



# The Continuity of Orkney's Fishing Industry

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### 1. Executive Summary

The number of vessels in Orkney's fishing industry has decreased by 6% between 2008-2016, a trend that threatens the long-term continuity of the industry. Contributing factors include economic trends such as stagnant market prices and rising operating costs, as well as socio-cultural trends, such as the perception that fishing is a poor career opportunity. The impact of the decline has implications for the wider community as well as knowledge transfer between individuals. Understanding the various factors influencing people's decisions to leave the industry as well as the barriers to entry may help reverse the trend.

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## 2. Introduction

Orkney's fishing industry is on the brink of a continuity crisis. Currently, there are 106 fishing vessels registered to Orkney, employing around 170 individuals full time (all of whom are male). The number of vessels has decreased by 6% between 2008-2016, a decline that may be attributed to stagnant market prices, rising operating costs, the 'greying of the fleet' and a net migration of younger individuals out of the industry partly as a result of an increasing number of alternative employment opportunities.

Traditionally, retiring skippers are replaced by new entrants to the industry. However, the low number of new entrants to Orkney's fishing industry has posed issues for this traditional succession model. The majority of Orkney's skippers are between the ages of 35-55 years old, while the ages of crew ranging from 17 to over 50. This high ratio of older to younger fishers is known as the 'greying of the fleet' and is becoming increasingly common throughout the UK fishing industry. A greying fleet threatens the continuity of the industry, both through the net loss of active fishers through retirement and the changing community perception of the viability of the fishing industry. Young people are less likely to consider the industry to be a viable career opportunity if there are few young people working in the industry. This is explored further in section 4.

As local crew becomes harder to recruit (see section 4.5) the reliance on foreign crew increases to meet the industry's labour demands. Within Orkney the presence of foreign crew is concentrated in the diving industry and on larger offshore vessels (personal observation, 2017).

The presence of foreign crew within the fishing industry can be seen as a mixed blessing. While foreign crew can help a skipper meet their labour demands (and often at a lower price than a domestic crewman), in the long-term a high presence of foreign crew can have severe consequences for the continuity of the industry. The recruitment of individuals into the industry is heavily reliant on the 'socialisation' of younger generations into the industry, achieved by strong relationships between current fishers and the local community. Foreign crew is frequently associated with a loss of these relationships, and subsequently a loss of interest in the fishing industry.

Additionally, the presence of foreign crew can be a sign to the community that the fishing industry is experiencing difficulties (Williams, 2008) and decrease the interest of people in entering the industry as they fear it may not be a stable career path. These perceptions are further explored in Section 4.5.2.

### 3. Methodologies

Data for this study was acquired from multiple sources including literature reviews of scientific papers and public documents, direct observations, and formal and informal interviews with fishers, fisher families, training providers, processors, wholesalers, suppliers, and local decision-makers. 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, social values, and decision-making processes), while allowing interviewees to bring up their own views and concerns organically, to ensure their unique experiences were not lost. Each interview was recorded, transcribed and analysed using the qualitative analysis software NVivo 11 Pro. Common themes and ideas expressed through this interview process are explored throughout the report, offering insight into the causes -and potential solutions- to the industry's continuity crisis.

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.

### 4. Key Concepts

This report draws upon concepts such as identity, community, resilience/transformability, and wellbeing to understand individual and community responses and attitudes towards the continuity of Orkney's fishing industry.

#### 4.1. Identity

Identities can be individual or collective, and both are defined through the creation of boundaries via internal and external identity. Fishing is a driver of the formation of individual, group, and community identity and as such it promotes a shared sense of cultural meaning (Acott and Urquhart, 2017). Those involved in fishing often have a strong sense of identity based around their occupation, while self-identifying "fishing communities" use the industry to create and express collective identities (Acott and Urquhart, 2017); Williams, 2008).

Identity, whether that be the identity of an individual or a community, is complex, multi-faceted, and dynamic, re-enforced through the process of active identification of similarities and differences via interactions with other individuals or communities (Williams, 2008).

An individual's identity is informed by (and in turn influences) the identity of the community/communities of which they are a part. As an individual's identity develops into a communal identity, which in turn can be seen to develop into a community, it is important to note the concept of place and the important role this plays in the development and maintenance of both identities and communities. Physical places, when associated with identities, are imbued with particular meanings, given to these places by those who claim association with that place (Williams, 2008; (Acott and Urquhart, 2017). The relationship an individual, group, or community has with a place influences and in turn can be influenced by the social and cultural values of the community or groups within the context. Thus, a sense of place is said to be co-produced (Acott and Urquhart, 2017).

## 4.2. Community

A community is the ultimate boundary-expressing tool, as it is the domain in which identity is performed for those who are perceived as 'different'. Traditionally, a fishing community has been defined by the proportion of its population that are engaged with the fishing industry, with most definitions requiring between 5 and 10% of the local workforce to be involved in fishing (Scottish Government, 2009). While such narrow definitions are helpful, they fail to account for the intangible relationship a community may have to its local fishing industry, which can cause us to underestimate the importance of the industry to its surrounding area. Alternative definitions, that encompass the social and cultural values of the industry, have been proposed. Brookfield, Gray, and Hatchard (2005) suggest that fishing communities can be seen as communities where "...the community understands and makes sense of the world from a perspective that is garnered from years of involvement in the fishing industry [...] fishing is the glue that holds the community together".

Using definitions such as this allows our understanding of how local communities understand and relate to the fishing industry to become more nuanced, as seen with the inclusion of concepts of 'real' and 'virtual' fishing communities (Reed et. al., 2011). Where 'real' fishing communities exhibit 'real' dependency in the form of economic reliance on the industry (and can therefore be defined using the more traditional parameters), 'virtual' fishing communities rely on the *idea* of the fishing industry, using the image of the industry as a cultural icon upon which it can found a tourist industry or create markets for seafood products (Reed et. al., 2011). While 'virtual' communities may not be economically dependent on a physical fishing industry and its output, many are economically

dependent on their 'virtual' industry, which has the potential to exceed the value of a 'real' industry (Scottish Government, 2009).

Once-real fishing communities can become virtual, as the fishing industry undergoes changes in the form of fleet consolidation, and the average age of fishers in the industry increases, and more and more individuals leave the industry. This process, while potentially benefitting the community as a whole, often results in the de-valuation of the fishing industry, with Jentoft (Scottish Government, 2009) describing the commercialisation of the industry as "reducing coastal culture to a caricature of itself".

#### 4.2.1. Resilience and Transformability of a Community

The resilience of a community refers to its ability to adapt and change while remaining within 'critical thresholds' (the characteristics that can be used to define the community). Resilience is an on-going process that can be achieved through purposeful decision-making in response to change and relies on access to assets (via social capital) that allows the community to exercise and legitimise their authority (Kawarazuka et. al. 2016; Folke et. al. 2010; Bakker, 2016). Community resilience theory assumes that every community is capable to some degree of responding to change and to taking ownership of development processes, utilising its natural assets to do so, although how a community responds is unique to the characteristics of the community and the situation they face (Bakker, 2016; Kawarazuka et. al. 2016; Folke et. al. 2010).

There are two categories of resilience: general and specified. Where general resilience refers to resilience against all kinds of challenges, including completely novel ones, specified resilience refers to resilience towards particular shocks (Kawarazuka et. al. 2016; Folke et. al. 2010).

In situations where a community is unable to respond to change in a way that allows it to stay within critical thresholds it is said to undergo transformation, in which the previous system is dismantled and a new one replaces it. Associated with innovation, novelty, and shifts in community values and social networks, transformation occurs across scales, with small-scale transformations encouraging transformation on larger scales, while drawing upon system connections and relationships to support its changes (Folke et. al. 2010). The transformation process has three stages: 1) the preparation of the system for change, 2) using the crisis as an opportunity for transformation, 3) creating resilience in the new system (Folke et. al. 2010).

#### 4.3. Social Wellbeing

Social wellbeing stems from the idea that human wellbeing and the environment are linked- the environment provides a range of ecosystem services, which influences an individual's perception of

‘living well’. Social wellbeing can be viewed as a state in which human needs are met, where individuals and groups are satisfied overall with their quality of life and are able to act in a meaningful way that enables them to pursue their goals (Johnson, 2017 A; Armitage et. al., 2012; Breslow et. al., 2016).

Wellbeing can be divided into objective, subjective, and relational dimensions, with the objective dimension referring to the assets and resources that relate to an individual’s living standards (e.g. income, educational level, and health), while the subjective dimension refers to personal evaluations on how the individual themselves is doing and includes notions of self. The third dimension focuses on networks (e.g. an individual’s relationships with others) (Johnson, 2017 A; Acott and Urquhart, 2017). These dimensions are applicable whether applied to a household scale, a community, or an entire human-ecological system (Acott and Urquhart, 2017).

