

Analysis of nephrops industry in Scotland

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Final report

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Executive summary

The study, commissioned by Scottish Fishermen's Federation and Scottish Fishermen's Organisation set out to answer three questions:

- How competitive is the Scottish nephrops fishing fleet;
- What is the economic value of the Scottish nephrops fishing fleet to Scotland; and
- What does the future look like for the Scottish nephrops fishing fleet?

Nephrops and the Scottish fishing fleet

The Scottish fishing fleet is known to be a diverse fleet, with a substantial fleet of vessels catching pelagic, demersal and shellfish stocks. In 2016, there were 2,033 active Scottish fishing vessels and they landed 453 thousand tonnes of sea fish and shellfish, with a sales value of £557 million. In 2016, Scottish vessels landed 21,046 tonnes of nephrops (4.6% of total Scottish landings) with a sales value of £76.7 million (13.8% of the total sales value).

Nephrops is prevalent around the Scottish coast and as a result Scotland is the largest producer of nephrops in the world. Accordingly, the UK receives most of the EU quota allocation for North Sea nephrops (i.e. ICES Area 4) and West of Scotland nephrops (i.e. ICES Sub-Area 6a).

The main catching method used is bottom trawl with nets of between 80-100mm typically allowed (previously referred to as TR2). Of the nephrops producing nations only Scotland and Sweden use pots or creels to catch nephrops at significant levels.

As well as diversity at the Scottish fleet level, what is quickly evident when looking at Scotland's nephrops fleet is the extent to which there is diversity within the nephrops fleet. Drivers of diversity include, but are unlikely to be limited to:

- the gear, creel or trawl, chosen by the business owner to catch nephrops;
- the grounds fished by the business owner – nephrops stocks are assessed at a functional unit (FU) level and each FU has its own nephrops stock and specific characteristics of the FU that can encourage diversity including catch composition and seasonality;
- the size of vessel operated by the business, the nephrops fleet consists of under 10m vessels up to 24m vessels;
- the nephrops products landed by the business – tubed live nephrops is most commonly landed by creel vessels and chilled nephrops and tailed nephrops are most commonly landed by trawl vessels;
- the market served by the vessel – whole nephrops are most commonly exported to other European countries and tailed nephrops are most commonly sold within the UK.

The decision-making of the business owner, and therefore the shape of the overall fleet, can also be influenced by the business owner's personal and professional history, location, access to facilities, access to investment, willingness to enter partnerships and/or employ others, desire for long or short sea trips, access to a buyer(s) for the product produced, barriers to entry and, importantly, the anticipated financial returns from any investment made.

The diversity of the UK fishing fleet is one of its strengths but diversity can also cause disharmony and can lead to conflict. Diversity, such as is evident in the Scottish nephrops fleet, is generally considered to be a positive trait but Scotland has a finite amount of nephrops grounds and a finite amount of quota. When either the grounds or quota are subject to high levels of demand, the diversity within the fleet can be a source of conflict. Competition for space in West of Scotland nephrops grounds is a concern for all owners of West of Scotland nephrops vessels. Access to quota does not appear to be a constraint for the Scottish nephrops fleet.

There are four main tools that have been used to manage the Scottish nephrops fishery including area restrictions, quotas, effort restrictions and technical measures:

- Area restrictions have increased for the trawl sector in recent years, Marine Scotland has introduced 30 new marine protected areas split between inshore and offshore. Some restrictions also affect the creel sector.
- Unusually, quota is not the constraint that it tends to be for other fleets, in recent years nephrops quota has not been fully utilised.
- Until recently, the trawl sector was subject to effort restrictions (days at sea) but these were removed in 2017. Discussions continue on whether effort controls (e.g. creel limits) should be introduced for the creel fleet.
- Technical measures include a minimum size, below which nephrops must not be landed and the trawl sector must comply with gear regulations in the North Sea and West of Scotland.

In general, the management measures applied to the creel fleet have been lighter-touch than those applied to the trawl fleet.

Scottish nephrops fleet segments

The analysis on the performance and competitiveness of the Scottish nephrops fleet, divides the fleet into eight fleet segments: two creel fleet segments in the West of Scotland; and six trawl fleet segments, three in the West of Scotland and three in the North Sea. The eight nephrops fleet segments are:

- under 10m West of Scotland nephrops creel;
- 10-15m West of Scotland nephrops creel;
- Under 10m West of Scotland nephrops trawl;
- 10-15 West of Scotland nephrops trawl;
- 15-24m West of Scotland nephrops trawl;
- Under 10m North Sea nephrops trawl;
- 10-15m North Sea nephrops trawl; and
- 15-24m North Sea nephrops trawl.

Weight and value of landings

In 2015, 15,224 liveweight tonnes of nephrops was landed from the North Sea and West of Scotland in Scotland. This is slightly less than the value landed by Scottish vessels as some landings by Scottish vessels are made outside of Scotland. Of this, 15,224 tonnes,

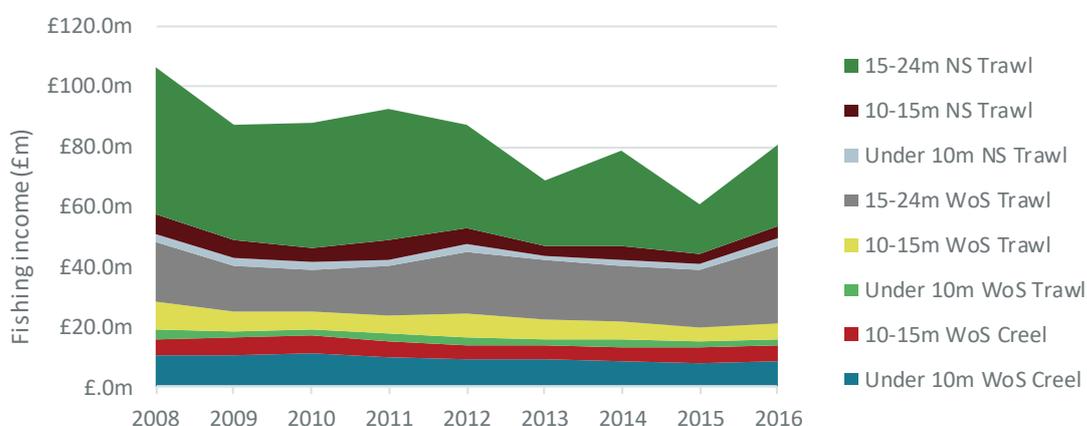
- 1,431t (9.4%) was landed by creel vessels and 13,793t (90.6%) was landed by trawl vessels;
- 4,840t (35.1%) of all trawl landings were North Sea nephrops and 8,953t (64.9%) of trawl landings were West of Scotland nephrops;
- Almost all creel landings, 1,369t (95.7%), were West of Scotland nephrops, although 62t was landed by creel from the North Sea;
- Of all trawl landings of North Sea nephrops, 3,277t (67.7%) was landed whole and 1,564t (32.3%) was landed as tails;
- Of all trawl landings of West of Scotland nephrops, 3,619t (40.4%) was landed whole and 5,334t (59.6%) was landed as tails; and
- Of all creel landings of West of Scotland and North Sea nephrops, 1,410t (98.5%) was landed whole.

In 2015, £55.8m of nephrops was landed from the North Sea and West of Scotland. Of this,

- £13m was landed by the creel sector and £42.8m was landed by trawl vessels;
- the landings of West of Scotland nephrops have a higher proportion of landed tails which therefore results in a lower share of the total value compared to weight of landings.

In 2015, the total fishing income generated by the Scottish nephrops fleet was £60.9m (Figure 7-2). This was down from £106.5m in 2008. However, there was an improvement in 2016, when total income increased to £80.7m. The fishing income in 2015 was the lowest income earned over the period 2008-2016. Therefore, this study, which is largely based on 2015 data, or a three-year average from 2013-2015 data, captures the fleet at its weakest time in recent years. The Figure below presents the fishing income of the Scottish nephrops fleet segments between 2008 and 2016. In the West of Scotland, there has been greater stability than in the North Sea.

Fishing income of the Scottish nephrops fleet segments, 2008-16



Source: Seafish fleet economic performance dataset

The pattern of fishing income in the nine years to 2016 follows the trend of nephrops landings into Scotland (see below). The total landings of nephrops by both volume and value is decreasing, although value is decreasing by less.

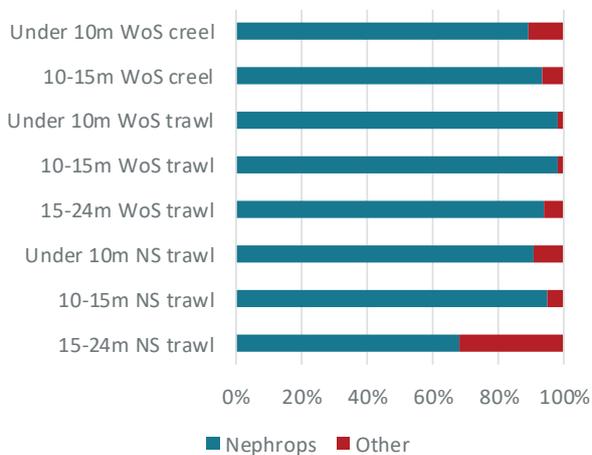
Liveweight and value of landings into Scottish ports, 2008-2015



Source: MMO fisheries statistics (2017)

The Scottish nephrops fleets for the most part specialise in nephrops. As indicated in the figure below, the total landings value of nephrops to all Scottish nephrops fleet segments exceeds 90%. The exception is the Scottish North Sea 15-24m nephrops fleet which lands a significant proportion of whitefish also, which is assumed to be a result of changing stock conditions for North Sea nephrops.

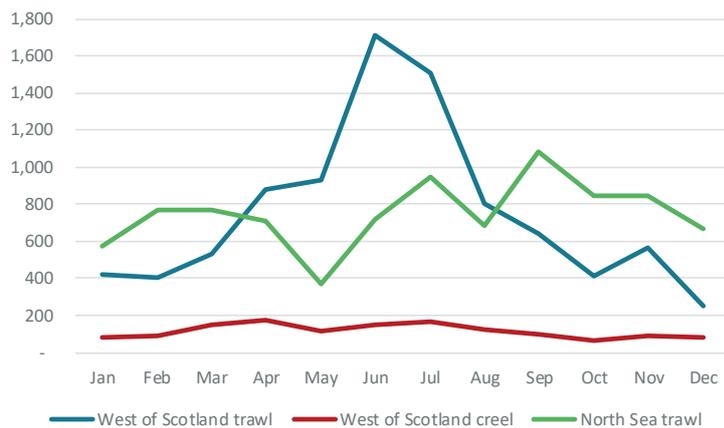
Sales value of nephrops landings and sales value of other landings as a percentage of total sales value, 2015



Source: Seafish fleet economic performance dataset

The landings of nephrops as a whole appear to be seasonal, but as indicated in the chart below this is largely driven by West of Scotland trawl landings. West of Scotland creel landings, although higher in the spring and summer, are relatively constant across the year. The landings from North Sea trawl are more variable, however in 2015 saw their lowest in May and highest in September.

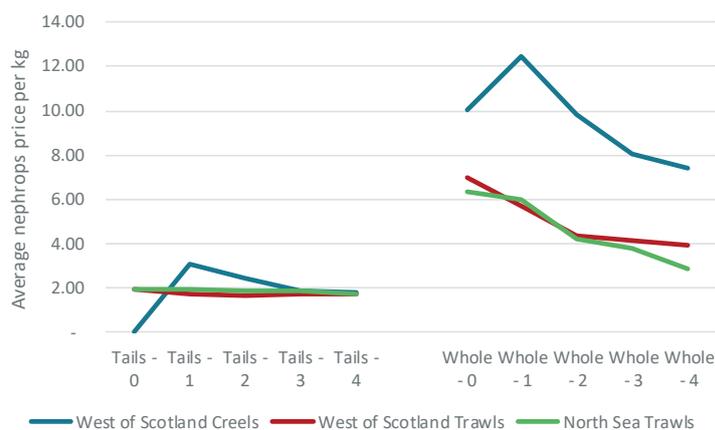
Nephrops liveweight landings in 2015 by month from West of Scotland trawl and creel and North Sea trawl



Source: MMO

The average prices per kg liveweight between creel caught and trawl caught nephrops is significant (as shown below). Creel caught nephrops are mostly whole and sold live resulting in the highest price. Trawl caught nephrops are a mix between whole and tails where whole are sold mostly to the fresh or frozen export markets and tails are sold mostly to the UK market. The differences in nephrops prices by size grade from trawlers from the West of Scotland and North Sea are negligible.

Average prices by size grade for whole and tailed nephrops from the West of Scotland and North Sea



Source: Marine Scotland

Competitiveness of the fleet

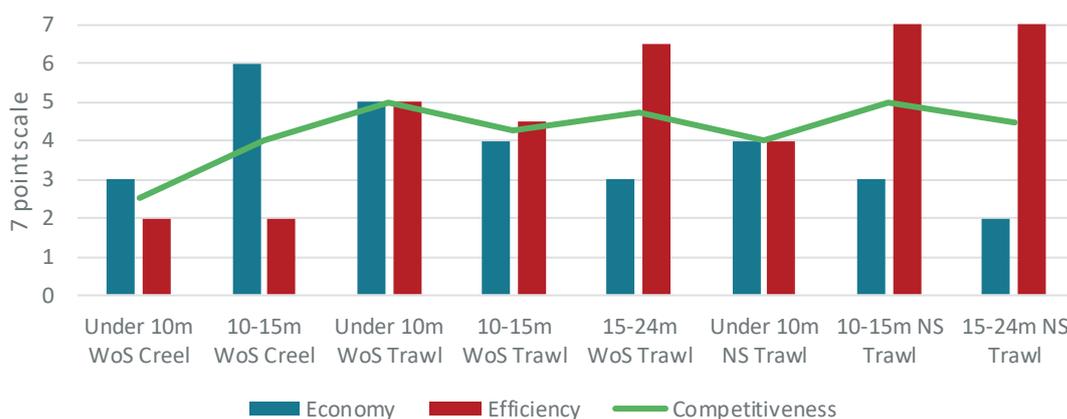
An analysis of the competitiveness of the eight fleet segments provides an understanding of the success and sustainability of the different fleet segments. The findings also provide one answer as to why Scotland has such a diverse nephrops fleet.

