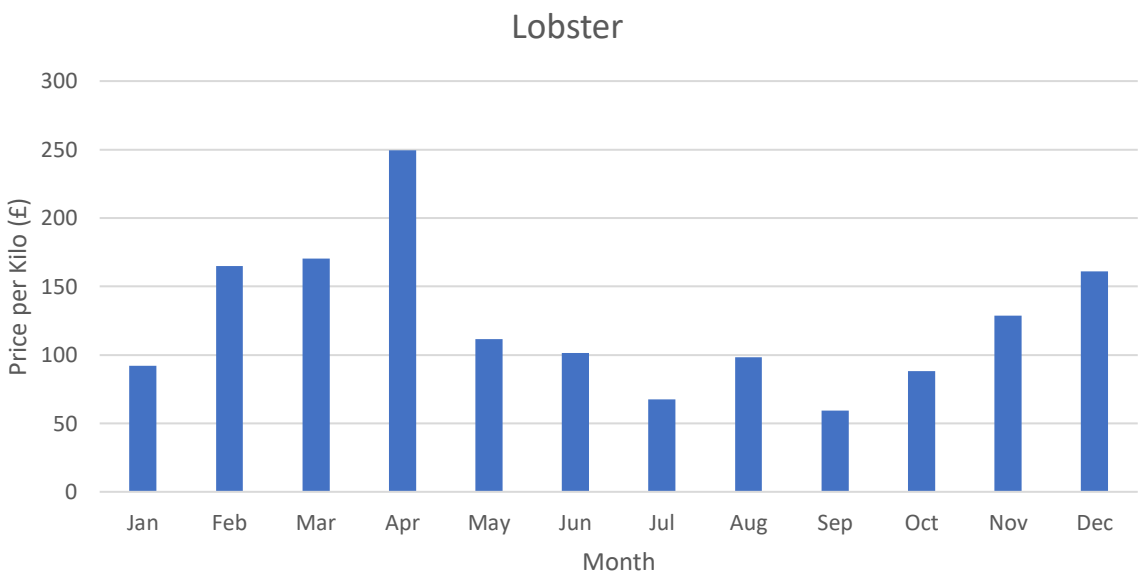


Figure 10:- The average monthly price of lobster from the period 2000-2005. Data collected from local wholesalers.

In Spain and Portugal, the Christmas and New Year demand drives the prices up and the majority of fishermen try to maximise their earnings in this period. During the winter months both full time and part-time fishermen (part-time here being defined here as individuals who own boats but have other occupations, only fishing around their other work) begin to increase their effort. One full time fisherman who has chosen to leave the industry discusses the impact part-time fishermen have on the market in the lead up to Christmas:

Through the summer, when its down there, you'll no see [part-time fishermen] about. They just take it ashore and wait for the price to go [up] …. But that affects the price. Even though they're minute, a lot of peedie fellas, that takes the price down for a peedie while. Because the market can't, the market now can't take a lot of velvets on the market before the price goes down. Too much velvets come on the market now, the price crashes.

10.4. The Expansion of the Asian Market

Historically, the Scottish fishing fleet's access to the Chinese market has been intermittent and vulnerable to the mercurial shifts in Chinese government policies and global trade agreements. In recent years, however, the market has opened for Scottish fishers and now makes up a significant proportion of non-EU sales (China-Britain Business Council, 2015; Stoll et. al. 2019).

Although the increase in foreign markets for Scottish shellfish benefits Orkney's fishermen, trading with China is associated with a number of risks, primarily stemming from the opacity of its trade networks. Traders with China must meet with the criteria for imported foods set out by the *General Administration of Quality Supervision, Inspection, and Quarantine* (ASQIQ):

1. The country of origin has undergone official investigation by the relevant Chinese authorities
2. The product type has completed all inspections and relevant quarantine entry procedures
3. The product manufacturer is registered in China and has the permission to export to China
4. The company has shown to the relevant Chinese authorities that it is compliant with Chinese food safety laws and standards
5. The product batch must be readily identifiable by ASQIQ upon entry to China
6. Each product batch must be accompanied with the relevant certifications

These extensive criteria make it difficult for Orcadian fishermen to trade directly with China, forcing them to rely on intermediaries. This raises the opacity of the Chinese seafood market, with high levels of hidden risk preventing fishers from predicting changes in consumer demand. While the high prices associated with the live shellfish market in Asia has been seen as a good thing by the majority of fishers, some have expressed concern over their inability to foresee future market trends, and fear losing both local market connections and the Asian market.