## 5. Introduction to Orkney and Orkney’s 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).

## 6. Orkney’s Fishing Industry

Orkney’s fishing industry consists approximately 111 vessels, the majority of which are under 10m. This fleet composition means Orkney’s fishing industry can be described as ‘inshore’, with the major fisheries centred around brown crab, velvet crab, and king scallops. Other important commercial species include queen scallops, lobsters, prawns, and whelks. The fleet is responsible for the 297.37 full-time-equivalent positions, with landings in 2015 valued at £6,264,459 (Seafish, 2017).

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).

There are two crab processing factories in Orkney, one located in Stromness and one on Westray. These processors act as buyers of brown crab, velvet crab, and lobster. In addition to these processors, a number of smaller buyers operate within Orkney.

## 7. Entering the Industry

All industries are reliant on a continual influx of new individuals for their long-term survival. For an individual to enter the fishing industry -whether as a crew or a skipper- they must first pass four mandatory training courses (see section 8.1.1). On average 26 individuals undertake these courses annually using financial support offered by Orkney Fisheries Association. The majority of these new entrants are aged between 20-29 years (over 35% of the total number of individuals entering the industry). Individuals aged between 20-39 years and 40-49 years each account for 29% of new entrants, while individuals aged between 50-59 account for the remaining 2%- see figure 1 (OFA data).

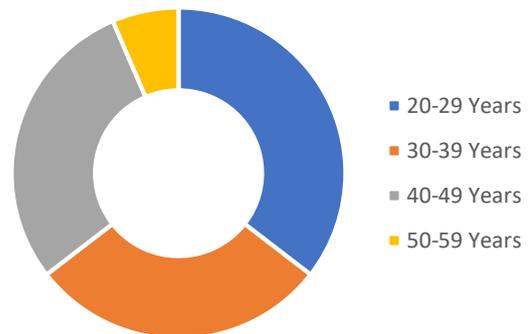


Figure 1

Today there are fewer individuals entering the fishing industry than in previous decades (the reasons for this are discussed in detail in section 4.5). Interviews with new entrants and existing fishers reveal that the most common motivating factors for individuals to enter the industry include lifestyle, family connections, and money (personal communication, 2018).

### 7.1. Motivations to Enter the Industry: Lifestyle

All of those interviewed said they were attracted to the lifestyle offered by a career in fishing. The chance of adventure, the ability to work outdoors at sea, and working independently were all described as being the major motivating factors listed by the majority of fishers. One fisher, who came from a farming background, describes how he was attracted to the fishing industry because it offered the chance of adventure:

*“It means nothing to me family, fishing [...] They're all farming, all, all me relations [...] Ken, I just wanted, I [wasn't] keen on the farming. I wanted an adventure and wanted*

*something else to try for a big adventure in life, no being stuck home in the same old same old. And the sea was a big adventure. You sailed away. You travelled. You seen things.”*

As well as the adventure of the fishing industry, fishers said they were attracted by the ability to work outside.

*“Nice in a summer’s day and bonny weather and oot there, it’s a pleasure and you’re just loving it and grinning about all day. You ken, doing the job and that in bonny weather you ken, there’s nothing like it.”*

## 7.2. Motivations to Enter the Industry: Family Connections (socialisation)

Many fishers interviewed had close relatives who fished while they were growing up and attributed this familial introduction into the industry as a major factor in their decision to become a fisher. One skipper describes how helping his grandfather was the catalyst that encouraged him to enter the industry:

*“Well, just grew up about hands. Used to go out fishing with me grandfather. Go to the creels, and work a while at that, and I just gradually got involved in it like that... so it was in me blood.”*

Another fisher describes how during his childhood he would go fishing with his grandfather after school:

*“Umm.. it was all we knew. I used to go out with me grandad before I even started school. And then, I think.... I was in school I put creels in the sea... it wasn’t very many. Just did that when we got home from school at night. Just for the summer. As soon as you were home at night you were off to the creels.”*

Familial connections or other social pathways that allow individuals to become familiar with the industry are valuable in ensuring the transfer of knowledge and the long-term continuity of the industry by attracting new entrants (see section 8). In recent years as the cost of entering the fishing industry has increased (see section 4.5.1) family connections may help individuals overcome financial barriers:

*“No way to get into fishing now, unless you’ve got a father or uncle in the business. No way. Quota’s too dear.”*

The socialisation of individuals into the fishing industry has been vital for the constant renewal of the fishing industry. A decline in the number of fishers (caused by a variety of external factors, discussed in section 4) is likely to have long term consequences for the continuity of the industry as fishing is no longer seen as a viable industry.

### 7.3. Motivations to Enter the Industry: Money

Some of those interviewed, typically older fishers (>40 years old) said that seeing the success of the fishing industry while they were growing up encouraged them to enter the industry, and that they were particularly influenced by the success of Orkney’s whitefish fleet. One fisher says:

*“Well, the fishing was big for Orkney. It was big in my day when I was a young boy and [I went to sea]. Because there was a lot of trawlers getting bought... young boys from the isles and that... Westray was one of the key islands, and ehh, the young and ambitious boys from there bought trawlers ken, did their tickets as skippers as young boys then we ended up on that trawlers [...] I think there was about twelve boats here at one time. Whitefish boats. It was a big industry...”*

In recent years increased operational costs and stagnant market prices have reduced the profitability of Orkney’s fishing fleet, which is considered by the industry to be a major barrier to attracting and retaining new entrants- see section 4.

### 7.4. Motivations to Enter the Industry: Adjacent Career Pathways

While fishers from the whitefish and creel fisheries often start their fishing careers at a young age many scallop divers enter the industry later in life after working as commercial divers. One scallop diver describes how he would dive for scallops during his free time to supplement his income from commercial activities:

*“Well, I first got into fishing, I came to Orkney as a job- working diving. And then, in between jobs I was just at the scallops, I got into the scallops. With [NAME] and [NAME]. And that’s where I started me scalloping from. Yeah it was just like a job filling in between commercial diving, and ehh, scalloping “*

Moving from commercial diving into scallop diving is a common career pathway for many of Orkney's divers. The movement from one industry to another is often linked with the life stage of the individual, as older commercial divers choose to become fishers as the pace and activity levels associated with scallop diving is more compatible with other areas of their life as there is less need to spend long time periods away from home (personal observation, 2018).

## 7.5. Barriers to Entry

Interviews with fishers not only reveal their own motivation to enter and stay in the fishing industry but highlights potential barriers that they perceive as preventing the next generation from entering the industry. The three most common barriers to entry cited by existing fishers were: financial constraints, changes in work ethic of young individuals, and increased legislation. Around 35% of fishers interviewed said they did not perceive there to be any barriers preventing entry into the industry.

The impacts of these barriers to entry extend beyond the short-term consequences of limiting the number of young people entering the industry and are associated with long-term shifts in how the industry is perceived by the local community, which may compound the current recruitment issues and can ultimately even contribute to overfishing (see section 9.1). However, as one fisher pointed out, with the correct attitude these barriers can be overcome:

*“If they want to work, no, there's no barriers. But it is hard work in comparison to work ashore. But it's also far better money than they could earn ashore. So... anybody with a keen sense of humour and willing to work is more than welcome “*

### 7.5.1. Financial Barriers

All fishers interviewed who perceived barriers to entering the industry identified financial barriers as being one of the more significant factors preventing entry. Increased prices for fuel, bait, licences, and quota were all highlighted by the individuals interviewed- as was the stagnation of market prices for most of Orkney's traditional commercial stocks. Financial entrance barriers act at all levels of the fishing industry- hindering crew recruitment, crew retention, and preventing new vessels from entering the fleet.

The recruitment -and retention- of crew into the fishing industry is reliant on consistent and moderate profits from the vessel. The majority of Orcadian vessels operate under the traditional 'share system' when paying their crew members, with 50% of all profits going towards the vessel, and the remaining

50% being split amongst the skipper and crew. The average Orcadian crew can expect to earn between £25-40,000 a year (personal communications, 2018). The financial pressures faced by many of Orkney's smaller vessels (see report *The Economics of Orkney's Fishing Industry*) has prevented many skippers from hiring crew or replacing older crew members when they leave the industry, which has long-term consequences for the industry (see section 8). One skipper describes the situation:

*“Why don't you have a crewman anymore?” “Because you can't afford to take anybody on, basically, at the end of the day. You can make a living yourself, but you cannae with two of you, you ken, so... not the whole year round. You could in the summer time, but then when the winter comes, you couldn't make a living then, if there were two of you. ”*

Financial barriers also prevent the fishing industry from providing a competitive wage in the job market. The average income of a deckhand within Orkney is £25-40,000 a year, which is comparable to similar jobs in other marine industries, such as aquaculture. This suggests the low entry and retention levels of the industry stem from a cultural barrier more than a financial one. The expansion of other maritime industries within Orkney, such as aquaculture, ferry work, renewable energy, and tourism (see section 7) has led to a greater competition for labour amongst the industries, and an individual looking to enter a maritime industry now has significantly more options than thirty years ago and may prefer a career with higher and more regular wages to the lower, irregular pay of the fishing industry:

*“Why do you think fewer people are entering the industry?” “With other industries, like... with the ferries and that... they have a set wage so they [the workers] can get a mortgage and all that kind of stuff. At this time, it's quite difficult to get a mortgage fishing- because your wages is no fixed.”*

The decline in the number of local individuals willing (or able) to enter the fishing industry has led to an increase in the number of foreign crew -both EU and non-EU- working within Orkney, which has both economic implications for the local community but may also in itself harm the continuity of the industry over time.