Using a multi-criteria analysis to compare the efficiency and economy of the fleet segments, the findings suggest that the competitiveness of the different fleet segments in Scotland is relatively well-balanced. However, for some fleets their competitiveness is achieved by strong economy, for some fleet segments their competitiveness is achieved by strong efficiency and for others it is a balance of the two which supports their competitiveness. The decisions of business owners in the nephrops fleet will be influenced by a range of factors, as discussed above, however, regardless of their individual decisions,

on average each fleet segment achieves a level of competitiveness similar to other nephrops fleet segments.

The only fleet segment that appears to underperform in the competitiveness analysis is the under 10m West of Scotland creel fleet. From the findings of the various analyses, measures to reduce the cost base relative to income, and therefore improve economy, appear to be the most effective option to improve the competitiveness of the under 10m creel fleet.

Competitiveness of each fleet segment, derived from measures of economy and efficiency, using a 3-year average, 2013-2015



The nephrops industry onshore

In 2015 there were 110 buyers of Scottish landed nephrops, the majority of which were based in Scotland:

- 109 of the buyers bought whole nephrops and 54 bought tails;
- 46 buyers bought less than one tonne of nephrops; and
- nine buyers bought 68% of all landings (10,208t liveweight) which represented 58% of whole nephrops and 80% of tails.

Four main products are processed by primary processors in Scotland. The liveweight tonnage associated with each product and the cost to the processing sector is also presented:

- whole live nephrops, 1,410 liveweight tonnes, £12.9 million;
- chilled whole nephrops, 1,800 liveweight tonnes, £8million;
- frozen whole nephrops, 5,095 liveweight tonnes, £22.7 million; and
- tailed nephrops, 6,919 liveweight tonnes, £12.0 million.

Of the above products described above, an estimated 8,288 liveweight tonnes is exported, mainly to other European countries and 6,106 liveweight tonnes of tails is retained in the UK for further processing into scampi. Some product wastage is accounted for in the primary processing stage.

The total value of landings made by the eight Scottish nephrops fleet segments in 2015 was £55.8m. The export market is estimated to result in sales of £57.4m by primary processors in Scotland, which adds value of £12.3m to the value of the catch. The UK market is estimated to result in sales of £13.1m by primary processors in Scotland, which adds value of £2.4m to the value of the catch.

Therefore, the total value added by primary processing to Scottish landings of nephrops is estimated to be £14.7m, an increase of 26.4% over the raw material cost.

Value of Scottish processed nephrops by destination, 2015

	Creel Sector	Trawl Sector	Total
Value of exports	£12.9m	£44.5m	£57.4m
Value of UK sales	£0.04m	£13.1m	£13.1m

Economic value

The economic value of the nephrops industry to Scotland can be indicated through two measures: GVA and employment. The direct GVA generated by the nephrops fleet and related processing amounts to an estimated £36.8m. For a single species, this is a strong contribution to the Scottish economy. Of this total, the fleet contributes £27m and the processing sector contributes £9.8m. The total estimated creel GVA contribution across fishing and processing is £8.9m and for trawl the total direct GVA is £27.9m. The GVA analysis does not include indirect and induced GVA.

Total direct, indirect and induced employment generated from catching and primary processing of nephrops in Scotland is estimated to be 2,077 FTE posts. Of these FTE posts, 1,267 of the posts are in fishing, 302 in processing and 508 jobs are in the supply chain. Using a general assumption to divide the total FTE posts between 'creel' and 'trawl' related employment suggests that approximately 489 FTE posts are generated by the creel sector and 1,588 FTE posts are generated by the trawl sector.

Outlook for nephrops industry in Scotland

Whilst most of the analysis was based on 2015, or a three-year average for 2013-2015, there are signs from the activity and the estimates of economic performance for 2016 that the economic performance of the fleet is improving after a period of relative weakness.

Furthermore, after a period of declining landings, there are encouraging signs of business confidence both within the fleet, with the purchase of new-build vessels and new gear, and onshore, with investment in the development of new products and markets.

The analysis has also considered the threats to the Scottish nephrops fleet and many of these are shared across all fleet segments, including:

- uncertainty around Brexit and its potential impact on fuel prices and key European markets for nephrops;
- competition for fishing grounds is a persistent and real concern, comments such as creel saturation and gear conflict frequently cropped up in consultations. The problem is greatest in waters to the West of Scotland, competition can arise within a fleet segment, between different nephrops fleet segments and with other fleets and marine users. It appears that management solutions are required to address this challenge.

For example, the trawl segments must advance their selectivity in response to the landing obligation. The West of Scotland trawl fleets and the wider value chain have concerns around the increase in the fishing grounds that could be closed to trawl vessels.

Nephrops fishing has been undertaken in the same inshore and offshore areas for over 30 years, and in some over 50 years. Good nephrops grounds on the West of Scotland are known for both creeling and trawling and fishermen use their knowledge to their advantage to make a living, including the setting of creels 1-2 days after a trawler has 'worked' the ground, which is known by fishermen to increase creel productivity. However, new restrictions, for example through MPAs, are changing the fishing opportunities available to fishermen. The effect of these restrictions on the decisions of business owners is not yet known, however a displacement effect is likely. The challenge is for the Regional Inshore Fisheries Groups and the Scottish Government to find a way to ensure the continued productivity of all nephrops fleets.

Overall the view from consultees is that, whilst there are challenges to be resolved, there is much to be positive about in the nephrops industry in Scotland.

Conclusions

The phrase 'comparing apples with pears', or a similar sentiment, was expressed by consultees when discussing the nephrops trawl and creel fleet segments. They use different gear, face different regulations, produce different volumes of product, achieve different prices and on the whole produce different products for different markets. It is presumed that the reason Scotland has such diversity in its nephrops fleet is influenced by a range of factors including, but not limited to local conditions, personal preferences of the business owner and economic (including market) opportunities. However, the analysis of competitiveness has shown that while different businesses do make different decisions, there is remarkable similarity in the competitiveness of the larger creel vessels and the trawl fleet segments.

1 Introduction

Anderson Solutions was commissioned by Scottish Fishermen's Organisation (SFO) and Scottish Fishermen's Federation (SFF) to undertake analysis of the nephrops industry in Scotland.

1.1 Purpose of the study

The nephrops fleet in Scotland demonstrates more diversity than any other major fleet type in Scotland. The main driver of diversity is the gear used: creel or trawl. The gear used influences what regulations a vessel must abide by, where the vessel can fish, catch-rates, what product is produced and which markets the vessel can sell into. Diversity is generally considered to be a positive trait but Scotland has a finite amount of nephrops grounds and a finite amount of quota. When either the grounds or the quota are subject to high levels of demand, the diversity within the fleet can be a source of conflict.

The SFO and SFF commissioned the study to produce an objective economic analysis of the Scottish nephrops industry with the aim of better understanding how all the different elements of the Scottish nephrops fleet, and the onshore infrastructure associated with its landings, contribute to the economy of Scotland.

There are three broad questions which the study sought to answer:

- How competitive is the Scottish nephrops fishing fleet;
- What is the economic value of the Scottish nephrops fishing fleet to Scotland; and
- What does the future look like for the Scottish nephrops fishing fleet?

1.2 Methodology

The methodology for the study provided a framework and focus through which the questions set out above could be responded to. Three main research techniques were utilised to undertake the study:

- One-to-one consultations with representatives of the nephrops fishing industry. 20 consultations were conducted, largely by telephone, with Producer Organisations, Fishermen's Associations, Agents, Processors, Seafish Industry Authority and Fishermen;
- Desk research to review data and reports published by others; and
- Bespoke data analysis of existing data sources, particularly the economic performance dataset created and held by Seafish, and quota and landings data held by Marine Scotland.

A list of consultees, the publications reviewed, and the data sources used is presented in Appendix A.

Throughout the report, the source or methodology used to create an analysis is presented. For some elements of the analysis there was extensive data and information available, for other elements the analysis was dependent on the comments of informed consultees. Due to the timing of the analysis, the most recent year for which all data was available was 2015. However, 2015 was a relatively weak year for the nephrops industry in Scotland with relatively poor landings. To avoid the performance in 2015 unduly affecting the analysis, a three-year average is often used.

1.3 Structure of report

The report presents the findings from a comprehensive analysis of the nephrops industry in Scotland and is structured as follows:

- Chapter 2 provides a detailed overview of the nephrops industry in Scotland including the gear used, the history of the industry, the weight and value of landings, governance and management. The chapter also introduces the Scottish nephrops fleet segments used for the analyses in the rest of the report;
- Chapter 3 provides an analysis of the competitiveness of the Scottish nephrops fleet;
- Chapter 4 provides information on the nephrops products produced by Scotland, the price achieved for the products and the market for nephrops products;
- Chapter 5 presents the findings from an economic analysis which values the contribution of the nephrops industry to Scotland;
- Chapter 6 considers the future for the nephrops industry in Scotland;
- Chapter 7 provides a summary of key findings and presents a brief conclusion on the analysis of the nephrops industry in Scotland.

The appendices are structured as follows:

- Appendix A contains the list of individuals consulted for the study, the publications reviewed and data sources;
- Appendix B provides information on inshore fisheries prohibitions in Scotland;
- Appendix C provides a detailed individual analysis of each of the fleet segments analysed for the study; and
- Appendix D provides the methodology for the multi-criteria competitiveness analysis contained in Chapter 3.

2 The nephrops fishing fleet in Scotland

2.1 Scotland's fishing fleet

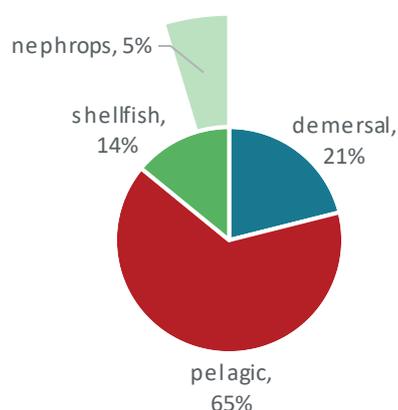
In 2016, there were 2,033 active Scottish fishing vessels and they landed 453 thousand tonnes of sea fish and shellfish, with a value of £557 million. Scotland has a highly diverse fishing fleet, with vessels ranging from 50 metre pelagic vessels to under 10 metre inshore vessels. Under 10 metre vessels are the most common size of vessel, representing 72% of the number of vessels in the Scottish fleet. The under 10 metre fleet is dominated by vessels fishing with creels. In the over 10 metre fleet, there were 569 vessels in 2016 and trawling is the most common method of fishing for the larger vessels¹. Despite having fewer vessels, the over 10 metre fleet landed 97% of all liveweight landings and 92% of the total value of landings made by Scottish vessels.

Scottish vessels are frequently categorised by the type of species that they target, i.e. pelagic (e.g. mackerel and herring), demersal (e.g. cod, haddock, saithe, plaice) and shellfish (e.g. nephrops, scallops). The majority of the Scottish fleet is shellfish vessels. In 2016, of the 569 over 10 metre vessels, 64% were shellfish vessels whilst 33% were demersal and the remainder were pelagic vessels. Under 10 metre vessels that use creels also generally target shellfish.

Despite having the most vessels, shellfish represented just 14% of all liveweight landings by Scottish vessels in 2016, and approximately one-third of all shellfish landings were nephrops. Therefore, in 2016, nephrops represented 4.6% of all liveweight landings (21,046t) by Scottish vessels in the UK and abroad (Figure 2-1).

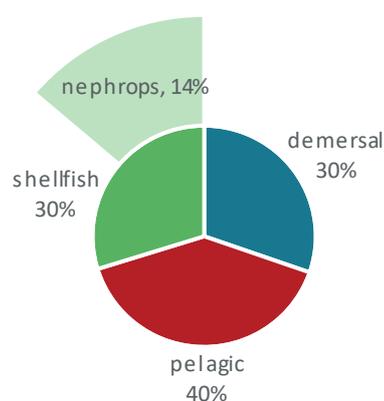
However, shellfish is a high value catch and its importance cannot be judged by weight alone. The higher relative value of shellfish, compared to demersal and pelagic species can be seen in Figure 2-2. When value is considered, instead of weight, shellfish increases its share of the total to 30%. Furthermore, nephrops trebles its share of the total, from 4.6% of all liveweight landings by Scottish vessels to 13.8% of total value (£76.7m).

Figure 2-1: Liveweight landings by Scottish vessels by type of species in 2016, UK and abroad (tonnes)



Source: Marine Scotland sea fisheries data

Figure 2-2: Value of landings by Scottish vessels by type of species in 2016, UK and abroad (£)



¹ Source: Scottish Government Sea Fisheries Statistics 2016

2.2 Nephrops (*Nephrops norvegicus*)

Nephrops lives predominantly on muddy bottoms living in burrows. Atkinson (1986) writes that “nephrops are burrowing crustaceans that live in muddy sediments with a silt/clay fraction above 20% by weight”.

The terminology used to describe *Nephrops norvegicus* can be confusing. In Scotland, fishermen and those in the wider fishing industry refer to nephrops as ‘prawns’. However, nephrops are not North-Atlantic prawns. In the market-place, the two main products from the nephrops fishery are whole nephrops, commonly called langoustines, and the tail of nephrops, commonly called scampi. Another terminology quirk is that the ‘tail’ of a nephrops is the body of the nephrops with the head removed. Additional names for nephrops include Norway lobster and Dublin Bay prawn. The term nephrops is used throughout this report to describe *Nephrops norvegicus*.

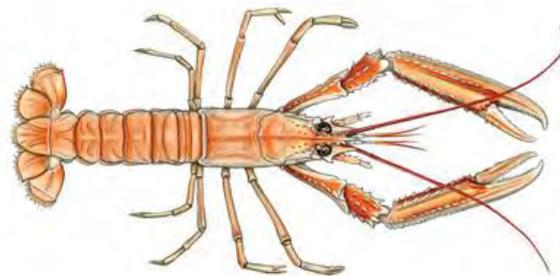


Image supplied by Seafish/Marc Dando (www.seafish.org)

2.3 Governance and management of the nephrops fishing industry

There are four main tools that can be used to manage the nephrops fishery, these are:

- Area restrictions;
- Quotas;
- Effort restrictions; and
- Technical measures

These are each discussed in turn below. Although these tools have traditionally been administered by government, fishermen are being increasingly encouraged to get involved in nephrops fisheries management through the Regional Inshore Fisheries Groups.