The expansion of the Chinese market has been associated with a raise in the market price of live shellfish (China-Britain Business Council, 2015; Cumulus Consultants, 2018). While these high market

prices benefit local fishers, processors and domestic wholesalers struggle to match export prices (China-Britain Business Council, 2015; Cumulus Consultants, 2018).

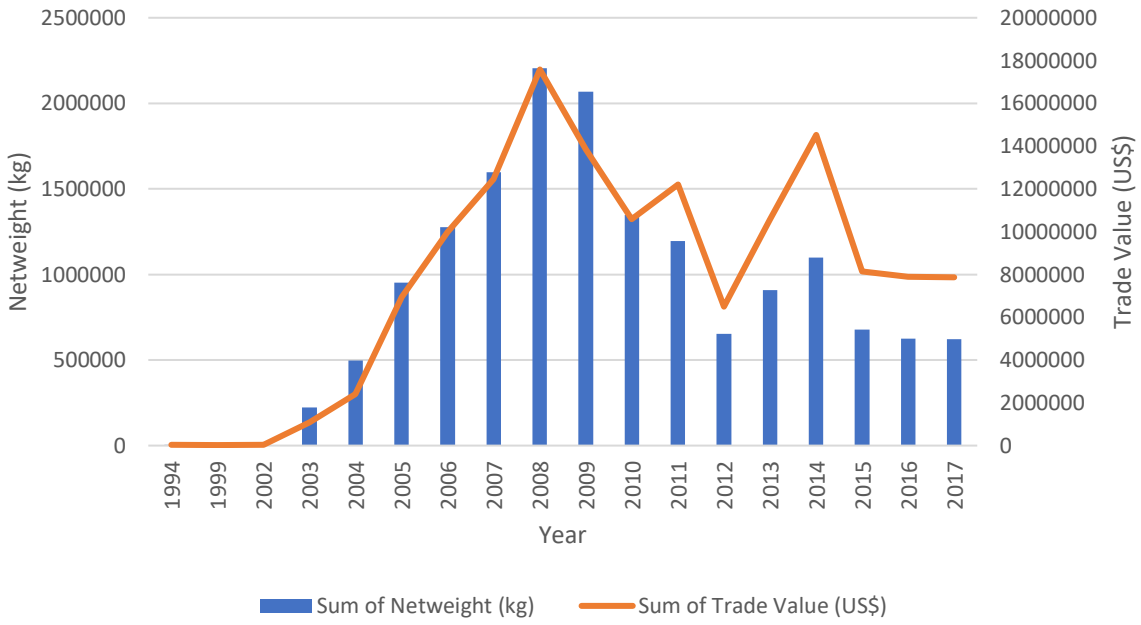


Figure 11:- Chinese imports of crab products from the UK between 1994-2015. Data from: China-Britain Business Council, 2015 and Cumulus Consultants, 2018

The rise of the Chinese market has implications for the sustainability of the industry, seen through risks to the sustainability of the stock (e.g. increased fishing effort) and risks to industry economics (e.g. market opacity preventing business strategizing, weakening of secure local infrastructure such as processors). More information may be found in the report *The Continuity of Orkney's Fishing Industry*.

10.5. Wholesalers

There are multiple wholesalers operating within Orkney, several of which are based within the archipelago and around three who are based elsewhere but export from Orkney. Many of the wholesalers in Orkney operate ponds where they store and sort the catch before transporting it southwards. The storage facilities vary in size depending on the processing capacity of the wholesaler.

The species handled by wholesalers is often dependent on their size and those who supplies them. The majority of Orkney's wholesalers focus solely on crab and lobster while a few focus exclusively on scallops. Some wholesalers have enough resources to be able to handle crab, lobster, scallops, as well as other species simultaneously. The capacity of each buyer determines who sells to them and the quantities they can take. One interview discussed having to change how he sold his catch by splitting it between buyers as his original buyer did not have enough capacity to handle everything they landed:

We've been putting all our brown crab to the OFS. And about half the velvets and lobster to the OFS and half the velvets and lobster to O Fish Shell. We used to land everything to OFish, but crabs go to the OFS now because OFish couldn't handle it all. So... we had to look for another buyer.