Financial barriers are not restricted to attracting and hiring crew: they also impede new vessels from entering Orkney's fleet. In 2018 the cost<sup>1</sup> of an under 8m vessel without a licence was -on average- £9,833 (increasing to £21,777 with a licence), while an 8-10m vessel without a licence had an average

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<sup>1</sup> Vessel costs averaged from FindAFishingBoat.com, with prices checked in June-November 2018.

cost of £51,200 (£79,000 with a licence). While previous generations of skippers have benefitted from financial assistance from Orkney Islands Council and Business Gateway to help them establish their businesses, this assistance is no longer available to the industry (personal communication, 2017). In addition to a lack of financial support, today's new skippers face additional costs not seen by previous generations of fishermen: licences, quota, and safety equipment all increase the capital costs of starting a new business. This is especially true for the whitefish industry where the cost of quota and licences are so high that they are prohibitive to the vast majority of would-be new entrants -as well as existing fishermen- restricting these individuals to the shellfish industry, which increases competition within the sector, drives down market prices, and ultimately makes it harder to run a profitable business:

*“What about people entering the industry?” “A young man now trying to buy a trawler and get to sea, get quota and.... its near impossible. [It] Takes a wealthy man to get into the game. So, the only other fishing is the creel fishing to try and have a go at- to get to the sea for fishing you ken. But the other hand, there's nothing there to catch. So... He's gonna fail before he starts.”*

Financial barriers are not unusual within any industry, but what sets fishing apart is the lack of support offered to those hoping to start their own business. This lack of financial support is compounded by the self-employed nature of fishermen, making entry into the industry a high-risk decision.

While the costs of entering the industry may form significant financial barriers to entering the fishing industry, increasing operational costs combined with stagnant market prices are often contributing factors that cause individuals to leave the industry for alternative employment- see section 7.

### 7.5.2. Cultural Barriers

Changing attitudes towards the fishing industry may also be an influencing factor on why fewer individuals are choosing to enter the industry. Younger generations are more frequently being encouraged to pursue higher education and choose a career path associated with regular working hours and wages, meaning the fishing industry -characterised by uncertainty, long hours, and relatively low wages- is becoming less appealing to young people (Williams, 2008). Three of the fishers interviewed said they would discourage a family member from entering the

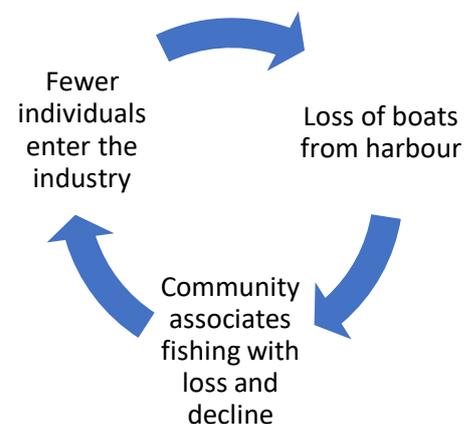


Figure 2

industry and instead encourage them to enter similar but more profitable occupations, such as aquaculture or the pilot boats.

The perception of the industry as uncertain and unrewarding may stem from the economic issues Orkney's communities have witnessed the fishing fleet face, and these perceptions are strengthened by the absence of young skippers in the industry. Increasingly, fishing is seen as "an old man's game" and not a viable career opportunity for a younger individual. Two fishers said that while they would discourage any family members from entering the inshore fishing industry, they would encourage them to enter the whitefish industry:

*"Would you encourage a family member to become a fisherman?" "No. Highly not recommended. At all in the shellfish sector especially. But the whitefish sector the trawlers now, that's good money for a young'un. I would push them into that. Yah I would, because that's come back...."*

A lack of local recruits in the fishing industry may cause skippers to hire crew from outside the local area. Increasingly such crew are being sourced from Northern Europe (particularly Poland) or Asia (particularly the Philippines). While this may meet the short-term labour demand it may further reduce the likelihood of new entrants to the industry due to a loss of community connection, which results in reduced socialisation of younger generations into the fishing industry (see section 4) (Williams, 2008). This lack of socialisation further discourages young people to enter the industry, as fishing becomes 'hidden' and therefore is often not considered a career option- see figure 2.

During interviews multiple fishers spoke of the perceived indifference of the younger generations towards fishing, which they have experienced through work trials and a rapid crew turnover. One fisher sums up the situation:

*"There [are] no young fellows going into it. And that's a shame on the whole industry. It's the same with most of the jobs nowadays. There's nobody interested in going to sea...."*

Those who do attempt a career at sea are frequently put off by the long hours and hard work, with some leaving the industry after just a day at sea. Multiple skippers cite a poor work ethic among the younger generations, and an unwillingness to work long, often anti-social hours.

#### 7.5.2.1. Seafish: Attracting Young People to the Sector

A report by Seafish (2019) explored some of the cultural attitudes and barriers that prevented young people from considering a career in the fishing industry. The report found that the five most common

negative perceptions of a fisheries career were: handling fish, the industry being “smelly, dirty, or dangerous”, limited industry prospects, low pay, and concern for what peers or family members would think. The same report explored the top five things young people look for in a job, which were: enjoyment, good pay, opportunities, variety, and travel. The pervasiveness of the negative perception of the fishing industry was attributed to cultural attitudes, with schools encouraging young people to pursue higher education rather than entering the industry.

The Seafish report identified key ways to engage with young people to encourage entry into the industry, including using social media as an engagement tool. Interactive, highly visual approaches using a variety of media and real-life, positive case studies were highlighted as being some of the most effective tools, as was highlighting the variety of careers available in the industry.

### 7.5.3. Legislative Barriers

Fisheries management strategies and their supporting legislation is the foundation for the financial - and to some extent, the cultural- barriers preventing the sustainable growth of the fishing industry. The introduction of the fishing licenses and quota systems has hindered the ability of the fleet to diversify and forced many inshore fleets to concentrate their efforts onto a handful of stocks, making it harder for individual fishermen to make a living.

These legislative barriers act across scales, influencing the behaviour of small inshore fishing boats working within six nautical miles as well as large pelagic vessels fishing in the Exclusive Economic Zone. These barriers not only prevent the diversification of the industry but can prevent the sustainable management of local fisheries. Initiatives from Orkney’s fishing industry such as introducing management controls for King Scallops and in achieving MSC certification for brown crab were ultimately unsuccessful due to the lack of control held by the local community in managing and controlling their marine resources. One fisher spoke of how he perceives legislation as a major barrier in the sustainable development of the industry:

*“I’m maybe biased but, we’re surrounded by water. We’re surrounded by fish... shellfish. And I think a bit more could be made of it. And ken, we’ve lost a lot of our fishing rights. [The law says] “You cannae do this, and you cannae do that”. And I think if we can get some of that rights back, you could build the industry to be worth considerably more than it is at this time.”*

Additional barriers include perceived overregulation in some aspects of the industry, and their associated financial burdens. An ex-fisher talks about the changes in management over time and how

increased regulation prevents him from re-entering the industry:

“Oh. Would you ever start fishing again?”

“No.”

“No? Why not?”

““... Like from when I fell in love with it, speaking to the guys that got into it a lot earlier, like in the 80s and stuff, it's just.... it's just a different world. They were throwing it at them as far as licences and you know, regulations and everything else, it was free and easy. And now, it's very, very tight. The MCAs obviously looking closer at fishermen as well. It's just a different world”

#### 7.5.4. Barriers to Entry and Sustainability

Many of the barriers to entry highlighted in this report have long-term implications for the sustainability of commercial stocks, causing uneven effort allocation within the local fleet and preventing the diversification of fishing activities. Whereas traditionally a number of individuals would have moved from the inshore industry to the pelagic or demersal fisheries, barriers (primarily financial and legislative) prevent this graduation:

*“I looked at buying a whitefish boat but... I spoke to [the producers organisation] about it but... it was just quota was the problem. I wanted, I'm wanting to buy a bigger boat. But, I can't get quota- unless you spend millions on it, and no body's going to give you millions. If you go to the bank, they're gonna laugh at you, so... you're really stuck where you're at, basically. Which is no a good thing, because most jobs you want to go up the ladder, instead of going down the ladder. So I don't know where to go, except to stay where I am, no doubt.”*

Such barriers prevent the natural diversification of the fleet, leading to increased fishing pressure on inshore stocks as existing fishers are unable to move into new fisheries, and new entrants to the industry are more likely to enter the inshore fishery due to the greater barriers associated with offshore fisheries. This maximisation of individuals working as inshore fishers has consequences for the ecological, economic and social sustainability of the fishing industry, as the increased fishing pressure causes local stocks to decline, and floods the market with shellfish, creating a low price per kilo. One fisher sums up the situation:

*“...it takes a lot a lot of money and quota to get into the [whitefish] industry [...] for a young man now trying to buy a trawler and get to sea, get quota.... its near impossible. [It] takes a wealthy man to get into the game. So, the only other fishing is the creel*

*fishing to try and have a go at, to get to the sea for fishing you ken. But [...] there's nothing there to catch."*

## 8. Leaving the Industry

For some the decision to leave the industry is a natural part of their career path as they grow older and retire, but for a number of individuals the choice to leave the industry is based on necessity rather than choice. Crew turnover within Orkney is just under 30% (data from OFA), with an average industry turnover of 26 individuals per year. Interviews with skippers reveal that many of those who leave the industry are relatively new entrants, having worked in the industry a year or less<sup>2</sup>. Those who have worked in the industry for long periods of time are less likely to leave, with those who do citing external forces (such as finances or health) as their primary motivation to exit.