2.3.1 Area restrictions

An area restriction is a tool that allows the governing body to close an area to fishing or limit the type of fishing that can take place. In 1984, new regulations allowed for trawling within 3 nautical miles of the coast (Inshore Fishing (Scotland) Act, 1984), effectively opening inshore waters to fishers. However, closed seasons to mobile gear continued for 6 months per year in certain areas. Various restrictions on mobile gear were put in place at the time of the 1984 Bill and in the years after. Detail of these measures is provided in Appendix B.

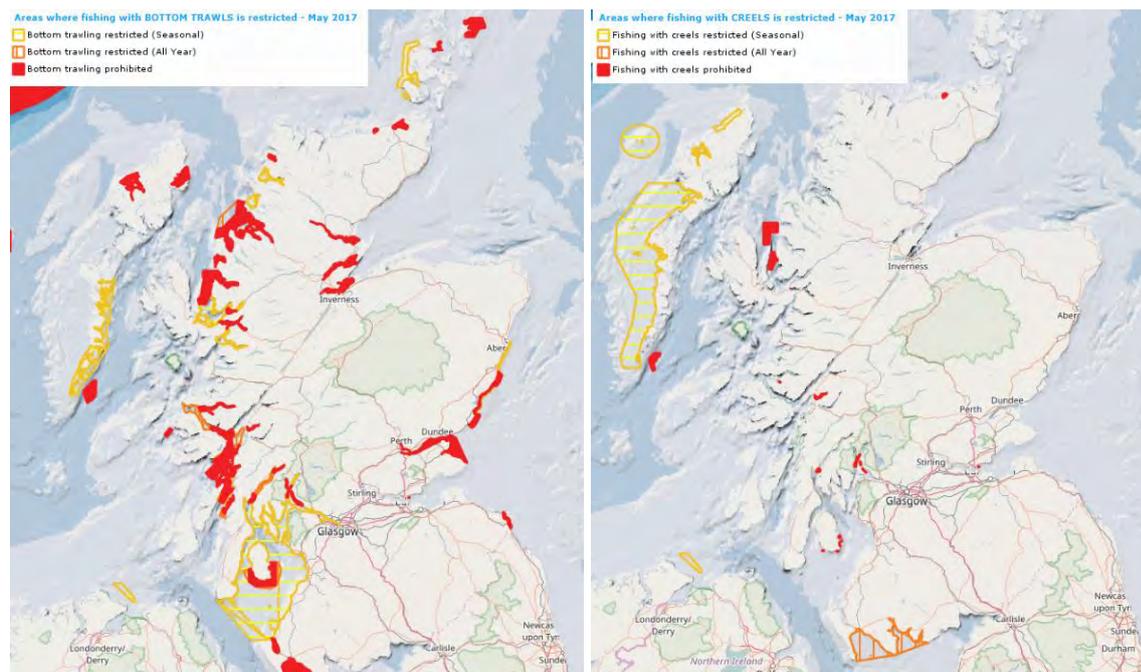
The UK is committed to the meeting the goals of the Convention on Biological Diversity and the EU Marine Strategy Framework Directive.² The former agreement sets a goal (known as Aichi target #11) that by 2020, “10% of coastal and marine areas, especially areas of particular importance for biodiversity and ecosystem services, are conserved through effectively and equitably managed,

² See JNCC DEFRA website for further information (<http://jncc.defra.gov.uk/page-1365>)

ecologically representative and well-connected systems of protected areas”. According to Marine Scotland’s website “The Scottish MPA network covers approximately 20% of our seas” (see <http://www.gov.scot/Topics/marine/marine-environment/mpanetwork>).

30 Nature Conservation Marine Protected Areas (MPAs) were designated in Scotland’s seas, 17 of these MPAs fall under the Marine (Scotland) Act 2010 in inshore waters. In line with EU legislation, suitable management measures must be implemented at each site to conserve the protected features. The 17 inshore MPAs and 22 Special Areas of Conservation (SACs) were split into two groups to allow for phased implementation of management measures. Details of the sites are provided by Marine Scotland and indicated on the Marine Scotland Online Interactive Maps (see Figure 2-3).

Figure 2-3: Areas restricted to fishing in 2017: bottom trawling (left) and fishing with creels (right)



Source: Marine Scotland Online Interactive Maps (<https://marinescotland.atkinsgeospatial.com/nmpi/>)

Most of the inshore MPAs implemented impact nephrops fishing by trawl vessels as trawling is prohibited in part or in full within the MPAs (see Figure 2-3). The offshore MPA likely to impact nephrops trawlers the most is the Central Fladen MPA (<http://jncc.defra.gov.uk/page-6476>). For the most part, creel vessels are not as affected by the majority of MPAs.

2.3.2 Quotas

Quota is an output based fisheries management tool that is used to limit fishing activity. Quota is the main form of catch management for nephrops. UK nephrops quota is divided up between the four nations and fishing quotas allocated across three fishing industry groups:

- the sector – Fish producer organisations (FPOs) that manage quota for their members,
- 10-metres-and-under pool – vessels 10 metres or under that are not members of an FPO, and
- non-sector – vessels over 10 metres that are not members of an FPO

There are various approaches that FPOs use to manage quota, for example:

- (i) ITQs where each vessel can land against or trade the quota units registered against its licence,

- (ii) a pool system where each vessel contributes into the PO pool all the quota units registered to its licence and then the pool is shared out among members for instance by monthly allocations by species to each member vessel, and
- (iii) a combination of pool plus ring-fenced quota.

Quota for the non-sector and under 10 metre fleet is managed by the Fisheries Administrations and provided along similar lines to (ii). There are few non-sector nephrops trawl vessels but the majority of Scottish over 10m creel vessels are part of the non-sector.

Monthly catch limits for nephrops were brought in for the under 10 metre fleet in 1999 (Riddington et al, 2015). With respect to nephrops, for all vessels, landings of nephrops over 12 kg are required to be submitted in logbooks (Riddington et al. 2015).

In 2016, the final TAC for nephrops in areas IV and IIa (i.e. the North Sea) was 13,700 tonnes, with the UK allocation 11,865 tonnes and Scotland 8,130 tonnes (i.e. Scotland receiving 59% of the total TAC for North Sea nephrops). For nephrops in 2016 in areas VI and Union & international waters of Vb, the final TAC was 16,524 tonnes of which the UK and Scotland was allocated 16,134 tonnes and 12,081 tonnes respectively (i.e. Scotland receiving 73% of the total TAC for North Sea nephrops).

2.3.3 Effort restrictions

Effort restrictions are an input fisheries management tool. Currently there are no effort restrictions in operation for the nephrops fleet. Previously, as part of the EU Cod Recovery Plan, the Scottish Government managed fishing effort (i.e. days at sea) through the Conservation Credits Scheme (CCS). Whitefish trawlers and nephrops trawlers over 10m were those affected. In 2013-14, the basic allocation of days for nephrops trawl (i.e. using TR2 gear 79-100mm mesh) were: in the North Sea 130 days, and on the West of Scotland 110 days (see Mardle, 2014; Riddington et al., 2015).

In 2017, the MMO (<https://www.gov.uk/government/publications/manage-your-fishing-effort-cod-recovery-zone>) stated that, "The commission have recognised that the Cod Recovery Scheme is not compatible with the landing obligation. Therefore, there will be no need to apply for days at sea to fish in the Cod Recovery Zone this year 2017".

The consultations highlighted a growing demand for effort restrictions in the creel sector, with consultees stating that there was creel saturation in some places in the West of Scotland. A recent survey by the Scottish Government, the findings of which are published as the *Creel Effort Fishing Survey* (<http://www.gov.scot/Publications/2017/08/1797>), found that there was a clear view that current management needs to be reviewed, if not a direct request for management intervention, with effort control one potential option for management. **The survey covered all creel fishing, not only nephrops.**

2.3.4 Technical measures

Technical measures are a management tool which requires vessels, that meet certain criteria, to adhere to specifications in order to avoid unwanted catch.

Current minimum landing sizes for nephrops on the West of Scotland (i.e. in ICES sub-area VIa) are total length 70 mm and carapace length 20 mm, with tail sizes at 37 mm, whereas those in for the North Sea (i.e. ICES area IV) are total length 85 mm, carapace length 25 mm, with tail sizes being 46 mm. These minimum sizes apply to both the creel and the trawl fishery. It is unclear from a technical or biological perspective why different sizes exist for the two sea areas. 'Tailed' nephrops are generally smaller animals that have the "head" removed at sea.

The trawl gear used for nephrops since 2009 uses a mesh size of 80-99m. It is reported that a square mesh panel of 200mm is typically used on the West of Scotland. The North Sea has specific net grid specifications from the MMO (<https://www.gov.uk/government/publications/manage-your-fishing-effort-cod-recovery-zone>).

2.4 Gear types used to catch nephrops

There are two main types of gear used in Scotland to catch nephrops: static gear and mobile gear, and there are significant differences between both.

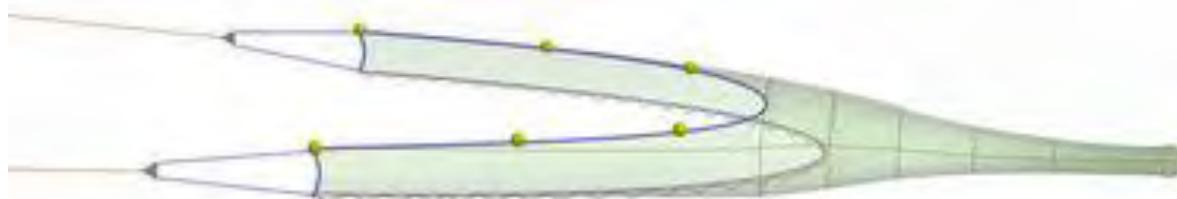
Static gear, in this case a nephrops creel, is baited and left on the sea bed and returned to after a period of time, often after 1-2 days, to extract any catch.

Nephrops creel



Mobile gear, in this case a nephrops trawl, is towed by a fishing vessel and provides a near instant catch, although the duration of each tow can vary. The gear can be either single-rig (as shown in the diagram below) or twin-rig. The consultations suggest that a twin-rig trawl is the more common gear in the Scottish trawl fleet. The Seafish gear database explains twin-rig nephrops gear as follows: A method of towing two otter trawls side by side to target nephrops. The nets are usually smaller and lighter than an equivalent single net but are designed to sweep a wider area of seabed using less fuel.

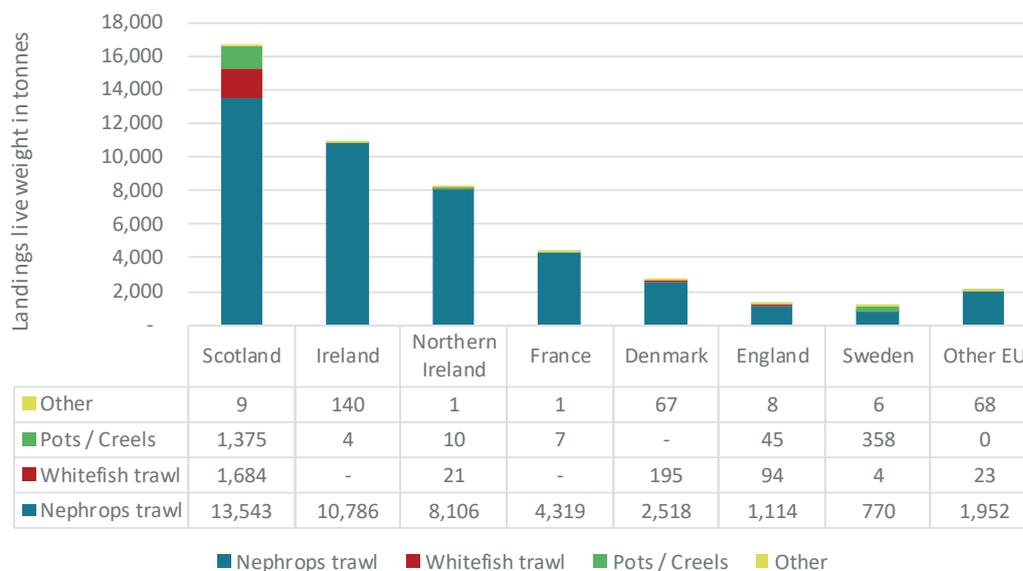
Nephrops single-rig trawl



Images supplied by Seafish (www.seafish.org)

Comparing the landings by main gear across European countries, nephrops trawling is the production technique predominantly used (Figure 2-4). Whitefish trawl landings are identified as catch using mesh sizes greater than 100mm. The only major nephrops producing country to catch nephrops by creel (pots) is Scotland, although there is also a creel fishery in Sweden. Small amounts of landings using pots/creels are also reported in other UK countries as well as France and Ireland. It is unclear why the use of creels is so limited, but this may reflect the environments fished and the preferences of business owners.

Figure 2-4: Landings (liveweight) of nephrops in EU countries in 2015 by regulated gear type



Source: STECF FDI Database, 2017

2.5 History of the nephrops fleet in Scotland

The production of nephrops in Scotland has developed since the 1950s with the support of a number of critical developments:

- Changes to fisheries regulations;
- United Kingdom’s decision to join the European Communities or ‘Common Market’;
- Development of refrigerated transport;
- Decline in whitefish stocks in the late 1980s, early 1990s;
- Development of fishing gear to target nephrops; and
- Increased knowledge of the species and the nephrops grounds around Scotland.

In Scottish inshore waters, particularly on the West coast, the herring fishery was of importance for hundreds of years. With the decline of the herring fishery, focus shifted towards nephrops. The Clyde area was one of the first regions to target nephrops in the 1950s. The nephrops fishery soon developed and increased in importance in the Clyde area and the rest of Scotland (Thurston, 2007).

In inshore waters, seine net and drift net had been typically used (Ryan and Bailey, 2012) until trawling was allowed in certain inshore areas in 1962 (e.g. Clyde). During the 1960s, on the West of Scotland, demersal trawling became the predominant means of fishing by the Clyde and other fleets (Thurstan 2007). Improvements in engine power and rock hopper gear lead to expansion of the nephrops fishery into areas difficult to fish previously with trawl gear (Thurstan 2007). By the 1970s, it is reported that nephrops had become the most valuable species landed in Scotland (Thurston, 2007).

Consultation with fishermen indicates that on the West of Scotland, whole nephrops were landed in the early years but soon after tails became the norm for the UK market. Following the development of export markets in continental Europe, which preferred whole nephrops, greater balance between the landings of whole and tails came about.

Beginning in 1990, multi-rig trawls (typically twin trawls, two smaller trawls pulled together) became more common (Ryan and Bailey, 2012). When the stocks of whitefish were declining in late 1980s, early 1990s, businesses that had previously been wholly dependent on whitefish, particularly in the North Sea, started to shift to nephrops.