10.6. Processors

Orkney is home to two processors- Orkney Fishermen's Society (OFS), located in Stromness, on the Orkney Mainland, and Westray Processors in Pierowall, Westray. Both factories are run as co-operatives, with shares being held by the local community. There is a high degree of co-operation between the two processors, with Westray Processors sending the majority of its final product to Orkney Fisherman's Society, allowing them to meet the demands of their customers. Combined, the two processors employ over 130 full time staff and have a turnover of over £10million (Orkney Sustainable Fisheries Ltd, 2017). Both factories primarily process brown crab, however OFS also handles a variety of other seafoods, including scallops, mackerel, salmon, cod, tusk, and monk which it sells from its on-site fish shop. As there is no fish market in Orkney, fish are brought from the Scrabster markets. Approximately 2,879 tonnes of brown crab were landed in Orkney in 2015, 80% of which was processed at one of the two factories, and the remaining 20% being shipped live by vivier lorry (Orkney Sustainable Fisheries Ltd, 2017).

Brown crabs are processed by dividing them into smaller parts which can themselves be sold separately (as is the case with claws and BBQs) or can be further broken down and the meat separated. Figure 8 shows the process of how a single brown crab is broken down to its component parts.

In recent years Orkney Fishermen's Society has been able to diversify its product range although brown crab products remain their main product. A new contract with Marks and Spencer's for scallops sees the factory shucking hand-dived scallops, cleaning the shells, repackaging the product, and sending it southwards.

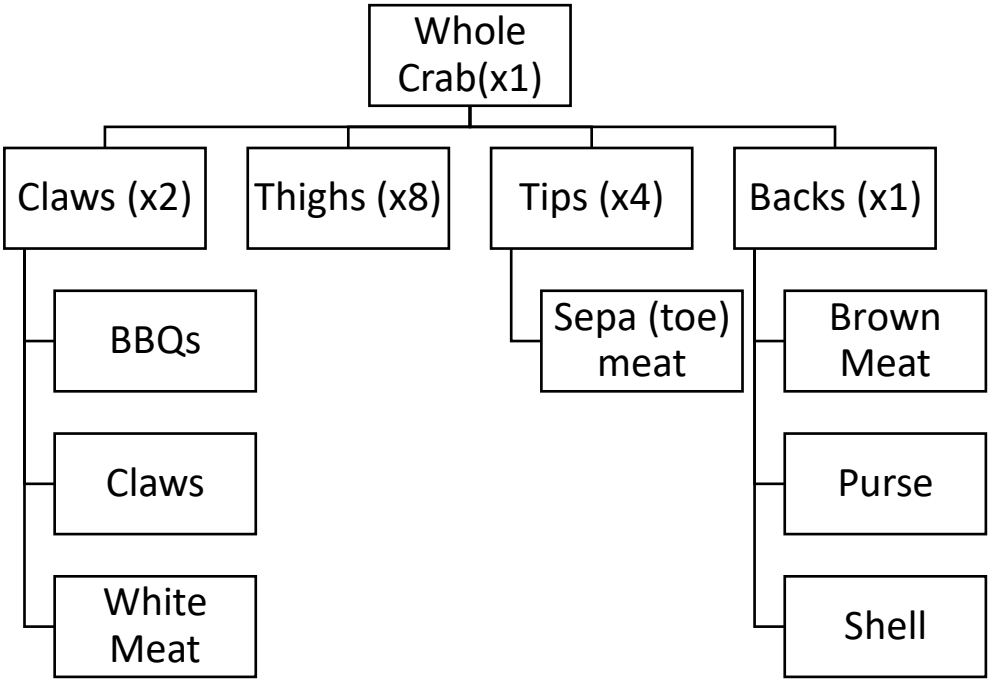


Figure 8:- End products (and quantities) of brown crab processing in Westray Processors Ltd

The growing market for live crab in Asia has threatened the continuity of both processors (which are significant sources of local employment- see section 11) as the supply of crab meat for processing has become irregular as more and more fishermen are choosing to sell to the live crab market. During interviews with Westray fishermen in early 2017 many expressed a desire to support the local factory, but often chose to sell part (and occasionally all) their catch to the live market. Many of these individuals acknowledged the importance of the processor for the local community in terms of employment opportunities and family ties, but still chose to sell at least part of their catch to the live market in order to increase their own chances of long-term survival. The price discrepancy between the processing and live markets is significant- with the average price for a processed brown crab at just over £3 a kilo, while on the live market it is often double.