Individuals leaving the industry entirely (e.g. through retirement or seeking a new career) should not be confused with individuals selling their vessels and taking up new positions within the industry. Additionally, it is important to distinguish leaving the industry via retirement (a natural part of a fishing career) from leaving the industry to seek alternative work, which may be viewed as an unnatural end to a fishing career brought about by an imbalance within the fleet (see section 9.1 and section 10).

### 8.1. Leaving the Industry vs. Consolidation of the Fleet

When discussing individuals leaving the industry it is important not to confuse the consolidation of the fishing fleet with the decline of the industry, as fewer boats does not always mean fewer fishers. As profit margins within the fleet become smaller skippers may sell their boats and take work as a crew on another vessel- decreasing the number of vessels in the fleet but maintaining the number of individuals working in the industry. While not inherently harmful, consolidation indicates an imbalance between fleet behaviour and the biological and economic parameters it operates within (see section 10) which may be damaging to the industry long-term.

Fleet consolidation is associated with a loss of crewing opportunities for new individuals looking to enter the industry. Long-term fleet consolidation may be unsustainable but in the short term it is a viable and common survival method for young, new skippers with small vessels.

Younger skippers are more likely to take work as crew in periods of financial stress than older skippers, as older skippers are more likely to either continue to fish even if it is not economical to do so, or to

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<sup>2</sup> The reasons behind why these individuals choose to leave the industry after such a short time period has yet to be fully explored, but it is highly likely that they find the work unsuitable and unenjoyable compared to other opportunities (see sections 8.2.1-8.2.3).

choose to retire (see section 5.2.1). Younger fishers, however, may choose to sell their vessels and take a position as crew for an older and more established fisher. Two young fishers talk about this decision:

*“Just one problem after another, so I just sold the thing. Crew a while, make some cash, and then get a better boat and give it another shot. That’s the plan.”*

*“I sold the boat cause I wasnae making any money and [wasn’t] getting [out] as much as I needed to, what with the weather and all.... So, I went back to crew with [SKIPPER] and save some cash... maybe try again at some point....”*

## 8.2. Motivations to Leave the Industry

While the circumstances surrounding each individual’s decision to leave the fishing industry are unique, some motivating factors are more common to skippers than they are to crew, and vice versa. The age of the individual often influences how they respond to external pressures. Older fishers are more likely to continue fishing despite long-term uncertainties than younger individuals, as they - generally- have greater financial security and fewer familial and financial obligations, which allows them to ‘wait out’ periods of low market prices<sup>3</sup>. Alternatively, older fishers may struggle to leave the industry as a large portion of their capital has been invested into the business, and they may not be able to leave without making a substantial loss, so are unwilling to leave in the hope that they may be able to recoup these losses. Meanwhile, individuals in financially precarious situations (such as new entrants), or that are supporting young families, may be forced to downsize their activity to retain profitability or are forced to leave the industry entirely. Table 2 and 3 are a simplified visual demonstrating how different age groups are likely to respond to these pressures.

Likelihood of Leaving the Industry	Number
Very Likely	
Likely	
Somewhat Likely	
Unlikely	
Very Unlikely	

Table 1:- Key for table 3

<sup>3</sup> This suggests that older fishers prioritise different values than economic values, and their motivation to fish is different from their younger counterparts. Understanding individuals’ motivations to fish, and their decision-making process, is an important part of fisheries management. A system that accounts for diverse motivations and behaviours will inherently be more robust than one that does not.

Factor	Age Group				
	16-20	21-30	31-40	41-50	50+
Retirement					
Unprofitable Business (>3 months)					
Unprofitable Business (<3 months)					
Unsuitable Work-Life Balance					
Dissatisfaction with Occupation					
External Financial Needs (e.g. need for monthly income to obtain a mortgage)					

Table 2:- Simplified table showing the how likely a motivating factor is to affect an age group of fishers within Orkney. The table does not account for relationships between factors nor does it account for different sized vessels, social connections, or other similar variables. This table focuses on single-skipper vessels with 0-1 members of crew. Note the list of factors does not include overregulation as in many cases it is impossible to distinguish whether the individual has chosen to leave the industry due to overregulation or its associated financial cost.

The interplay of economic and social factors that culminate in an individual’s choice to leave the industry are complex and as such it is rare for any single factor to be the sole reason an individual chooses to leave the industry. Frequently, financial factors such as low market prices or high operational costs contribute to increased pressures from the fisher’s family to leave the industry and find a stable source of income. No matter the reason, the act of leaving the industry is often a difficult experience which is associated with a loss of identity and social bonds, which often has severe impacts on the individuals involved- see section 5.3.

### 8.2.1. Motivations to Leave: Retirement

Retiring from the industry is most common among older skippers who generally have the resources to weather market fluctuations, as well as a family situation that allows them to downsize (as older individual’s generally have fewer dependents than their younger counterparts). Retirement for fishermen is frequently associated with an acute sense of loss- off both the individual’s sense of identity but also of a community. As a result, older fishers can be reluctant to retire, as they attribute their fishing activities to their current good health and fear they will “decline” upon retirement. Frequently the decision to retire is accompanied by pressure from the individual’s family.

*“He’s been saying he’s gonna retire for years now- I think this year he might. He’s getting a lot of pressure from home, you see. He [doesn’t] want to though- he’s scared he’ll go into decline if he stops. But when he does, I’ll take him out on me boat for some o’ the time, get him out a bit”*

It is common for a retired fisher to stay involved within the industry- most commonly as a crewman (normally on an occasional, part time basis) or by carrying out shore-based work such as mending creels and splicing ropes. For these reasons it can be difficult to classify retirement from the industry as a ‘true’ exit from the industry. While the roles they perform may appear relatively insignificant when compared to their previous positions, retired skippers are vital in the continuity of the industry by facilitating knowledge transfer between generations- see section 8.

### 8.2.2. Motivations to Leave: Economics

Individual economics as well as wider market forces not only prevent individuals from entering the industry but are frequently contributing factors to why people choose to leave the industry. The economic motivations to leave the industry may be business-oriented (such as small profit margins) or family-oriented (where the finances of the business impact the individual and their family in a manner which ultimately causes them to leave the industry), or -most commonly- a combination of the two.

The long-term profitability (or lack thereof) for a fisher is a major factor behind an individual’s decision to leave the industry, with the majority of interviewees naming lack of profits as core contributing factor to their decision to leave the industry. Fishers aged 21-49 are more likely to leave the industry as a result of domestic pressures exacerbated by financial issues, which may have serious implications for the long-term continuity of the industry and knowledge transfer (see section 8).

The lifestyle associated with the fishing industry is often incompatible with modern life: fishers are self-employed, and their income may vary dramatically between weeks and months depending on a variety of external factors including markets, target stocks, and weather. This often makes it difficult for fishers to obtain financial support, including loans or mortgages, because they lack evidence to show a steady and reliable income. Additionally, their self-employed status means they are not eligible for sick pay. One skipper describes how over the years many of his crew have chosen to leave the industry in pursuit of financially stable careers:

*“[...] In the past there [has been] various boys that have worked with me. And... they’ve gone to the fishing and they’ve got a job and money and some of them [have] moved on to.... other marine jobs. Erm. One of the boys is on the ferries now so they can...”*

*they have a set wage, so they can get a mortgage and all that kind of stuff. At this time, it's quite difficult to get a mortgage fishing- because your wages is no fixed"*

The financial instability associated with fishing may also prevent those who have left the industry from returning, even after the pressure from their family has decreased. When asked if they would ever consider re-entering the industry once their children had left home, one ex-fisher said:

*"No. No. [...] I have no interest in going back to it. Unless it was for fun. But everybody needs steady money. And fishing can't provide that. I mean, yeah, you can make twice as much in winter, but there's massive parts of summer where you'll make nothing. I've been on trips and made nothing. So, [I'll] pass"*