2.6 Global nephrops production growth, 1950-2015

Analysis from the Food and Agricultural Organisation of the United Nations (FAO) demonstrates the development of the nephrops fishery from the 1950s (Figure 2-5). Until 1959, global production was below 20,000t per annum but between 1982 and 2014, global production exceeded 50,000t. Figure 2-5 shows that nephrops are predominantly landed in Europe and that from the 1970s, the UK is the largest of all the producing countries. In recent years, UK production is shown to be more than half of all landings.

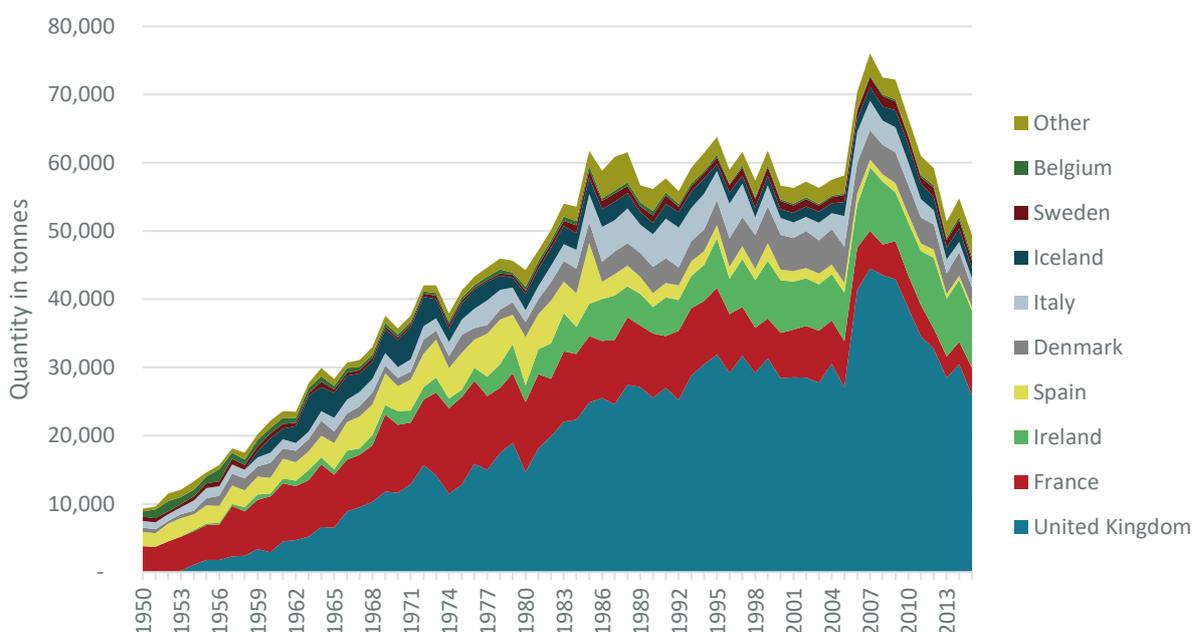
From Scottish Government Sea Fisheries Statistics, the Scottish fleet landed (liveweight):

- 20,498t of nephrops in 2014;
- 16,512t of nephrops in 2015; and
- 21,046t in 2016.

With global production of approximately 50,000t in 2015, Scottish vessels landed one-third of global nephrops landings in 2015 (16,512 tonnes out of 49,402 tonnes) and 37% in 2014 (20,498 tonnes out of 54,763 tonnes).

Figure 2-5 shows that following a period of growth, in the mid-1980s global production plateaued at around 57,000t, albeit with annual variation. This continued until 2006, when a substantial spike in UK production drove global growth. Between 2012 and 2015, UK production was more consistent with the pre-2006 period.

Figure 2-5: Global liveweight landings of nephrops, 1950-2015



Source: FAO, 2017

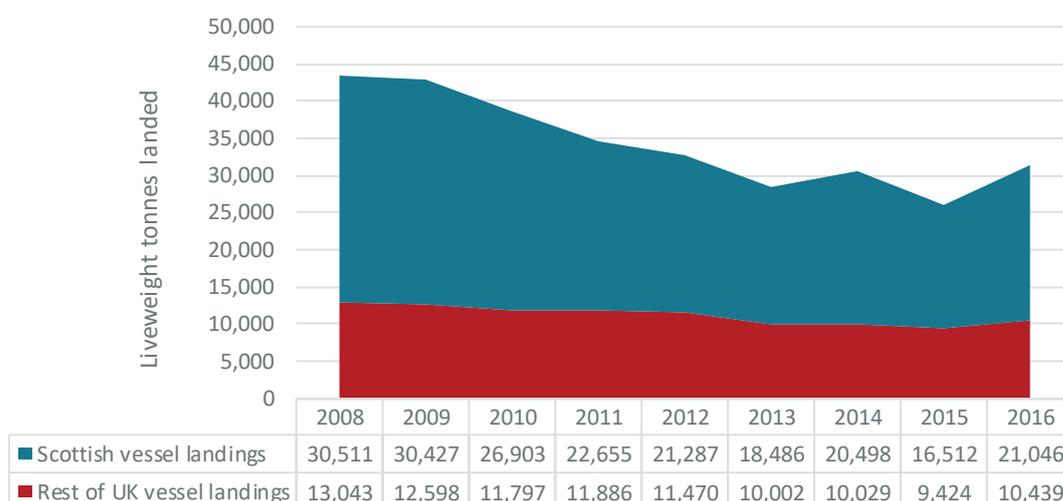
2.7 Weight and value of nephrops landings by UK and Scottish vessels

2.7.1 Weight of landings by UK and Scottish vessels, 2008-2016

Figure 2-6 shows UK vessels liveweight landings of nephrops into the UK and abroad, although on average only 1.1% of UK vessel landings were landed abroad. As previously mentioned, Scottish vessels land a substantial proportion of UK and global landings, and in the nine years to 2016, landings by Scottish vessels represented between 64% and 70% of all UK landings.

As previously demonstrated, there was a spike in UK production between 2006 and 2010. Figure 2-6 shows UK production reducing from 2009 to 2013, and that the reduction is only notable in the landings of the Scottish fleet. Further, as indicated in Table 2-1, the largest decrease resulted from the North Sea although there was also a more modest decrease in the West of Scotland. It could be concluded from this sudden decline to a more consistent level as previously seen that the level of fishing between 2006-10 was unsustainable. One potential reason might be increased fishing through displacement from vessels restricted by limits in other fisheries (e.g. whitefish).

Figure 2-6: Weight of nephrops landings by UK vessels in the UK and abroad, 2008-2016



Source: MMO and Marine Scotland sea fisheries data

Table 2-1: Summary of landings by liveweight of nephrops by Scottish vessels by sea area, 2008-15

	2008	2009	2010	2011	2012	2013	2014	2015
Northern North Sea (IVa)	13,172	13,516	13,173	8,542	5,116	3,618	5,362	2,588
Central North Sea (IVb)	3,871	5,072	3,246	3,490	4,015	3,164	4,045	3,141
West of Scotland (VIa)	13,205	11,463	10,249	10,419	11,813	11,401	10,624	10,263
Other sea areas	274	339	229	218	343	301	446	496

Source: MMO sea fisheries data

The findings above have already referred to liveweight landings. An understanding of the difference between liveweight and landed weight is important in the analysis. A proportion of nephrops are landed 'tailed'. Tailed nephrops are initially processed at sea and the heads are removed, it is generally accepted that this process removes two-thirds of the body weight. Therefore, a measure of liveweight represents the nephrops before it is processed i.e. the weight that was caught and deducted from quota allowances, rather than the weight that was landed.

Table 2-2 shows the landings in 2015 by UK vessels in liveweight and landed weight for each home-nation. Scottish vessels landed 64% of all liveweight UK vessel landings, and 71% of the total landed weight.

The table also shows for each home-nation, the proportion of liveweight that was landed as whole, rather than tailed, nephrops. In 2015, UK vessels landed 45% of their nephrops catch as whole nephrops. Scottish vessels landed an above average 74% of their nephrops catch as whole nephrops.

Table 2-2: Liveweight and landed weight of nephrops by home-nation of vessels (port of registration) in 2015
(Source: MMO, 2017)

Home-nation of vessels	Liveweight landings (tonnes)	Landed weight (tonnes)	Proportion of liveweight that was landed as whole nephrops
UK – Scotland	16,487	11,544	74%
UK – Northern Ireland	8,124	3,741	44%
UK – England	1,246	1,031	19%
UK – Isle of Man	1	1	55%
UK – Wales	4	3	68%
TOTAL	25,863	16,320	45%

[^] Others includes Isle of Man and Wales

Source: MMO sea fisheries data

The difference between the landings of Scottish creel and trawl vessels, and between Scottish North Sea and West of Scotland trawl vessels is presented in Section 2.7.3.

2.7.2 Value of landings by UK and Scottish vessels, 2008-2016

Figure 2-7 shows how the total value of UK nephrops landings has changed in the nine-year period to 2016. The first notable finding is that the decline in landings weight between 2009 and 2013, as presented in Figure 2-6 **Error! Reference source not found.**, is not as evident in the value of landings. Instead, the value of landings remained around an average of £107m in the five years, 2008-2012. In the four years since 2013, the average total value was £93m. The lowest total value in the nine years to 2016, was £83m in 2015, however this was followed in 2016 by a total value of £104m in 2016, a substantial increase of 25% in just one year.

Figure 2-7: Value of nephrops landings by UK vessels in the UK and abroad, 2008-2016



Source: MMO and Marine Scotland sea fisheries data

2.7.3 Weight and value of Scottish nephrops landings by gear, stock and product³ in 2015⁴

In 2015, 15,224 liveweight tonnes of North Sea (Area 4) and West of Scotland (Area 6) nephrops was landed in Scotland. This figure varies from the tonnage landed by Scottish vessels as some Scottish vessels land outside of Scotland and some vessels from elsewhere land into Scotland. Analysis of the data on landings into Scotland is shown in Figure 2-8 and Figure 2-9, in summary:

- 1,431t (9.4%) was landed by creel vessels and 13,793t (90.6%) was landed by trawl vessels (Figure 2-8 central circle);
- 4,840t (35.1%) of all trawl landings were North Sea nephrops and 8,953t (64.9%) of trawl landings were West of Scotland nephrops (Figure 2-8, second ring);
- Almost all creel landings, 1,369t (95.7%), were West of Scotland nephrops, although 62t was landed by creel from the North Sea (Figure 2-8, second ring);
- Of all trawl landings of North Sea nephrops, 3,277t (67.7%) was landed whole and 1,564t (32.3%) was landed as tails (Figure 2-8, outer ring);
- Of all trawl landings of West of Scotland nephrops, 3619t (40.4%) was landed whole and 5,334t (59.6%) was landed as tails (Figure 2-8, outer ring); and
- Of all creel landings of West of Scotland and North Sea nephrops, 1,410t (98.5%) was landed whole (Figure 2-8, outer ring).

In 2015, the value of landings of North Sea (Area 4) and West of Scotland (Area 6a) nephrops into Scotland was £55.8m (Figure 2-9). This is less than the value landed by Scottish vessels (Figure 2-7) as some landings by Scottish vessels are made outside of Scotland. The creel sector landed £13m of the total value of landings into Scotland (Figure 2-9, central circle), and the creel sector has a greater share of total value relative to its share of total weight, 23% and 9% respectively. This is because of the high price paid for creel caught product.

North Sea nephrops landed by trawlers broadly maintained its share of the total as it represented 32% of total liveweight landings and 30% of total value. However, in terms of value, the landings of West of Scotland nephrops lost its proportionate share of the whole as the landings represented 59% of all liveweight landings but 47% of total value. The reduction in proportionate share of value for West of Scotland nephrops is driven by the high proportion of West of Scotland nephrops that was landed as tails.

³ In this context, product refers to either whole or tailed nephrops.

⁴ Data on the detail of Scottish landings in 2016 was not available at the time of analysis.

Figure 2-8: Liveweight nephrops landings in Scotland by gear, stock and product type in 2015 (tonnes)

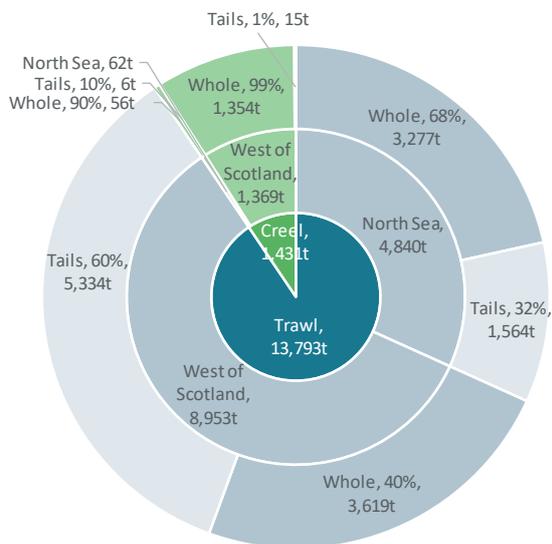
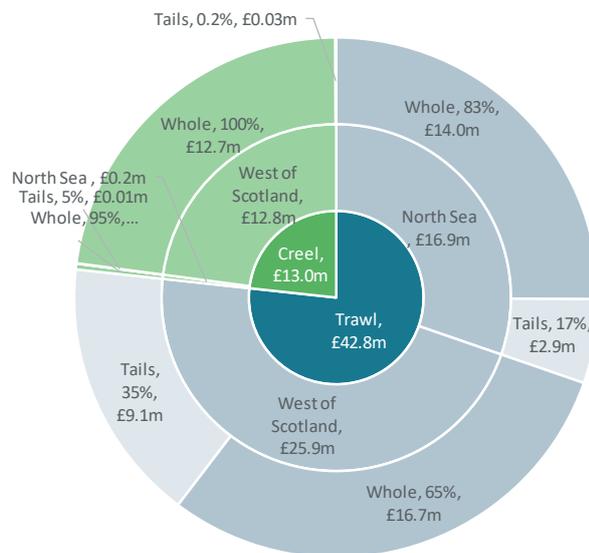


Figure 2-9: Sales value of nephrops landings in Scotland by gear, stock and product type in 2015 (£)



Source: Marine Scotland sea fisheries data

In 2015, one interesting finding is that the North Sea trawl segments landed 68% of their liveweight catch whole and 32% of their catch as tails. Whereas these proportions were reversed in the West of Scotland, where 40% of the liveweight catch landed by West of Scotland trawlers was landed whole, and 60% landed as tails.