10.7. Employment in Downstream Processes

A study by the Scottish Government (2014) explored the secondary impacts fishing has on the Pentland Firth and Orkney Waters (PFOW) area in terms of employment. Type 1 multipliers include direct and indirect effects while Type 2 multipliers include direct, indirect, and induced effects.

On a local level Orkney's fishing industry is responsible for 118 direct and indirect full-time equivalent positions within the PFOW area (table 4) and 127 FTE positions within Scotland (table 5). If we include induced effects these numbers rise to 180 FTE positions in Orkney (table 4) and 192 FTE positions in Scotland (table 5).

	Crustacean Processors and Merchants		Non-Crustacean Processors and Merchants	
	Orkney Landings	North Highland Landings	Orkney Landings	North Highland Landings
Type I, Direct and Indirect Effects, FTE Jobs	112	31	6	10
Type II, Direct, Indirect, and Induced Effects, FTE Jobs	171	48	9	16

Table 4:- The employment (in FTE) in the PFOW area that is dependent on the fish and shellfish processing sectors in the PFOW area. Data from Scottish Government, 2014.

	Crustacean Processors and Merchants		Non-Crustacean Processors and Merchants	
	Orkney Landings	North Highland Landings	Orkney Landings	North Highland Landings
Type I, Direct and Indirect Effects, FTE Jobs	121	34	6	11
Type II, Direct, Indirect, and Induced Effects, FTE Jobs	183	51	9	18

Table 5:- The national employment (in FTE) that is dependent on the fish and shellfish processing sectors in the PFOW area. Data from Scottish Government, 2014.

11. Input-Output Tables

Input-Output tables are a tool demonstrating the interactions and relationships between industries, demonstrating how the outputs from one industry are the inputs to other industries. Input-Output tables are a tool allowing us to estimate the gross value added (GVA) of an economy[3] (Cogentsi, 2012).

In 2014, Marine Scotland commissioned a study to explore the value of the downstream industries of seafood processing and distribution industries in the Pentland Firth and Orkney waters area to the local and national economy (Scottish Government, 2014). The study found that more than £40million of fish and shellfish is landed to ports in the Northern Highlands[4] and around the Orkney islands and estimates that £7.4million of this comes from within those waters (Scottish Government, 2014). The trickle-down value of these landings is impressive: in 2011 £2.5million worth of landings generated £10.4million in sales of seafood products (Marine Scotland Science, 2015).

[3] In business terms, gross value added is the difference between sales and the goods and services purchased

[4] In this report, the North Highland region is defined as the local authority areas of Caithness, Sutherland, Scrabster, and Wick.

2011, £	Crustaceans	Non-crustaceans
North Highlands	474,000	241,000
Orkney	1,706,000	106,000

Table 6:- the input of raw material from the PFOW area to the fish processing and merchanting sector in 2011. Data From Scottish Government, 2014

The output of the Scottish economy that is generated from the fish and shellfish processing and merchant sectors in the PFOW area is set out in table 7:

	Crustacean Processors and Merchants		Non-Crustacean Processors and Merchants	
	Orkney Landings	North Highland Landings	Orkney Landings	North Highland Landings
Type I, Direct and Indirect Effects (£million)	7.98	2.24	0.44	1.01
Type II, Direct, Indirect, and Induced Effects (£million)	13.81	3.87	0.74	1.61

Table7:- The Scottish output that is dependent on the PFOW fish and shellfish processing activities. Data from Scottish Government, 2014

The findings of the study are presented in a Leontief input-output table, that allows us to measure the output, income, and employment generated by the fish processing industry and merchants. This method relies on the calculation of supply-driven downstream multipliers, which are set out on a national level.