For many, the financial uncertainties associated with the fishing industry are compounded by other unknown and uncontrollable variables including fluctuating market demand, changes to commercial stock levels, and changes in climate and local weather patterns. These uncertainties prevent fishers from creating long-term business strategies, while existing fisheries legislation and management strategies hinder the fleet's ability to respond to any changes in a robust manner. Additionally, increased start-up costs for an individual looking to buy their own vessel (see section 4.5.1) has led to a reliance of external funding for the establishment of new businesses, which may place skippers in a vulnerable position during periods of low prices or poor catches. One fisher describes the situation:

*"Well, it is quite a lot of money to set up from scratch, that will be the [...] A lot of folks come and worked on boats, and then they've bought boats and think 'oh its great, its easy money' and all the rest of it and they borrow very, very heavily. Like they buy a boat for £70,000 and then another £40,00 in creels or whatever. And by the time the bank takes that chunk out of it every month, they're left with next to nothing and putting in a hell of a lot of effort into it. And then they just give up after a couple of years."*

As well as high entry costs, vessel operational costs have risen over the years while the market price for shellfish has remained relatively stable- see figure 3. 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.*

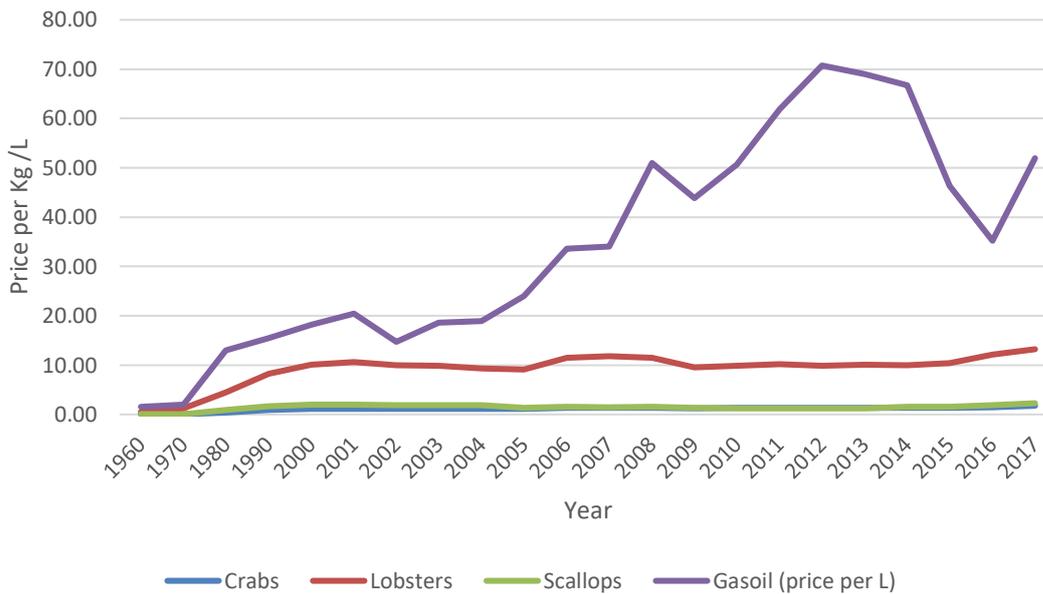


Figure 3:- The average market price per kilo for crab, lobster, and scallops (data from Marine Management Organisation, 2017) compared with January prices for fuel (data from Department for Business, Energy, and Industrial Strategy, 2018)

### 8.2.3. Motivations to Leave: Overregulation

While periods of low prices and smaller profit margins are less likely to cause well-established, older fishers to leave the industry than their younger counterparts, the opposite can be said for their response to perceived ‘over regulation’. Several fishers over 50 said that they would consider leaving the industry as a result of over regulation- most commonly MCA inspection- compared to 0% of their younger counterparts (aged <50). The difference between the responses of younger and older fishers can be attributed the different values and experiences between the groups. Younger individuals tend to accept that MCA inspections are part of the operational costs of a fishing vessel and are thus willing to pay the associated costs, even if narrow profit margins mean they struggle to do so. Older fishers (including those in a position to pay the fees associated with inspections) are more reluctant to pay as these costs have only been introduced relatively recently and may instead choose to sell their vessel. An ex-fisher discusses the change in regulatory attitudes between the 1980s and the present:

*“... Like from when I fell in love with it, speaking to the guys that got into it a lot earlier, like in the 80s and stuff, it’s just.... it’s just a different world. They were throwing it at them as far as licences and you know, regulations and everything else, it was free and easy. And now, it’s very, very tight. The MCAs obviously looking closer at fishermen as well. It’s just a different world. And I’ve heard stories of guys in Shetland trying to take boats that had been lain aside, and try to bring them back, and have to spend*

*absolutely thousands to get them up to code, because everything's been tightened up so much"*

While interviews did not reveal a pattern of younger fishers leaving the industry solely due to perceived overregulation, it is likely that the costs associated with MCA inspections and an inability to diversify their activities due to quota and licencing laws are contributing factors in their decision to leave. Young and new skippers may be especially vulnerable as they have fewer financial resources than their older and more established peers, and they typically have older vessels that require a higher level of maintenance. One ex-fisher describes his experiences with MCA inspections, and how they were a deciding factor in his decision to finally leave the industry:

*"[...] They did a survey on my little dinghy. If I had done it three years earlier it would have cost me nothing, but because of the time I did it, it cost me two grand to get the boat up to spec [...] After I gave it up full time I kept the dinghy as a hobby boat. Then the MCA came down on me really hard. I didn't have... You know... they want you to have a category C medical kit. That's the kind of thing that if you need that, you need somebody else to put it on you. And I'm working a single-handed boat, so... You know. A waste of money as far as I'm concerned. First aid box will do. Anything worse and I'll have to call for somebody to help, so... But yeah, they came down hard. Gave me a massive list and threatened to take the licence off me. And I was just thinking, 'You know what? Go fuck yourselves' so just [sold] the boat. But I understand why he was doing it. It's because if anything happened to me it would come back on him now, so... But that's just another form of regulation I suppose..."*

### 8.3. Challenges Associated with Leaving the Industry

There are a number of social and economic challenges associated with leaving the fishing industry- including the potential loss of identity and social network, and the financial cost of retraining for entry into a new career pathway.

Financial cost of leaving the fishing industry (if not retiring)- cost of retraining to enter another industry is high.

*"It'll set you back around £3,000, with no guarantee o' a job at the end. I had all [my] tickets for fishing but they're no good if [you want to retrain] for the Merchant Navy or the ferries. No good at all. So, you have to pay. I spent the last lot of me money on*

*it, scraped it all up and used it to take those courses, [with] no guarantee [of] a job at the end.”*

Leaving the fishing industry can be a difficult experience associated with a sense of loss, social isolation, and -in extreme cases- deteriorating health. An individual's response to leaving the industry largely depends on their reason for doing so. Older fishers are more likely to experience a sense of loss upon leaving the fishing industry, having to re-define their identity in the absence of their occupation. Younger individuals tend to be more resilient and are able to use their new employment opportunities to help them in the transition outside of the industry. However, younger individuals may still experience a sense of loss and may struggle to adjust to their new career path, which they often associate with a loss of freedom and flexibility.

The sense of loss associated with leaving the fishing industry may be compounded by the loss of the individual's social network, which is often underpinned by regular interaction in communal spaces (such as piers) or through formal communication channels such as the VHF. Upon leaving the industry a skipper no longer has access to these networks but may instead take advantage of networks created by the Fishermen's Mission which encourages regular meet-ups among retired seafarers to combat social isolation.

The loss of individual identity as well as increased social isolation can have harmful effects on individuals, manifesting as poor mental and physical health. Many older fishers who are at the traditional age to retire are reluctant to do so, fearing their health would deteriorate:

*“He's scared to sell the boat, to quit. Thinks he'll become stagnant, sitting about at home, like. That's what tends to happen.....”*

## 9. Continuity in Downstream Industries

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 (the majority of which are British males- see figures 5 and 6) 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.