Further investigation was undertaken to ascertain whether this was influenced by the relatively weak landings from the North Sea in 2015 but the proportions for whole and tail remained similar in both sea areas in 2013 and 2014. Further analysis also explored whether it might be the size distribution of catch which, if a higher proportion of trawled West of Scotland nephrops were caught in the smaller size grades, might influence the proportion that is tailed. However, the analysis found that in 2014 and 2015, it was the North Sea trawlers which had a higher proportion of the smaller grade 3 and 4 nephrops. The reason for the different ratio of whole to tail landed by the North Sea and West of Scotland trawl fleets remains unknown. The consultations with industry provided little explanation. Therefore, only speculation can suggest what the cause might be. One potential cause could be differences in the onshore infrastructure and sales routes in the West of Scotland which may be better adapted to the tails market due to the historic pattern of development on the West Coast. Another potential explanation is the higher degree of seasonality in West of Scotland trawl landings. If periods of high supply encourage more catch to be tailed, this could offer a potential explanation. Evidence on seasonality is presented in the next section.

2.7.4 Seasonality of nephrops landings in Scotland by gear, stock and area in 2015

The seasonality of nephrops landings in to Scotland is presented in the following three Figures. The landed weight from each Functional Unit is also shown. Functional Unit is the geographic level at which stock assessments are undertaken, although total quota is set at North Sea and West of Scotland level.

Figure 2-10 and Figure 2-11 show the seasonality of trawl caught nephrops landings by Scottish vessels. The graphs show a much greater degree of seasonality in the West of Scotland trawl fleet. The landings in just two months: June and July, represented 36% of total annual landings of trawled nephrops from the West of Scotland in 2015.

Across all functional units in the North Sea, there is much less seasonality. However, landings from the Farn Deeps and the Moray Firth reduce in the latter half of the year, whereas catches from the Fladen ground increase quite substantially. It does seem reasonable to assume that the consistency of supply from the North Sea trawl fleet supports a better market than the much more seasonal West of Scotland landings, which is perhaps why we see differences in the landings of whole and tailed nephrops, as discussed above.

Figure 2-12 shows the landings from West of Scotland Functional Units by the creel fleet. There is less seasonality evident for the creel fleet, compared to the West of Scotland trawl fleet, although landings do reduce in the last quarter of the year to 17% of total landings.

North Sea trawl landings are the only landings which increase in the second half of the year, when demand is usually higher for whole nephrops. This may further support a conclusion that seasonality is a key influence on the type of product, i.e. whole or tailed, landed by the West of Scotland and North Sea fleets.

Figure 2-10: Trawled liveweight landings of nephrops by Scottish vessels from the West of Scotland by month (tonnes) **Figure 2-11: Trawled liveweight landings of nephrops by Scottish vessels from the North Sea by month (tonnes)**

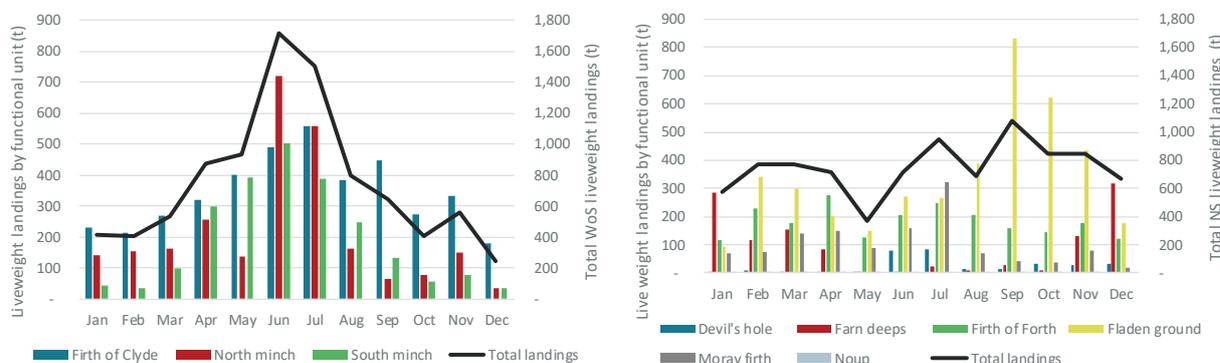
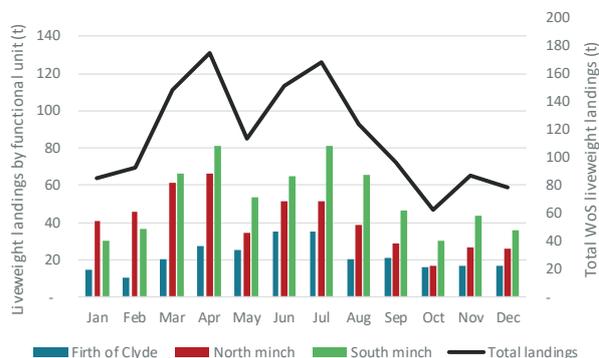


Figure 2-12: Creeled liveweight landings of nephrops by Scottish vessels from the West of Scotland by month (tonnes)



Source: MMO data

2.8 The Scottish nephrops fleet and its fleet segments

In the analysis of the different fleet segments, the Scottish nephrops fleet is defined in this study as all vessels registered in Scotland for which nephrops was the species of greatest value to a vessel's total income in a calendar year.

The Scottish nephrops fleet is then segmented further using three further criteria:

- does the vessel fish with static gear (creel) or mobile gear (trawl);
- does the vessel mainly fish in the West of Scotland (ICES Area 6) or the North Sea (ICES Area 4); and
- what size is the vessel?

These characteristics have been used to create eight Scottish nephrops fleet segments: two creel fleet segments in the West of Scotland; and six trawl fleet segments, three in the West of Scotland and three in the North Sea. The eight nephrops fleet segments are:

- under 10m West of Scotland nephrops creel;
- 10-15m West of Scotland nephrops creel;
- Under 10m West of Scotland nephrops trawl;
- 10-15 West of Scotland nephrops trawl;
- 15-24m West of Scotland nephrops trawl;
- Under 10m North Sea nephrops trawl;
- 10-15m North Sea nephrops trawl; and
- 15-24m North Sea nephrops trawl.

If a combination of gear type, size and area is missing from the list, for example under 10m North Sea creel vessels, it is because there are no nephrops vessels of this type or there was insufficient activity to support analysis.

At the time of analysis, the most recent confirmed data available for the nephrops fleet segments was for 2015, although estimates were provided by Seafish for 2016. The eight fleet segments were created in conjunction with the Seafish economics team and used to create a bespoke analysis of the Seafish fleet economic performance database. The fleet segmentation and data processing completed for this analysis was done on an annual basis, therefore if a vessel switched from the North Sea in one year to the West of Scotland in another year, the vessel's activity would be allocated to the appropriate fleet segment for each calendar year.

All findings presented in the remainder of the report for the eight fleet segments is based on the data held in the Seafish fleet economic performance dataset.

2.8.1 Number of Scottish nephrops fishing vessels

The data provided by Seafish shows that there were 462 vessels in the Scottish nephrops fleet in 2015 (Table 2-3). Of the 462 vessels in 2015, 55% (254) were trawl vessels and 45% (208) were creel vessels. Of the 254 trawlers, 148 trawlers were predominantly fishing West of Scotland and 106 trawlers were fishing predominantly in the North Sea. All creel vessels were active in the West of Scotland.

In 2015, the West of Scotland creel fleet segments and the North Sea trawl fleet segments had the younger fleets with an average age of vessel of 26 years and 27 years respectively. The three West of Scotland trawl fleet segments had an average age of 35 years.

In total the nephrops fleet in Scotland employed 1,266 FTE posts, with an average of 2.7 FTE posts per vessel. The nephrops fleet spent 71,770 days at sea in 2015, which averaged at 155 days per vessel. However, the average days at sea for fleet segment varied between 97 days at sea per vessel (10-15m North Sea trawl fleet segment) and 178 days at sea per vessel (10-15m West of Scotland creel fleet).

Table 2-3: Number of active vessels in each fleet segment, average age of vessel, employment and days at sea in 2015

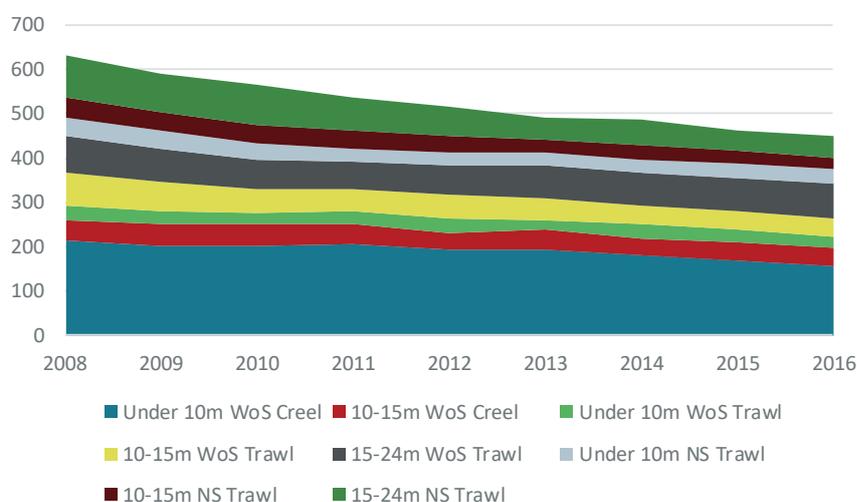
Size, gear type and predominant location	Number of vessels	Average age of vessel	Full time equivalent (FTE) posts		Days at sea	
			Total	Per vessel	Total	Per vessel
Under 10m WoS Creel	168	25	204	1.2	27,074	161
10-15m WoS Creel	40	30	104	2.6	7,112	178
Under 10m WoS Trawl	29	29	52	1.8	3,940	136
10-15m WoS Trawl	44	33	153	3.5	6,498	148
15-24m WoS Trawl	75	38	432	5.8	12,362	165
Under 10m NS Trawl	33	28	63	1.9	4,683	142
10-15m NS Trawl	28	33	53	1.9	2,726	97
15-24m NS Trawl	45	23	205	4.6	7,375	164
TOTAL	462		1,266	2.7	71,770	155

Source: Seafish fleet economic performance dataset

Following 2015, the fleet reduced to 450 vessels in 2016, a reduction of 12 vessels compared to 2015. The number of under 10 vessels reduced by 20 and the number of 10-15 m trawlers reduced by three. However, in 2016, the number of vessels in the largest size category in each gear type increased: the number of 10-15m creel vessels increased by three and 15-24m trawl vessel increased by eight.

The noted increase in the number of larger vessels in 2016 is a partial reversal of an overall downward trend in the number of vessels in all eight fleet segments (Figure 2-13). Between 2008 and 2016 there was a 29% reduction in the number of vessels across the eight fleet segments, from 632 vessels to 450 vessels.

Figure 2-13: Number of vessels in the eight nephrops fleet segments, 2008-2016



Source: Seafish fleet economic performance dataset

3 Business performance and competitiveness of Scotland's nephrops fleet segments

Nephrops is a highly valuable stock to Scotland, and as a result the species supports a significant number of vessels in the Scottish fleet. According to the Seafish dataset, in 2015, there were 232 over 10m nephrops vessels in Scotland and 230 under 10m nephrops vessels. The previous chapter highlighted the diversity within the Scottish fleet segments. The different characteristics of the different fleet segments influence the species, type of product (tailed or whole nephrops) and quantity of product landed. The species, type and quantity of product landed drives the income of a vessel business but an understanding of sales value and income is insufficient to understand the business performance of vessels within each fleet segment and the relative competitiveness of each of the fleet segments. In Chapter 3, findings are presented on:

- The weight of landings by each fleet segment (all stocks);
- The landings composition of each fleet segment;
- The average price paid to each fleet segment for its landings (all stocks);
- The income, costs and profitability of the eight Scottish nephrops fleet segments;
- The competitiveness of each fleet segment as measured by economy and efficiency; and
- Key factors in competitiveness including access to commercial fishing opportunities and access to good sales routes and how this varies between fleet segments.

NOTE: the findings presented in Chapter 3 provides an overall view of the fleet and its constituent fleet segments, and creates a view of average performance within a fleet segment based on research undertaken by Seafish Industry Authority. In every fleet segment, there will be vessels that outperform the view presented here and likewise there will be vessels that are performing less well.

3.1 Weight and value of landings by the eight nephrops fleet segments

In 2015, the total liveweight landings made by all eight fleet segments was 20,614t, of which 14,217t (69%) was nephrops. Figure 3-1, Figure 3-2 and Table 3-1 demonstrate how the liveweight of landings (all stocks) has changed in the nine years to 2016. Total landings declined from 37,386t in 2008 to its lowest point, 20,614t in 2015. Figure 3-2 further demonstrates the earlier discussion that the decline in production largely occurred in the North Sea. In 2008, North Sea fleet segments landed 23,610t but in 2015, this had declined to 8,910t. In the West of Scotland fleets, total landings remained between approximately 11,500t and 13,500t until 2016. Although there were differences between the fleet segments, the landings of the under 10m West of Scotland trawl fleet and the landings of the 10-15m West of Scotland trawl fleet declined between 2008 and 2015 by 35% and 50% respectively between 2008 and 2015.

However, in both the North Sea and West of Scotland fleet segments, there was a notable improvement in 2016. Landings by North Sea fleet segments increased by 40% compared to 2015, to 12,493t and landings by the West of Scotland fleet segments went up by 30% compared to 2015, to 15,265t. However, two smaller West of Scotland trawl fleet segments, that experienced the greatest decline in

production in the eight years to 2015, have not shared in the 2016 bounce in landings with an increase of just 8% for the under 10m trawl fleet segment and 15% for the 10-15m trawl fleet segment. The 10-15m creel fleet segment also did not experience a substantial bounce in landings in 2016, but this fleet also maintained relatively stable landings in the nine years to 2016.

Table 3-1 contains the data presented in the two figures.