The outputs of the crustaceans and non-crustacean sectors in both the North Highlands and Orkney can be seen in Table 8, below. The data suggests that the £6million created through the outputs of fish and shellfish processors creates £10million worth of direct and indirect effects. When induced effects are added into the equation, this number increases to £18million (Scottish Government, 2014).

	Crustacean Processors and Merchants		Non-Crustacean Processors and Merchants	
	Orkney Landings	North Highland Landings	Orkney Landings	North Highland Landings
Type I, Direct and Indirect Effects (£million)	7.12	1.99	0.39	0.90
Type II, Direct, Indirect, and Induced Effects (£million)	12.74	3.55	0.67	1.44

Table 8:- Table showing the outputs in Orkney and the North Highlands that are dependent on the landings of fish and shellfish. Data from Scottish Government, 2014

These sectors also impact the local economy through the employment they provide, and the income generated by their activities. Income, as well as FTE, into the local and national economy generated by these activities can be seen below, in tables 9 and 10, showing how the £1.4million of income from the sector generates £2.9million through direct and indirect effects (Scottish Government, 2014).

	Crustacean Processors and Merchants		Non-Crustacean Processors and Merchants	
	Orkney Landings	North Highland Landings	Orkney Landings	North Highland Landings
Type I, Direct and Indirect Effects (£million)	2.04	0.57	0.10	0.20
Type II, Direct, Indirect, and Induced Effects (£million)	3.99	1.11	0.20	0.39

Table 9:- The local income that is generated by, and dependent on, the shellfish and non-shellfish processing sectors in the PFOW area. Data from Scottish Government, 2014.

	Crustacean Processors and Merchants		Non-Crustacean Processors and Merchants	
	Orkney Landings	North Highland Landings	Orkney Landings	North Highland Landings
Type I, Direct and Indirect Effects (£million)	2.34	0.65	0.12	0.24
Type II, Direct, Indirect, and Induced Effects (£million)	4.36	1.22	0.22	0.45

Table 10:- The national income that is generated by, and dependent on, the shellfish and non-shellfish processing sectors in the PFOW area. Data from Scottish Government, 2014.

12. Orkney Islands Council and Fishing Quota

The economic benefits of the fishing industry- both local and national- are felt throughout Orkney. Indirect economic linkages, such as local investment in national fishing quota, has benefited the wider Orcadian community substantially over past years. Orkney's Producer Organisation consists of twelve vessels, two of which hold over 70% of the Orkney PO's 70,522 FQA units. In addition to these twelve vessels there are five dummy licences which also hold FQA units. All but one of the seventeen members of the PO are Scottish. (Gov.co.uk, 2018)

Orkney Islands Council holds 11,843 FQA units through Orkney's Producer Organisation, with a market value of £2.225million as part of its Strategic Reserve Fund, which in 2017 was worth £207.2million (Gov.co.uk, 2018;, Orkney Islands Council, 2017 A ; Orkney Islands Council, 2017 B). The Strategic Reserve Fund has been designated by the council to help projects that will benefit Orkney and its inhabitants- for example, by financing one-off capital projects through the Community Development Fund (Orkney Islands Council, 2017 A). In 2017, the Strategic Reserve Fund had contributed £68,627,000 to various projects, including (Orkney Islands Council, 2018):

- Community Development Fund – £6,447,000
- General Fund Services- £3,088,000
- Scapa Flow Oil Port – £45,250,000
- Scapa Flow Landscape Partnership - £229,000
- Stromness Townscape Heritage Initiative - £638,000
- House Build Programme - £4,328,000

13. Economics and the Continuity of the Industry[5]

The economic health of the industry is a major factor in determining its long-term sustainability. Poor returns on investment, coupled with uncertain markets and low prices has led to an increase in the number of people exiting the industry in search of alternative employment. The inability of the fleet to diversify is largely economic. Legislation governing access to fisheries through licences and quotas has created a financial barrier to many fishers, while narrow profit margins prevent fishers from experimenting with new areas or new fisheries. One fisher interviewed spoke about how he was interested in trying to fish for squid to access a higher-value market but is unable to do so because the financial risk is too great. He says:

It will all come down to money at the end of the day, you ken. See the thing with an

[5] Please see report 2: *The Continuity of Orkney's Fishing Industry* for further information on the socio-economic factors influencing the continuity of Orkney's fishing industry.

under 10m boat you can't afford to go and experiment. And that's the... problem with it is you cannae afford to take two weeks off and go and experiment with something. You're better sticking to something you're making money at […]

As an occupation fishing is a precarious one: classified as self-employed by the government they are unable to access statutory sick pay and struggle in successfully applying for loans due to a lack of reliable income. Many fishers have chosen to leave the industry and pursue careers with more stability. Often these individuals move into other maritime activities such as aquaculture, marine renewable energy, or working on the pilot boats. The decision of a fisher to leave the industry is often difficult and is largely influenced by familial and financial pressures, although is also occasionally influenced by the health of an individual (this will be explored further in the report *Continuity of Orkney's Fishing Industry*). One ex-fisher who was interviewed left the creeling sector to get a job with a local salmon aquaculture company:

*"*How does fishing compare to your job now? What made you become a fish farmer?" *"Steady money. That was really it. Because I only had a 19-foot dinghy, so it was kind of tough fishing through the winter… I had 350 creels, which is quite a lot for a small boat. Yeah. Getting out was the problem, because it was always a gale from somewhere, so that wasn't great." "*How do you feel about working as a fish farmer*?" "Ah, the stability and yeah, it's a lot safer. It's a lot safer than what I was doing, that's for sure. Yeah. Its easy money. Its easy money now. All you got to do is turn up."*

Those who choose to remain in the industry may seek supplemental income opportunities, usually in other maritime activities that operate on a rotational basis (e.g. month on, month off). One fisher talks about the other work he has taken on in order to supplement the income he earns from fishing:

[I've done] various things, ehh, worked on the tugs in the flow... bit of part time work and I worked with Green Marine in the renewables, a bit of part time work there […]. But yah, that's just other ventures to try and get some money in. It's been forced to go that way. It's no[t] a choice it's a thing you're having to do.

The existence of these part time jobs allows fishers to continue fishing activity. One fisher interviewed worked solely in the winter months when poor weather makes it difficult to go out fishing:

… I was out on the Capella, and skippering the Green Quest, stuff like that, you ken. So it was a bit of income, extra income. Because the fishing in the winter is pretty crap, so.... you're not making a lot of it you ken, really so... So it was a good income last winter […]. Between the whole thing it would give you a good income, you ken, at the end of the year.

Ultimately the economics of Orkney's fishing industry is a key contributing factor for the long-term economic and environmental sustainability of the fishing industry. Narrow profit margins prevent the diversification of the fleet resulting in a concentration of effort onto a few core species and in well-known, well-fished areas. The high level of competition within the fleet for increasingly limited resources not only has harmful effects on local stocks but discourages new entrants from the industry, ultimately harming the long-term continuity of the fleet itself.

14. Conclusion

Orkney's fishing industry is an important contributor to Orkney and Scotland's economy, worth £13.81million in 2014 and responsible for 297 full time equivalent positions. Through upstream and downstream connections the average Orkney vessel has a GVA of £67,600, and council investment in fishing quota has supported a variety of local projects improving the quality of life for residents throughout Orkney and strengthening the economy overall.

Despite its island nature, Orkney's fishing industry has built trade networks with Europe and Asia. The overall opacity of these markets mean individual fishers are vulnerable to market variations and struggle to diversify their fishing activities due to management legislation. These restrictive regulations combined with stagnant market prices have led to high levels of competition within the fleet which threatens the long term continuity of the industry. However, economic indicators suggest the pot and trap fleet is economically stable.

The economic and stock sustainability of Orkney's fishing industry are closely related, with the rising cost of fuel and bad weather often influencing where and what fishers fish, placing pressure on an already heavily exploited stock. Economic solutions to high fishing effort to combat over fishing and unsustainable practices have the potential to be incorporated into local fisheries management to improve the overall sustainability of the industry. The decision-making pathways used by fishers and identified in this report allows us to identify areas where sustainability has the potential to be compromised, which has the potential to inform future fisheries management strategies.

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