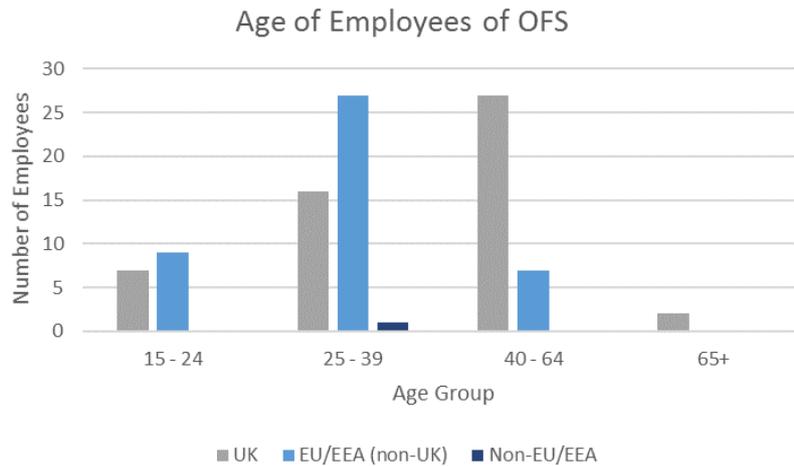


Figure 4:- The age of employees at Orkney Fishermen's Society. Data from Orkney Fishermen's Society

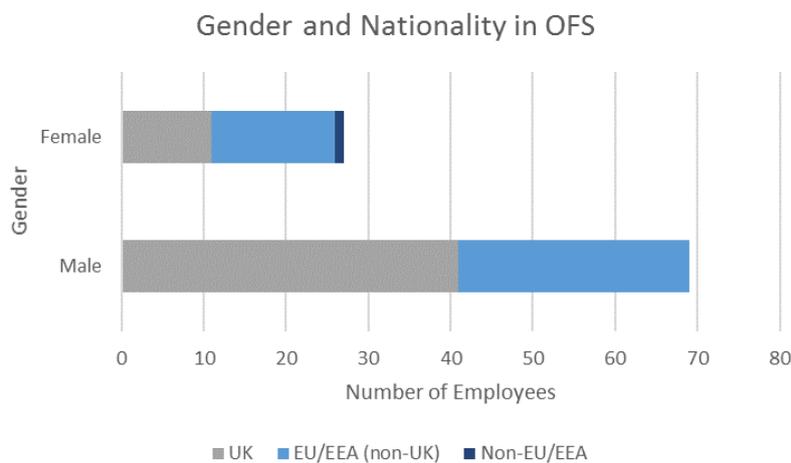


Figure 5:- Gender and nationality at Orkney Fishermen's Society. Data from Orkney Fishermen's Society

The growing market for live crab in Asia has threatened the continuity of both processors 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.

*“I... I’ll sort of split my landings [between the processor and wholesaler]. The factory... it’s a big thing here and would be a shame to see it go, but you’re getting between £1-2 more from a wholesaler, which all adds up. I land to them when I can though”*

The increased competition between processors and wholesalers has led to changes within the industry. Traditionally, OFS was Orkney’s second largest employer (Bakker, 2016) but has been forced to downsize, with a net loss of 14 staff occurring between 2016-2017 (Personal communication, 2018). The volatile nature of the Asian market makes it difficult for both processors and fishers to accurately plan for the future, which has implications for the long-term future of both Orkney’s processors and its fishing fleet (China-Britain Business Council, 2015; Stoll et. al. 2019). More information on the economic decision-making process of the industry can be found in the report *The Economics of Orkney’s Fishing Industry*.

## 10. Alternative Employment Opportunities

The impacts of the reduction in new entrants and the increased number of individuals leaving the industry may extend beyond the fishing industry and into other maritime Orcadian industries. The Occupational Alternative Ratio (OAR) can be used to gauge a community’s dependency on fishing by comparing the importance of the fishing industry to an alternative occupation<sup>4</sup>, and assessing the impact the fishing industry may have on the labour supply for these alternative occupations if the fishing industry were no longer a viable occupation. The OAR allows us to highlight communities which may be particularly vulnerable to declines in the fishing industry resulting from market or stock shifts- the results do not reflect the economic contribution of fishing to an area (see report *The Economics of Orkney’s Fishing Industry* for information on economic contributions). Within Orkney, eleven alternative occupations were identified<sup>5</sup>:

- |                                       |  |
|---------------------------------------|--|
| - Aquaculture labourer                | - Fish Processor/Wholesaler <sup>6</sup> |
| - Charter Fishing/ Dive Boat Operator | - Fisheries Officer                      |
| - Commercial Boat Hire                | - Harbour Staff                          |
| - Commercial Diving                   | - Pilot Boat Staff                       |
| - Renewable Energy Worker             | - Retailer                               |
| - Ferry Staff                         |  |

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<sup>4</sup> Defined as an employment opportunity that requires a comparable skill base and training requirements and that does not require an individual to leave the island or undergo a significant lifestyle change such as having to leave their home for long periods of time (Fofana, no date).

<sup>5</sup> This is not a comprehensive list of alternative employment opportunities within Orkney, but it is representative of the diversity within the region.

<sup>6</sup> Processors as an alternative occupation only include Cooke Aquaculture’s processing facility and excludes shellfish processors on the basis that these jobs would no longer be available under the assumptions this model is based on.

Through OAR assessment, the greater the OAR score the greater the impact the fishing industry will have on the labour supply, and thus the higher degree of importance of the fishing industry in that area. A score of >100 suggests that fishing is of equal or greater importance in terms of employment as any of the alternative occupations (and thus the labour market for these occupations would be quickly saturated if multiple individuals were to choose to leave the fishing industry). A score of 99 or lower suggests that the number of individuals engaged with fishing as an occupation is fewer than the individuals working in any one of the listed alternative occupations, and thus fishing would have less of an impact on the local labour supply.

Due to the geographical complexities of the region, Orkney has been divided into four areas<sup>7</sup>: Orkney Mainland, Inner Isles (Shapinsay, Rousay, Egilsay, and Wyre), Northern Isles, and Southern Isles (Hoy, Flotta, Burray, and South Ronaldsay). Individual calculations were not made for central hubs such as Kirkwall or Stromness. As different employment opportunities are available in each of these areas an OAR was calculated for each- see table 4.

Area	OAR	Rank	Number of Fishers Per Alternative Employment Opportunity
Orkney Mainland	1606.95	1	16
South Isles	477.27	2	4.7
Northern Isles	317.23	3	3.1
Inner Isles	194.05	4	1.9

Table 3:- The Occupational Alternative Ratio for Orkney, based on Fofana, no date

For each of the four areas within Orkney, the fishing industry is of a greater importance than any of the alternative industries that are available within that area. Orkney Mainland has the highest ratio, with 16 fishers available for every alternative employment opportunity. In contrast, the Inner Isles has only 1.9 fishers for every alternative career opportunity.

While the hypothetical situation described in the OAR methodology (of all of Orkney's fishers suddenly seeking alternative employment), the results do highlight areas and labour markets that may be particularly vulnerable to changes in global markets or local stocks.

## 11. Knowledge Generation and Transfer within the Industry

The continuity of the fishing industry is heavily reliant not only on new entrants, but the transfer of knowledge between generations, allowing the next generation of skippers to understand and work within an incredibly complex and risky environment. Advancements in technology have led to less

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<sup>7</sup> Areas are based on the areas used by Orkney Islands Council employment records

emphasis on some traditional skills (e.g. meteorology) and placed increased emphasis on more modern skills and knowledge bases (e.g. engineering and accounting). A decline in the number of new entrants into the industry is putting traditional knowledge transfer pathways into jeopardy. One fisher explains:

*“... Because the older fella’s [are] just dying off... a lot of experience is being lost daily. It’s a lot of knowledge getting lost, you ken, if you don’t get these young fellas back into the job....”*

Traditionally much of the knowledge shared between fishers was generated and exchanged informally: through daily observations of the surrounding environment and through casual conversations at the harbourside. The introduction of mandatory training courses for those wishing to enter and work in the industry, combined with the local fishing industry’s increased interest in the science behind their observations has led to the creation of formal knowledge pathways that supplement traditional, informal modes of knowledge generation and exchange.

### 11.1. Informal Knowledge

Informal knowledge generation and exchange is a continuous event which occurs naturally through the day-to-day activities and interactions of those working in the fishing industry. Often occurring on a relatively small scale (either at an individual or a community level), these pathways lack scientific credibility but provide valuable insights into the experiences of the local fishing industry.

Informal knowledge generation events frequently focus on the effectiveness of fishing- whether this be gear efficiency, exploring new fishing grounds, or experimenting with a new fishery. Informal knowledge generation often occurs over long periods of time and is founded on the observations of an individual or group of individuals. One fisherman describes how their experience of fishing in Scapa Flow has led to them designing a new type of net that they have found to be more suitable for their fishing grounds than other, generic designs:

*“Can you tell me more about your nets?” “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 the nets 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. There’s a few different things in it, you ken. The way the shape of it, its slightly different, and it’s just with working for so long I have a better idea now of how it, to get it to fish a bit better. And ehh... it usually works good. Comparing with the other guys anyway.”*

Similarly, another fisherman describes how they set aside a few creels to experiment with- whether this be by changing the depth, the bait, the size of eye holes. He describes the process:

*“I’ll just do a few, like, change the size of the eyes, change the bait, where I put [them]. Just to test and to see... see what happens. Its kinda exciting, when you’re pulling them up, you don’t know what you’re [going to] get. We’ve found a few good spots that way, and know what works for us”*

Informal knowledge generation is not only restricted to gear design, but also extends into finding new fishing grounds. One scallop diver talks about how, by drawing upon their experience working within Orkney, they were able to consult admiralty charts and find new scallop grounds:

*“Sometimes we’ll.... What you find by accident is that if you jump in the water and the water takes you somewhere, and then you, like, fall out of a current, you’ll fall where the scallops fall. So, we try and find those areas. Because it makes sense. They’re looking for that edge of water to get their feed. So, we check the charts and look at areas we know what like the tide and currents are... we’ve found a few new grounds that way before”*

Informal knowledge generation underpins the daily activities of Orkney’s fishermen and is the foundation on which many decisions are made. While the informal nature of these observations may have previously resulted in their exclusion from formal decision-making processes, they often highlight knowledge gaps that have yet to be explored through a formal scientific process (see section 8.1.1).