Figure 3-1: Weight of landings (all stocks) by West of Scotland nephrops fleet segments, 2008-2016 (liveweight tonnes)

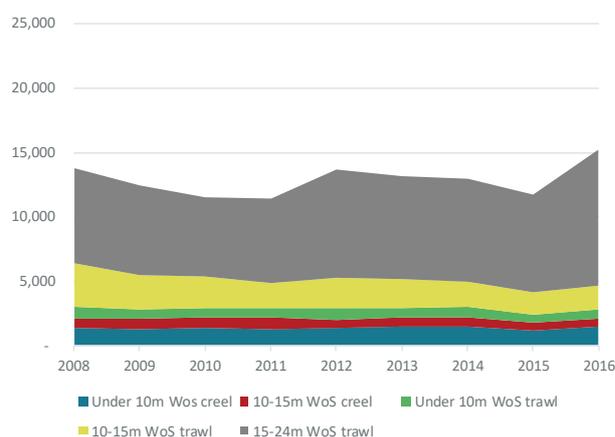


Figure 3-2: Weight of landings (all stocks) by North Sea nephrops fleet segments, 2008-2016 (liveweight tonnes)

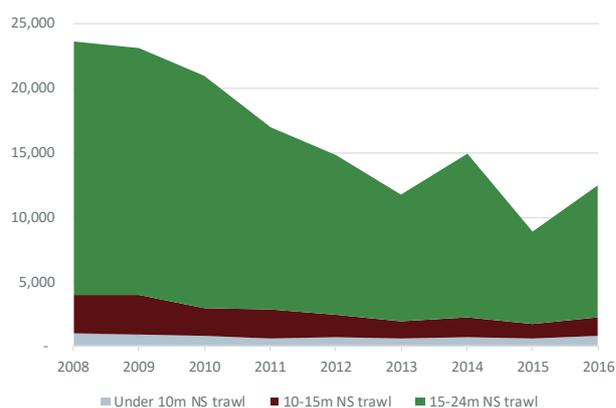


Table 3-1: Weight of all landings (all stocks) by Scottish nephrops fleet segments, 2008-2016 (liveweight tonnes)

	2008	2009	2010	2011	2012	2013	2014	2015	2016
Under 10m WoS creel	1,349	1,303	1,368	1,280	1,323	1,462	1,451	1,124	1,413
10-15m WoS creel	701	726	844	877	699	694	752	677	710
Under 10m WoS trawl	925	752	736	690	883	711	792	602	648
10-15m WoS trawl	3,371	2,692	2,387	1,980	2,334	2,320	1,976	1,691	1,908
15-24m WoS trawl	7,430	7,015	6,195	6,547	8,411	7,984	7,982	7,611	10,586
Under 10m NS trawl	983	936	747	572	673	561	644	568	808
10-15m NS trawl	2,954	3,055	2,157	2,252	1,743	1,337	1,613	1,100	1,465
15-24m NS trawl	19,674	19,178	18,018	14,174	12,425	9,866	12,670	7,242	10,219
TOTAL	37,386	35,657	32,451	28,371	28,492	24,935	27,879	20,614	27,758

Source: Seafish fleet economic performance dataset

In 2015, the total value of landings made by all eight fleet segments was £60.91m of which £52.82m (87%) was nephrops. Figure 3-3, Figure 3-4 and Table 3-2 demonstrate how the value of landings (all stocks) has changed in the nine years to 2016. Total value of landings declined from £106.51m in 2008 to its lowest point, £60.91m in 2015. As expected, the largest decline in value occurred for North Sea fleet segments. However, Figure 3-2 shows that the decline in value was not as immediate as the decline in landings, which suggests that the fleet benefitted from higher prices as landings began to reduce. However, by 2013, the market appears to have adjusted to the reduced weight of landings. Between 2008 and 2013 landings by North Sea fleet segments reduced by 50% and total sales value reduced by 54%.

Following the pattern of improved landings in 2016, the value of landings by all eight fleet segments, in both the North Sea and West of Scotland fleet segments increased by 32%, compared to 2015, to £80.66m.

Table 3-2 contains the data presented in the two figures.

Figure 3-3: Value of landings (all stocks) by West of Scotland nephrops fleet segments, 2008-2016 (£million)

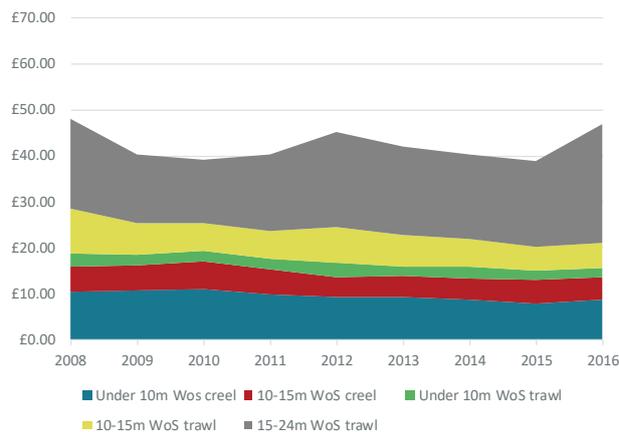


Figure 3-4: Value of landings (all stocks) by North Sea nephrops fleet segments, 2008-2016 (£million)

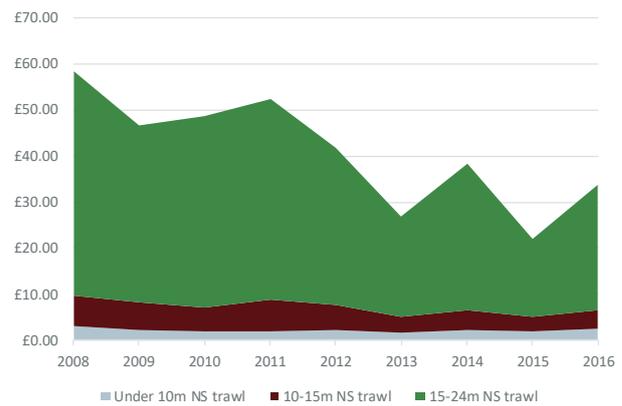


Table 3-2: Value of all landings (all stocks) by Scottish nephrops fleet segments, 2008-2016 (£million)

	2008	2009	2010	2011	2012	2013	2014	2015	2016
Under 10m WoS creel	£10.47	£10.59	£11.11	£9.98	£9.15	£9.14	£8.72	£7.68	£8.71
10-15m WoS creel	£5.48	£5.66	£5.93	£5.25	£4.52	£4.73	£4.51	£5.38	£4.85
Under 10m WoS trawl	£2.94	£2.26	£2.32	£2.27	£3.00	£2.14	£2.71	£1.98	£2.12
10-15m WoS trawl	£9.54	£6.74	£6.01	£6.05	£7.72	£6.74	£5.86	£5.03	£5.50
15-24m WoS trawl	£19.54	£15.13	£13.87	£16.77	£20.84	£19.25	£18.52	£18.83	£25.75
Under 10m NS trawl	£3.02	£2.23	£2.06	£1.97	£2.34	£1.72	£2.16	£1.96	£2.54
10-15m NS trawl	£6.76	£6.04	£4.95	£6.77	£5.43	£3.36	£4.39	£3.15	£4.03
15-24m NS trawl	£48.77	£38.48	£41.55	£43.72	£34.12	£21.71	£31.69	£16.89	£27.16
TOTAL	£106.51	£87.14	£87.80	£92.76	£87.11	£68.78	£78.55	£60.91	£80.66

Source: *Seafish fleet economic performance dataset*

3.2 Landings composition of the fleet segments

The eight fleet segments have different characteristics and this is reflected in the landings composition of the fleet segments. Gear, size of vessel and location all have an influence on landings composition of a fleet segment. Figure 3-5 shows the weight of nephrops landed compared to the combined weight of other species landed for each fleet segment, and Figure 3-6 shows the value of nephrops landed compared to the combined value of other species landed. For each fleet segment, the ratio of weight to value is better for nephrops than the ratio of weight to value of other species (combined), i.e. the importance of nephrops to all fleet segments increases when value rather than weight is considered.

The fleet segment with the most diverse catch is the 15-24m North Sea trawl fleet. In 2015, the liveweight landings of the 15-24m North Sea trawl segment consisted of 45% nephrops, 40% whitefish and 7% flatfish. A mix of other species made up the remaining 8% of liveweight landings. However, when value is considered, nephrops represented 68% of total value.

The fleet with the second most diverse landings is the under 10m West of Scotland creel fleet. In 2015, the liveweight landings of the under 10m creel fleet consisted of 68% nephrops and 30% other crustaceans (crabs, lobsters and whelks). A mix of other species made up the remaining 2% of landed weight in 2015. The two segments which were most dependent on nephrops in 2015 were the under 10m and 10-15m West of Scotland trawl fleet segments as nephrops represented 97% of liveweight landings for both fleet segments.

Figure 3-5: Weight of nephrops landings and combined weight of other landings as a percentage of total landings, 2015 (liveweight)

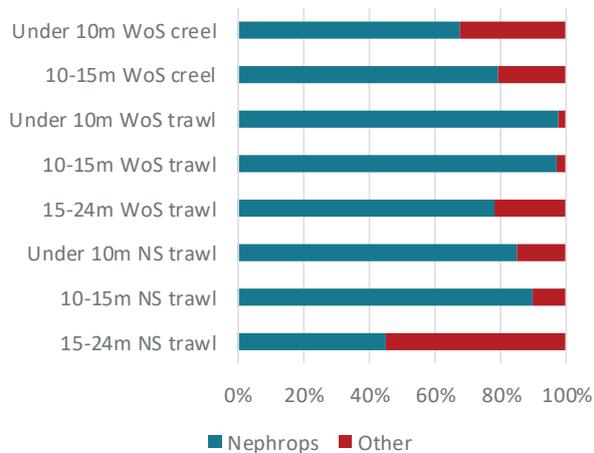
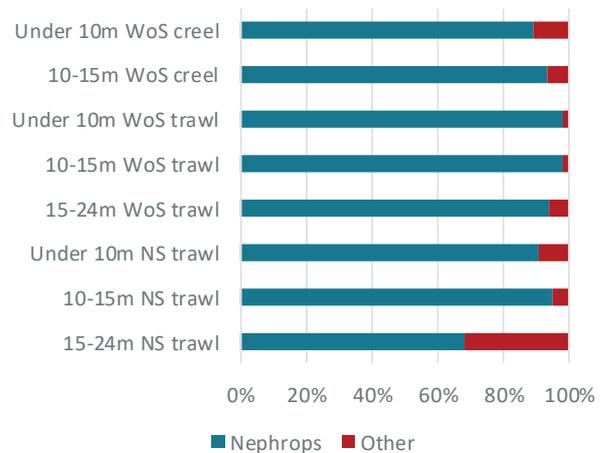


Figure 3-6: Sales value of nephrops landings and sales value of other landings as a percentage of total sales value, 2015



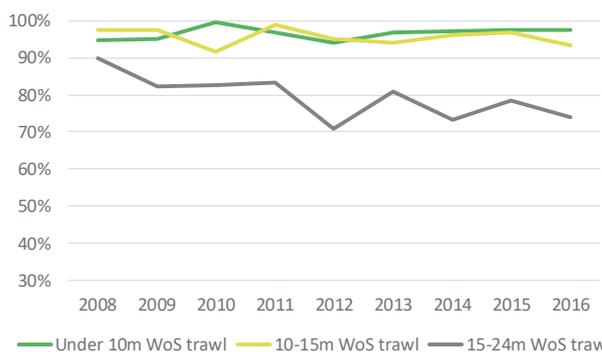
Source: Seafish fleet economic performance dataset

Figure 3-7, Figure 3-8 and Figure 3-9 show the dependence on nephrops for each fleet segment in the nine years to 2016⁵. The most consistent level of dependence over time can be seen in the fleet segments identified as the most dependent - the under 10m and 10-15m West of Scotland trawl fleet segments (Figure 3-8). There is no notable consistency between the two creel fleet segments until 2013, when the pattern of dependence on nephrops begins to follow a similar path for both fleet segments (Figure 3-7). The most notable difference in the three groups of fleet segments (West of Scotland creel, West of Scotland trawl and North Sea trawl), is within the North Sea trawl fleet segments (Figure 3-9). The difference in dependence on nephrops between the 15-24m North Sea fleet and the two fleet segments under 15m is substantial, particularly from 2013 onwards, this is attributed to a reduction in nephrops catches in the Fladen field from 2012, where the larger vessels tend to fish.

Figure 3-7: Nephrops as a % of liveweight landings for West of Scotland creel fleet, 2008-2016

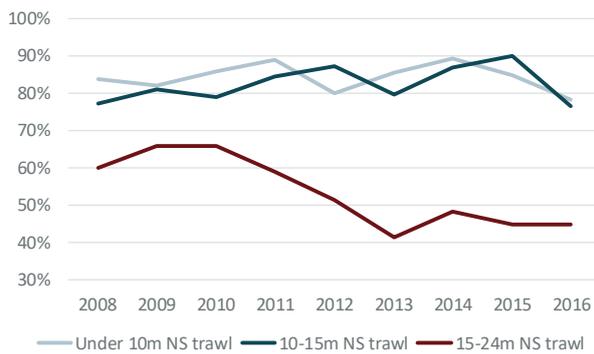


Figure 3-8: Nephrops as a % of liveweight landings for West of Scotland trawl fleet, 2008-2016



⁵ For this analysis the data provided by Seafish is actual 2016 data, not an estimate.

Figure 3-9: Nephrops as a % of liveweight landings for North Sea trawl fleet, 2008-2016



Source: *Seafish fleet economic performance dataset*

3.3 Average price paid to each fleet segment

The price paid to each fleet segment for its landings is determined by the market and can be expected to reflect the price available to the buyer/processor for their product. Species, type of product, size of product, quality and quantity available will all have an influence on the price paid to vessels; and the price paid for landings will have a direct impact on the business performance of the fleet segment. Figure 3-10, Figure 3-11 and Figure 3-12 show the average price earned by each fleet segment for every kg landed in 2008-2016. These figures are adjusted to 2015 values and represent the average price for all stocks. Of interest in these findings are:

- The decrease in average price earned by the under 10m West of Scotland creel fleet between 2010 and 2014, although an improvement did occur in 2015 (Figure 3-10);
- The volatility in the average price earned by the 10-15m West of Scotland creel fleet, and that until 2012 the larger creel vessels tended to earn less per kg than the under 10m fleet, although this position switched in 2015 and 2016 (Figure 3-10);
- The significant different in average price paid to the creel fleet segments compared to the trawl fleet segments (see all three figures, which use the same y-axis scale);
- The smaller trawl vessels achieve a higher average price than the larger trawl vessels (Figure 3-11 and Figure 3-12);
- The increase in the price paid to the two larger North Sea trawl fleet segments in 2011 and 2012 reflects the earlier analysis in Chapter 2, which showed that when landings dropped in these years, total value of landings remained relatively high (Figure 3-12); and
- The price paid to the West of Scotland trawl fleets has remained more stable than for other fleet segments (Figure 3-11).