Informal knowledge generation is vital to Orkney’s fleet as it fosters innovation within the industry. However, the financial challenges faced by the industry (see section 5.2.2 and report *The Economics of Orkney’s Fishing Industry*) hinder the natural process of knowledge generation and ultimately harm the continuity of the industry. One fisher describes their inability to experiment with a new fishery due to financial constraints:

*“It will all come down to money at the end of the day, you ken. See the thing with an 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. Ken you could go and experiment more on the squid, which I would like to do, but... you cannae afford to run about trying to catch squid, you ken?...”*

While informal knowledge generation often occurs at an individual or group level, informal knowledge exchange networks are larger and often encompass most of a fishing community. Informal knowledge exchange pathways tend to follow social networks and can reach many people. These exchange events can occur on a regular basis through everyday communication between fishers (occurring through conversations at the harbour side, on social networks such as Facebook and twitter, or on VHF) or they can occur as one-off events such as the sharing of plotter data, as one fisherman describes:

*“Yeah, we were having a bit of difficulty.... We didn’t really get started properly until we got hold of some plotter data from [NAME].... That helped us a great deal...”*

Such one-off informal knowledge exchange events are vital for the continuity of the fishing industry, and as a result such events are becoming increasingly common in more isolated Orkney communities as older fishers retire from the industry and pass on their knowledge to the small number of remaining fishers. One young fisher describes ‘inheriting’ fishing grounds from a newly-retired skipper from a closely neighbouring island:

*“[NAME] has helped me out a fair bit, shown me some of his old grounds that he [can’t] use any more. I think he doesn’t want to see it taken by the Kirkwall lot, so he’s show[ing] me”*

This process of fishing ground ‘inheritance’ not only reveals the pathways through which knowledge can be exchanged and transferred but reveals the strong desire to see the industry continue and the strong relationships and social capital built up within the fishing industry- see report *The Culture of Orkney’s Fishing Industry*.

Informal knowledge exchange pathways are a vital tool for maintaining community cohesion and promoting the continuity of the industry. Informal knowledge generation can provide insights into the marine environment and the behaviour of commercial species, while informal exchanges allow successive generations of fishers to make a living from the sea. However, informal knowledge lacks scientific credibility and has limited usages in formalised decision-making processes. Within the fishing industry itself, large-scale informal knowledge transfers are by their very nature unreliable as knowledge can become corrupted- like a game of Chinese Whispers.

### 11.1.1. Formal Knowledge

Contrasting informal knowledge generation and exchange, formal knowledge processes occur as discrete events (e.g. scientific studies and lectures), are scientifically credible, can be readily incorporated into formalised decision-making processes, and are often associated with high costs.

Within Orkney's fishing industry, formal knowledge generation events are used to support the informal observations made by fishers. Groups and associations such as Orkney Fisheries Association (OFA) and Orkney Sustainable Fisheries (OSF) work in close contact with the local fishing fleet to identify new areas of research to improve our understanding of the local marine environment, ultimately providing a mechanism by which these informal observations can be validated, enabling fisher engagement with local and national decision-making processes (both local and national).

Unlike informal knowledge generation, which can be carried out by an individual, formal knowledge generation is reliant on relationships with scientists and/or scientific institutions. Orkney's fishing industry employs five full time fisheries scientists and has strong relationships with research institutes such as Heriot Watt's Stromness campus.

While formal knowledge generation has become increasingly common within Orkney's fishing industry, formal knowledge exchange events are less so. Formal knowledge exchange events (including scientific talks and mandatory training courses) are relatively inaccessible as they are often associated with costs- including travel costs, costs of attendance, and missed fishing opportunities. Because of the prohibitive nature of these events, engagement with them is relatively low amongst members of the fishing industry. The exception to this is the mandatory Seafish training courses run by the local Navigation School (part of the University of the Highlands and Islands). Their compulsory nature ensures fishers attend the courses when required, although financial support for these services is available on a temporary basis through OFA.

## 11.2. Barriers to Knowledge Generation and Transfer

Barriers to knowledge generation and transfer (whether these be formal or informal events) can undermine the future of the fishing industry by reducing the understanding of the local marine environment, preventing sustainable fishing behaviour.

Financial barriers pose the greatest threat to both the generation and the transfer of knowledge. Narrow profit margins can discourage individual fishers from experimenting with new gear or new fisheries, preventing the generation of new knowledge. Additionally, a lack of financial security often prevents skippers from attending training courses or hiring crew, which ultimately form the next generation of skippers.

Amendments in legislation for licencing and quota may facilitate fleet diversification through the removal of legal and financial barriers, with the secondary benefit of improving industry -and knowledge- continuity.

*“Well, it will be all the fishing knowledge, the knowledge of the grounds and all that stuff, it’ll be all lost, you ken. A lot of knowledge being lost... There’s no young fellows going into it. And that’s a shame on the whole industry. It’s the same with most of the jobs nowadays. There’s nobody interested in going to sea...”*

## 12. The Future of the Industry

Nearly all of the fishermen interviewed were pessimistic about the future of the industry, voicing concern for declining catches, poor market prices and lack of interest by younger generations. Several of those interviewed indicated they felt there was no future for a full-time creel fisherman, and that part time fishers would become the norm.

*“...They’re only, ken.. most of them’s dinghies, little boats, but... you ken... there’s more of them up here in Orkney than there ever was. That’s the future to me, that is the future. It is part time, but I don’t, I’m not too keen on doing that because the full-time men is struggling as it is to make money...”*

The increase in the number of part time fishers has been attributed to the relatively poor economic performance of the fleet- forcing full time fishers to seek alternative employment or to become part-time fishers (personal communication, 2018). The increased number of part time fishers has been a source of stress within the fishing community as it is seen as placing additional pressure on already scarce resources (personal communication, 2018). However, if external stressors such as low market prices and uncertainty around stock sustainability continue the number of part time fishers may increase as full time fishers are forced to become part time.

### 12.1. The Role of Part time Fishing in Orkney’s Industry

An increase in the number of part-time fishermen within Orkney will change the social and economic landscape of the industry and may have short-term consequences for the health of commercially valuable stocks. The number of part time fishers within the industry may be viewed as a result of the inability of the industry to provide a viable employment opportunity- forcing individuals to seek work to supplement their fishing activity.

The activities of part time fishers differ from their full-time counter parts, largely in their decisions of how and when to fish. The intensity of part-time fishers’ activities can be seen as part of a spectrum, with low levels of activity (comparable to those of an intensive hobby fisher) at one end to intensive activity (similar to that of full-time fishers) at the other. For the part time fishers towards the lower end of the spectrum the decision of when and what to fish is largely dictated by external forces such

as market price and the season: many less-intensive part-timers choose to fish more intensively during periods of high demand, such as winter. Additionally, the warmer and longer days of the summer months also sees a rise in part-time fisher activity- suggesting that the motivations of part time fishers to fish extends beyond economic ones (see report *The Economics of Orkney's Fishing Industry*).

Full-time fishers perceive the activities of part-time fishers as damaging their livelihoods and jeopardising the future of the industry. The increase in the number of vessels fishing during summer months, when crabs are moulting, is seen as harmful to the stocks, while the spike in effort during November and December is felt to reduce the income from full-time fishers who are financially reliant on the increased demand.

Ultimately there is the possibility of part-time fishers, when combined with additional external factors such as low market prices, high operational costs, and changing stock behaviour and distribution- undermining the continuity of the full-time fleet by increasing competition within the industry at key points throughout the year.

### 13. The Balance Between Fishing Capacity and Fishing Opportunities

In 2014 the Scientific, Technical and Economic Committee for Fisheries 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 four indicators, two are biological (the sustainable harvest indicator and the number of over harvested stocks indicator) and two are economic (the return on investment and the ratio between current revenue and break-even revenue). While there is still a paucity of data available for many of Orkney's important stocks (stemming from how Marine Scotland collects and analyses data) important conclusions on the state of Orkney's fleets may still be drawn.

#### 13.1. Biological Indicators

The biological indicators outlined by the Scientific, Technical and Economic Committee assess the relationship between a fishing fleet and its stock to identify if the activities of the fleet are causing long-term harm to commercially important stocks, or if they are reliant on already unhealthy stocks. Of those outlined by the Committee, two biological indicators may be applied to Orkney: The Sustainable Harvest Indicator (SHI) and the Number of Overharvested Stocks (NOS) Indicator.

### 13.1.1. Sustainable Harvest Indicator

The SHI indicator measures the proportion of a fleet segment that is economically reliant on overfished stocks (defined as stocks being fished above  $F_{msy}$ ), with over-fished stocks denoted by a value of  $>1$ . Within Orkney the most important economic stocks are: brown and velvet crabs, lobster, and king scallops, however meaningful data on these stocks at a local level are only available for crabs and lobster. Although not a significant species in terms of landings or value for the local fleet, data is available for *Nephrops*. Data from Marine Scotland (Marine Scotland, 2017) reveals that within Orkney brown and velvet crabs are harvested at a rate above  $F_{msy}$ , at an average of 1.79 and 2.43 respectively, as are lobsters which have an average indicator of 1.43 (although female lobsters are harvested at below  $F_{msy}$ ). *Nephrops* is the only commercial species within Orkney with data showing harvest levels are below  $F_{msy}$ - see Section 11.1.2.

Species	Sex	Indicator Value
Brown crab	M	2.33
Brown crab	F	1.25
Velvet crab	M	2.63
Velvet crab	F	2.24
Lobster	M	1.87
Lobster	F	1.00
Nephrops	All Genders	$<1$ <sup>8</sup>

### 13.1.2. Number of Overharvested Stocks Indicator (NOS)

Building on the SHI, the NOS indicator measures the proportion of commercially important stocks to a fleet that are harvested above  $F_{msy}$ . Insufficient data on local (and national) levels prevent the ratio of  $F/F_{msy}$  being calculated for many of Orkney's most important species (both by weight and by value), however what data is available does provide a partial insight. Brown and velvet crabs make up 75% of the total volume of landings and 65% of the total value of the eight most-commercial species for Orkney's fishery, and both of these are being fished at a level above  $F_{msy}$ . Data for *Nephrops* (Marine Scotland, 2013) reveals that fishing effort was below  $F_{msy}$  in 2013, however the importance of the

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<sup>8</sup> Data from Marine Scotland, 2013 does not give a precise value of  $F_{msy}$ , only stating the Orkney stock was being harvested below the level.

fishery in terms of both value and landed weight (less than 1%) reveals the relative insignificance of this stock for Orkney's fleet.

Species Name	Landed Weight (tonnes)	% of Total Weight Landed by Fleet	Index Calculations
Brown Crabs	2878.91	66.5	1.79
Velvet Crabs	440.296	10.2	2.43
Whelks	400.789	9.3	-
Scallops	367.056	8.5	-
Green Crab	107.748	2.5	-
Lobsters	95.413	2.2	1.43
Periwinkles	36.397	0.8	-
Nephrops (Norway Lobster)	4.851	0.1	<1

Table 4:- Table ranking the relative importance (in terms of weight) of Orkney's 8 most important species, alongside their SHI ratio

Species Name	Value (£)	% of Total Industry Value	Index Calculations
Brown Crabs	£ 3,609,514.14	49.1	1.79
Velvet Crabs	£ 1,230,953.69	16.7	2.43
Scallops	£ 1,035,736.99	14.1	-
Lobsters	£ 999,340.30	13.6	1.43
Whelks	£ 300,733.05	4.1	-
Periwinkles	£ 81,067.15	1.1	-
Green Crab	£ 69,937.22	1.0	-
Nephrops (Norway Lobster)	£ 29,795.78	0.4	<1

Table 5:- Table ranking the relative importance (in terms of value) of Orkney's 8 most important species, alongside their SHI ratio

It is likely that other commercially important stocks are equally vulnerable -anecdotal evidence from fishers describes the increased fishing effort and subsequent decline of stocks such as *Pecten maximus* (King scallop) and whelks, which suggests these stocks are being fished at a level exceeding  $F_{msy}$ .

### 13.2. Economic Indicators:

The over or under capitalisation of a fleet (in both the short and long term) may be identified using the indicators outlined by the Committee. A number of indicators have been outlined by the

Committee, however a paucity of data prevents all but the Return on Investment and the Ratio between Current Revenue and Break-Even Revenue indicators from being used.

### 13.2.1. 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 fleet has an ROI of  $>1$ , indicating that it is profitable and there are no current economic imbalances (nor have there been for the past five years). The ROI for the creel fleet is consistently greater than the ROI from an alternative low risk and long-term investment- with a higher rate of return of 3.86%. Analysis for the demersal fleet is not available due to the relatively small number of datasets available.

### 13.2.2. Ratio between Current Revenue and Break-Even Revenue (CR:BR)

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.

## 13.3. Fishing Capacity and Fishing Opportunities: A Summary

While not all of the indicators outlined by the Scientific, Technical and Economic Committee may be used on Orkney's fishing fleets the four which can be used provide valuable insight into the state of Orkney's fleet. Environmentally, Orkney's fishing fleets are imbalanced: its two most important (both economically and in terms of volumes landed) species are fished at a level above  $F_{msy}$ , as are its fourth and eighth most valuable species. A lack of data on other commercially important species prevents a true understanding of Orkney fleet's reliance on vulnerable stocks- however it is likely that they too are being fished at unsustainable levels.

When using economic indicators, Orkney's fleets appear to be 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. However, the economic health of the fleets is unlikely to continue if the biological imbalances of the fleet are not addressed: over fishing and a lack of diversification within the fleet may lead to decreased profitability for segments. Additional indicators suggested by the STEC on the current utilisation of vessels within the fleets could provide further and valuable insights into the efficiencies of the fleet, however a lack of data meant this analysis could not be carried out in any satisfactory manner.

#### 14. Resilience and Transformability in Orkney's Fishing Industry

The continuity of Orkney's fishing industry is dependent on its ability to positively respond to environmental and social changes. Orkney's fishing industry is facing a variety of challenges, both internal and external, including the impact of increased fishing effort on commercial stocks, climate change, the aging of the fleet, and Brexit. How the industry responds to these challenges -and whether or not these challenges will make the existing system untenable- largely depends on how the industry utilises its social capital (Kawarazuka et. al. 2016).

Understanding the industry's response to these challenges requires an understanding of resilience theory as well as the concepts of adaptability, resilience, and transformability. How the industry (or any social-ecological system) responds to external forces is largely determined by the social capital of actors and groups within the system (their adaptability), as well as concepts such as identity, core values, people-place connections, and world-view. The ability to respond to a change while remaining within the system's critical thresholds is known as resilience, while the creation of a new system in response to pressures is known as transformability (Kawarazuka et. al. 2016; Folke et. al. 2010). Where a system's adaptive capacity allows it to retain certain processes in the face of internal and external challenges, transformability involves dismantling the old system and creating a new one more suitable to coping with internal and external challenges. Associated with innovation, novelty, and shifts in community values and social networks, transformation occurs across scales, with small-scale transformations encouraging transformation on larger scales, while drawing upon system connections and relationships to support its changes (Folke et. al. 2010). The transformation process has three stages: 1) the preparation of the system for change, 2) using the crisis as an opportunity for transformation, 3) creating resilience in the new system (Folke et. al. 2010).

The number of challenges facing the UK and the Orcadian fishing industry suggest their resilience has become somewhat compromised, and a wide-scale transformation is necessary. Facilitating change

within Orkney's fishing industry (also referred to as 'forced' transformability) will require an understanding of the issues needed to be addressed and the creation of new ecological, social, and economic structures utilising industry connections across scales. Some of the change required to address issues faced by local fleets must occur on a national scale (e.g. legal access to fisheries) while other change can occur on a smaller scale (e.g. reduction in fishing effort). Encouraging change within the fishing industry has the potential to promote the continuity of the industry, as well as social and environmental sustainability.

## 15. Conclusion

Orkney's fishing fleet has seen a 6% decrease in the number of active vessels between 2008 and 2016. The average age of fishers within the industry is increasing, and fewer younger people are entering and staying in the industry. Factors such as stagnant market prices, rising operating expenses, an aging fleet, and an increase in the number of alternative employment opportunities are contributing to this decline, with individual economics making it difficult to enter and remain in the industry.

Economic and biological indicators reveal that as a whole, Orkney's pot and trap fleet is economically balanced, however biological indicators suggest key commercial stocks are being overfished making the industry unsustainable in the long term. Fleet diversification has the potential to reduce fishing pressure on certain stocks and increase fleet robustness and economic and biological sustainability.

Social and cultural factors are also contributing to the decline of the fleet, with younger individuals less and less interested in a career in fishing. Negative attitudes towards the industry have the potential to create a self-fulfilling prophesy: signs of industry decline produce negative feelings towards the industry and perpetuate the reluctance of individuals willing to enter the industry. This can be further exacerbated by the presence of foreign crew members which may weaken the links between the fishing industry and the community.

The low level of entry into the industry by young people threatens traditional knowledge pathways within the industry. Informal knowledge generation and transfer events promote sustainability within the fishery as well as strengthening relationships between fishers and improving community cohesion and individual wellbeing.

Addressing the issues highlighted in this report may help reverse the current industry trends. Diversification of the fleet, combined with a campaign to attract young individuals and the removal of barriers to entry will help secure the future of Orkney's fishing industry, as well as helping the industry to become economically and environmentally sustainable.

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