Figure 3-10: Average price per kg of landings (landed weight) by West of Scotland creel fleet, 2008-2016

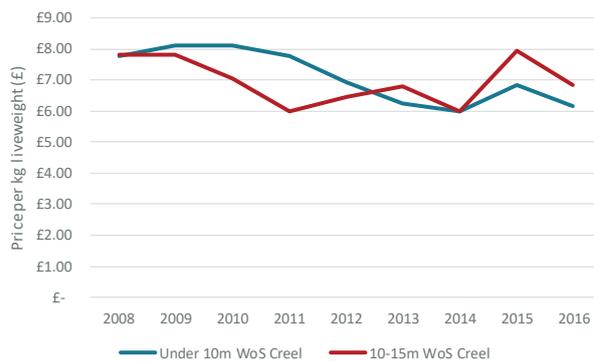


Figure 3-11: Average price per kg of landings (landed weight) by West of Scotland trawl fleet, 2008-2016

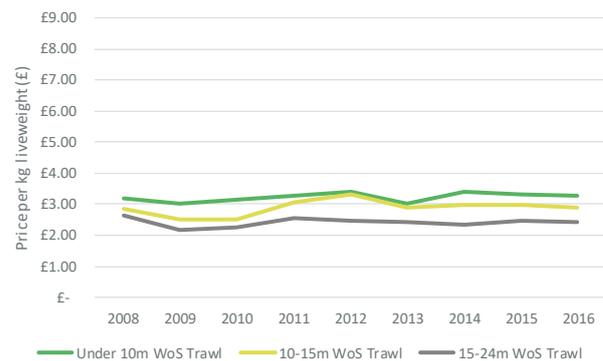
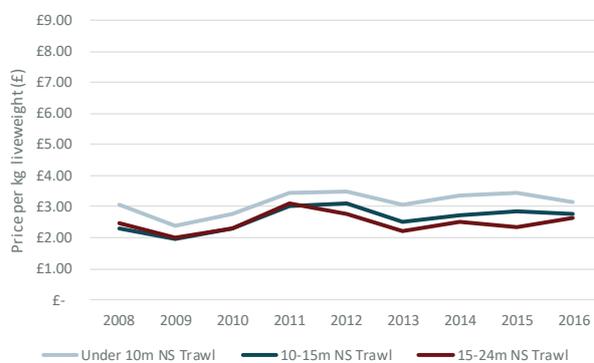


Figure 3-12: Average price per kg of landings (landed weight) by North Sea trawl fleet, 2008-2016



Source: *Seafish fleet economic performance dataset*

Note: A price analysis in Chapter 4 provides results which are focused only on nephrops landings and the price for liveweight landings, rather than landed weight.

3.4 Income, cost and profit margins

The graphs presented below in Figure 3-13 are taken from Appendix C, where more detail can be found on the business performance of each of the eight Scottish nephrops fleet segments. The graphs indicate the total income of the fleet segments relative to their total operating costs over the eight-year period to 2015⁶. Total income includes fishing income and non-fishing income. Non-fishing income may include earnings from guard duty, tourism, scientific surveys and haulage.

To enable fair comparison between the diverse fleet segments, income and costs are expressed as a value per kilowatt days at sea (kWdas). Using this measure allows easier comparison between fleet segments as the same scale can be used in each graph (£2-£10 on the y-axis). The gap between total income and operating cost is the operating profit margin of the fleet segment.

The following observations are made on Figure 3-13:

- All eight nephrops fleet segments maintained a profit margin throughout the eight-years to 2015 – this is not the case across all UK fleet segments as can be seen in the 2016 Seafish publication of *2016 Economics of the UK fishing fleet*.

⁶ Verified data on business performance in 2016 was not available at time of analysis.

- All six trawl fleet segments experienced an upturn in income per kWdas in 2011 and 2012 after North Sea production had reduced which appears to have supported higher average prices.
- The under 10m trawl fleet segments, maintain a larger profit margin than other fleet segments, albeit the total sums involved are smaller. However, there was a narrowing of their margin in 2015; and
- The under 10m West of Scotland creel fleet is the only fleet segment with an identifiable downwards income trend since 2010, with profit margins narrowing steadily up to and including 2015.

The efficiency and economy of each fleet segment is explored in more detail in the next section on the competitiveness of each fleet segment.

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Figure 3-13: Operating costs compared to total income per kWdas for each fleet segment (£)

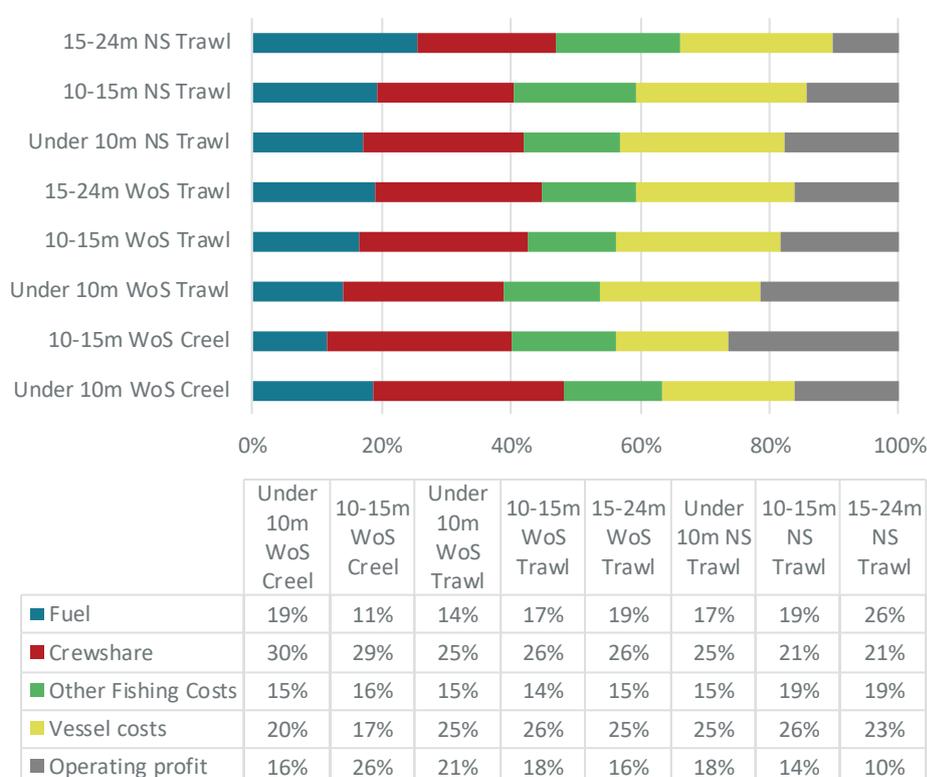


Source: Seafish fleet economic performance dataset

Figure 3-13 showed how the operating costs of fleet segments are largely in tune with total income, and follow the same pattern of rise and fall. The operating costs of fleet segments are grouped by Seafish into: fuel, crewshare, other fishing costs and vessel costs. Vessel costs include expenditure on gear. Figure 3-14 presents the proportion of total income for each fleet segment that is accounted for by each type of operating cost. For example, fuel is the largest cost for the 15-24m North Sea trawl fleet segment and the 10-15m West of Scotland creel fleet has low fuel costs relative to income. Crewshare (shown in red) varies between 21% and 30% of total income, and the two creel fleets have the highest crewshare as a proportion of total income. Figure 3-14 indicates the proportion of income allocated to each cost, not whether the crew of one fleet segment gets paid more than the crew of another.

In 2015, the highest operating profit margin was achieved by the 10-15m West of Scotland creel fleet (26%), although 2015 appears to have been a particularly good year for this fleet segment (see Figure 3-13). The 15-24m North Sea trawl fleet has the lowest profit margin (10%) but as shown in an earlier analysis, this fleet has substantially higher income and therefore higher total profit than the other nephrops fleet segments.

Figure 3-14: Operating costs for each fleet segment as a percentage of total income, 2015



Source: Seafish fleet economic performance dataset

3.5 Competitiveness

For a fishing business to be competitive and sustainable, several different factors must effectively combine. A fishing business must be particularly resilient as the nature of the industry means that the business is likely to face a cycle of challenges in areas such as access to commercial fishing opportunities (biomass and quota), access to good sales routes (demand, price, reliability) and in its cost base (fuel costs). Being competitively strong will improve the capacity of the business to invest in future success and help the business to overcome the inevitable challenges that occur in fisheries.

Findings presented in Chapter 2 showed that the UK is almost unique in having a creel sector that catches nephrops. The diversity of the UK fishing fleet is one of its strengths but diversity can also cause disharmony and can lead to conflict. There are some who would promote that creel fishing is better than trawl fishing. A recent report by the Scottish Creel Fishermen’s Federation (SCFF) proposed that the economic benefits of catching nephrops by creel is significantly greater than the economic benefits of catching nephrops by trawl⁷. However, our experience of the owners of fishing vessels is that they are hugely pragmatic individuals who are well-used to the vagaries of the fishing industry, and, importantly, are in the industry for the long-haul. If the economic advantages of creel fishing are as substantial as promoted in the SCFF report then it raises the question: why does such a sizable trawl fleet exist in the UK and in other countries? The remainder of Chapter 3 explores if the competitiveness of the different fleet segments can provide an answer as to why Scotland does have such a diverse nephrops fleet.

To understand the competitiveness of different fleet segments, analysis of factors considered to be critical to competitiveness was undertaken. Figure 3-15 presents key factors that influence the competitiveness of a fleet segment, and an individual vessel:

- The efficiency and economy of the fleet itself;
- The extent to which the fleet has access to commercial fishing opportunities; and
- The sales routes that the fleet has access to.

The best measure to assess the efficiency of a fishing fleet, or vessel, is to analyse landings per unit of effort, i.e. how much effort does it take to land a kilogram or tonne of catch. The best measure to assess the economy of a fishing fleet, or vessel, is to analyse how well it turns its operating costs into income.

Both economy and efficiency are relatively straightforward quantitative analyses using the bespoke nephrops economic performance dataset created by Seafish. However, access to raw materials and access to good sales routes are also vital factors in the competitiveness of a fleet segment. Whilst these factors can be harder to quantify, Chapter 3 uses published information and the views of consultees to understand how access to fishing opportunities and sales routes might affect different fleet segments.

Figure 3-15: Competitiveness of a fleet segment



NOTE: the analysis presented in the remainder of this chapter provides an overall view of the fleet and its constituent fleet segments, and creates a view of average performance within a fleet segment based on research undertaken by Seafish Industry Authority. In every fleet segment, there will be vessels that outperform the view presented here and likewise there will be vessels that are performing less well.

⁷ Correcting the misallocation of nephrops stocks in Scottish inshore waters: Untapping a vast economic and environmental potential, Scottish Creel Fishermen’s Federation, 2017.

3.6 Fleet efficiency

Fleet efficiency is judged by how well effort is turned into output, in the fishing fleet the output is the landings of a vessel. However, there are several different units of effort that could be used to create a measure of efficiency. For example, a vessel could be the unit of effort, as could days at sea, full-time equivalent (FTE) posts onboard and kilowatt days at sea (kWdas). For the analysis, two of these measures of effort are used: FTE posts onboard a vessel, and kWdas. FTE posts onboard and kWdas provide relatively well-balanced units of effort that are not unduly influenced by the size of vessel and, combined, the two analyses provide an interesting narrative.

The level of capital investment in trawling is designed to achieve efficiency, therefore it is unlikely to be surprising that trawling outperforms creeling in efficiency measures. The question is perhaps, by how much does efficiency differ. Figure 3-16 presents the tonnage landed by each fleet segment per FTE post onboard. The tonnage shown is an average of the tonnages landed per FTE across three years (2013-2015). Using a three-year average helps to limit the potential impact of extreme events that may be present in a single year. All tonnages are calculated as liveweight.

3.6.1 Landings per full-time equivalent (FTE) post

The average tonnage landed per FTE post across the eight fleet segments is 16.9t per annum. Figure 3-16 shows that the West of Scotland trawl fleet hovers around this average. The under 10m creel fleet and the 10-15m creel fleet on the West of Scotland land a lower tonnage, 7.2t and 6.9t per FTE post respectively. Interestingly, the analysis indicates that the under 10m West of Scotland fleets (creel and trawl) are making marginally more landings per FTE post than their comparable but larger 10-15m fleet segments. This suggests that there is no labour efficiency achieved on the larger 10-15m West of Scotland vessels, and indeed some labour efficiency may be lost on the larger vessels.

The most efficient fleet segments, in terms of tonnage per FTE post, are the over 10m North Sea trawl fleet segments, with the 15-24m fleet landing 33.7t per FTE post across the three years.

Figure 3-16: Annual landings (liveweight) per FTE post, using a 3-year average, 2013-2015



Source: *Seafish fleet economic performance dataset*

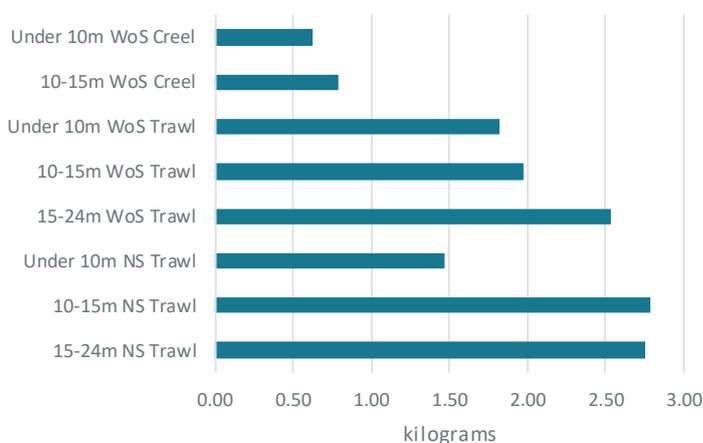
3.6.2 Landings per kilowatt day at sea (kWdas)

The average landings per kWdas across the eight fleet segments is 1.85kg. The three fleet segments that are closest to the average position are two West of Scotland trawl fleets (under 10m and 10-15m) and the under 10m North Sea trawl fleet. Both 15-24m trawl fleet segments (West of Scotland and North Sea) and the 10-15m North Sea trawl fleet land more than 2.5kg per kWdas. The creel fleet segments in the West of Scotland land less per kWdas, although, under this measure of efficiency, the larger 10-15m creel vessels were landing more per kWdas than the under 10m creel fleet (Figure 3-17).

The catch composition of the vessels could be expected to affect the average landings weight per kWdas. For example, in the West of Scotland trawl fleet, the larger vessels in the 15-24m trawl category are more efficient in terms of the weight of landings per kWdas. However, this fleet segment also catches a more diverse catch and, in 2015, 78% of its weight of landings was nephrops. Whereas 97% of the landings weight of the smaller two West of Scotland trawl fleet segments was nephrops. Therefore, a more diverse catch may be supporting better landings weight per kWdas. However, in the North Sea trawl fleet, a potential link between catch composition and landings per kWdas is not evident. Nephrops represented 90% of the weight landed by the 10-15m fleet segment but only 45% of the weight landed by the 15-24m fleet segment, however, both fleet segments have very similar landings per kWdas.

Regardless of the explanations, the findings of the analysis show, perhaps unsurprisingly, that again the larger trawl fleet segments are more efficient at turning effort, this time kWdas, into landings. As stated previously, this is believed to reflect the higher level of capital expenditure in trawl vessels.

Figure 3-17: Landings (liveweight) per kilowatt day at sea (kWdas), using a 3-year average, 2013-2015



Source: Seafish fleet economic performance dataset

3.6.3 Fleet efficiency, 2008-2015

In addition to the three-year average discussed above, the analysis can also review efficiency measures for the eight years to 2015. The FTE data collected by Seafish is less robust in the earlier years, therefore the analysis is focused upon landings per kWdas. Figure 3-18 shows that in the West of Scotland creel fleet there is remarkable consistency between the under 10m and 10-15m creel fleet in landings per kWdas. The only deviations occur in 2011, when landings per kWdas improved for the 10-15m creel fleet, and in 2014 and 2015 when landings per kWdas improved for the 10-15m creel fleet but reduced for the under 10m creel fleet. The effect of this latter deviation can be seen in the difference between the two creel fleet segments shown in three-year average above (Figure 3-17).

In the North Sea trawl fleet (Figure 3-20), there is a reasonable level of consistency in the landings per kWdas between the two larger fleets, 10-15m and 15-24m, although landings per kWdas is more stable across the years in the largest fleet segment. The only fleet segment where efficiency under the measure of landings per kWdas is on a downward trend, is the under 10m North Sea trawl fleet segment. From a peak of 2.16kg per kWdas in 2009, landings per kWdas has steadily declined to 1.19kg per kWdas in 2015. The effect of this can also be seen in the three-year average above (Figure 3-17).

Across all eight fleet segments, the two largest North Sea trawl fleet segments and the largest West of Scotland trawl fleet segment are consistently more efficient in turning kWdas into landings. Interestingly under this measure of efficiency, the 10-15m West of Scotland trawl fleet is consistently less efficient than the same size of vessels in the North Sea. One potential influence on this may be the age of the two fleets, with more modern vessels operating in the North Sea (see Chapter 2, Table 2-3).

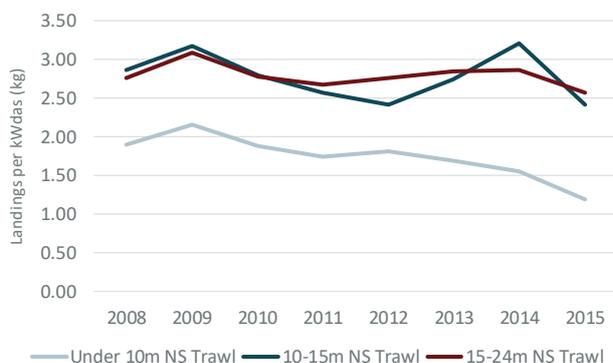
Figure 3-18: Landings per kWdas by West of Scotland creel fleet segments, 2008-2015 (kg)



Figure 3-19: Landings per kWdas by West of Scotland trawl fleet segments, 2008-2015 (kg)



Figure 3-20: Landings per kWdas by North Sea trawl fleet segments, 2008-2015 (kg)



Source: *Seafish fleet economic performance dataset*

3.7 Fleet economy

Fleet economy is a measure of how well a business turns its costs into income. The measure that best supports fair comparison between the fleet segments is how much income is generated for every pound of operating cost. The difference is the operating profit margin of the business. With the high prices earned for creel product, it would not be surprising to see the creel fleet do markedly better under economy measures. However, this expectation is not wholly supported by the analysis.

The analysis of the ratio between operating cost and income uses two different measures of income, the first is fishing income and the second is total income, i.e. fishing income plus non-fishing income.

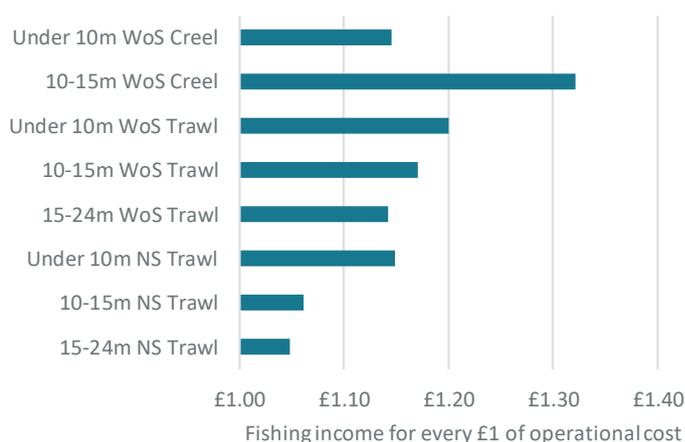
3.7.1 Fishing income per £1 of operating cost

Figure 3-21 shows the fishing income generated by each fleet segment from each pound of operating cost. The data is an average across three years (2013-2015), to minimise the potential impact of extreme events that may be present in a single year.

The average fishing income per pound of operating cost across all fleet segments was £1.15. Two of the fleet segments matched this average: the under 10m West of Scotland creel fleet and the under 10m North Sea trawl fleet. The over 10m West of Scotland trawl fleets (10-15m and 15-24m) also hover around the average. The most notable exceptions to the three-year average are the 10-15m West of Scotland creel fleet which has the best ratio of cost to fishing income, £1.32, for every £1 of operating cost, and at the other extreme is the over 10m North Sea trawl fleets (10-15m and 15-24m) which earned the least amount of fishing income, £1.06 and £1.05, for every £1 of operating cost.

Perhaps the most surprising finding is that the under 10m West of Scotland creel fleet only manages to equal the average fishing income of £1.15 per £1 of operating cost.

Figure 3-21: Fishing income generated for every £1 of operating cost, using a 3-year average, 2013-2015



Source: Seafish fleet economic performance dataset

3.7.2 Total income per £1 of operating cost

The second measure of economy includes non-fishing income (Figure 3-22). The average total income for every pound of operating cost was £1.22, up from £1.15 when only fishing income was considered. The extremes noted in Figure 3-21 are less evident when non-fishing income is included. However, the 10-15m West of Scotland creel fleet still outperforms the average and the 15-24m North Sea trawl fleet still has the weakest economy relative to the other fleet segments. The improvement noted from the inclusion of non-fishing income is greatest in the larger North Sea trawl fleets, particularly the 10-15m North Sea trawl fleet.

In the North Sea and West of Scotland trawl fleet segments, the ratio of total income to operating costs worsens as the vessels becomes larger. This suggests that to invest in larger vessels that can catch more fish, the business owner must accept a reduction in the margin earned on every £1 of cost. However,

from the business owner’s perspective, this may be offset by a larger overall turnover and a larger operating profit, albeit from a smaller margin.

However, this same effect is not evident in the creel fleet, where economy is notably better for the larger rather than the smaller vessels. This suggests that the under 10m creel fleet has a relatively high cost base for the income generated.

Figure 3-22: Total income generated for every £1 of operating cost, using a 3-year average, 2013-2015



Source: *Seafish fleet economic performance dataset*

3.7.3 Fleet economy, 2008-2015

A three-year average was used above to smooth out any extremes that can occur in a single year which allows a more balanced comparison of recent performance. The graphs below show, on an annual basis, how much income was generated for every £1 of operating cost by each fleet segment in the eight years from 2008 to 2015. All values are shown adjusted to 2015 values.

The most volatile ratio of operating cost to total income is seen in the performance of the West of Scotland creel fleet segments (Figure 3-23). The only nephrops fleet segment where performance under this measure is on a downward trend is the under 10m West of Scotland creel fleet segment (Figure 3-23). From a peak of £1.44 in 2009, the data suggests that income per £1 of operating cost has steadily declined to £1.16 in 2015. In contrast, the performance of the 10-15m West of Scotland creel fleet segment in 2015 appears to be exceptional, both when it is compared to previous years’ results, and when it is compared to all other fleet segments, including the under 10m creel fleet (Figure 3-23). The performance in 2015 has undoubtedly affected the three-year average for this fleet segment used in the economy analyses above. What is not known, is whether the results for economy in 2015 are a true reflection of a step-change in the performance of this fleet segment, or if there might be an exceptional event in performance or data in 2015. In progressing with the analysis, we assume that there was a step-change in performance, but would urge caution if using results affected by performance in 2015 to influence either policy or business decisions.

The same vertical scale is used for each graph below and there is less volatility evident in the West of Scotland trawl fleet segments (Figure 3-24) and the North Sea trawl fleet segments (Figure 3-25). The West of Scotland trawl fleet segments generally achieve an income of between £1.20 and £1.30 for every £1 of operating cost, although the income for the larger 15-24m trawl fleet was below £1.20 prior to 2011 and in 2013 (Figure 3-24).

The North Sea under 10m trawl fleet segment has a similar ratio and trend line to the under 10m West of Scotland trawl fleet. However, for the larger North Sea trawl fleet segments, 10-15m and 15-24m, the ratio of income to operating cost is weaker than the larger West of Scotland trawl segments. For the two largest North Sea trawl fleet segments a ratio of between £1.10 and £1.20 of total income for every £1 of operating cost is the norm in the eight years to 2015, compared to between £1.20 and £1.30 in the West of Scotland.

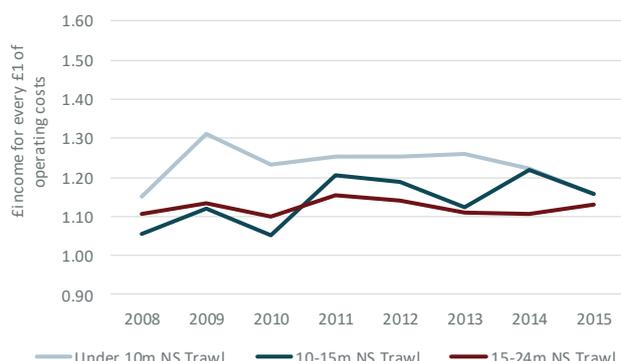
Figure 3-23: Total income per £1 of operating cost by West of Scotland creel fleet segments. 2008-2015



Figure 3-24: Total income per £1 of operating cost by West of Scotland trawl fleet segments, 2008-2015



Figure 3-25: Total income per £1 of operating cost by North Sea trawl fleet segments, 2008-2015



Source: Seafish fleet economic performance dataset

3.8 Competitiveness of the fleets: economy and efficiency combined

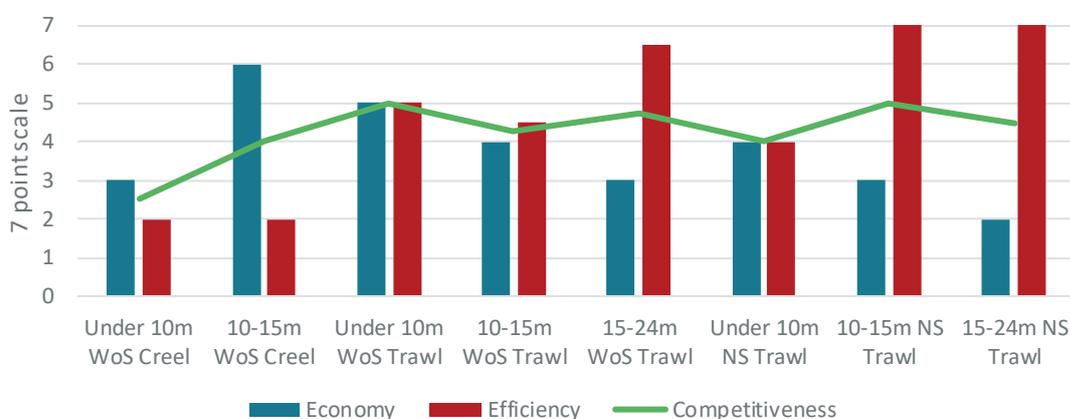
It is not considered reasonable to use any single finding on economy and efficiency to demonstrate that one fleet segment is 'better' than the other. However, a multi-criteria approach was developed to merge the findings on efficiency and economy to provide a quantitative view of overall competitiveness, which can indicate the overall success and sustainability of the fleet segments.

The results of the multi-criteria analysis are shown in Figure 3-26. The findings suggest that the competitiveness of the different fleet segments in Scotland is remarkably well-balanced, with most fleet segments scoring between four and five. However, for some fleets their competitiveness is achieved by strong economy, for some fleet segments their competitiveness is achieved by strong efficiency and for others it is a balance of the two which supports their competitiveness. The methodology for the multi-criteria analysis is presented in Appendix D.

The only fleet segment that appears to underperform in the competitiveness analysis is the under 10m West of Scotland creel fleet. The under 10m creel fleet does have a more diverse catch than the larger creel fleet and an earlier analysis showed that the under 10m creel fleet is the only fleet to have experienced a downwards trend in the average price achieved for each tonne landed in the period prior to 2015 (Figure 3-10). Furthermore, the proportion of income that is accounted for by fuel costs is higher than or equal to all trawl fleet segments, except the 15-24m North Sea trawl fleet segment, and higher than the 10-15m creel segment. If support could be provided to the fleet segment, the aim might be to improve economy, i.e. the ratio of income to operating cost, rather than efficiency. This is because the larger and more competitive 10-15m creel fleet segment has a similar efficiency, therefore it is assumed that efficiency is difficult to improve in the creel fleet, even in a larger vessel. The options to improve economy through an increase in price may also be restricted as the fleet already achieves a premium price for nephrops. Therefore, if catch composition is to remain the same, perhaps the best place to seek improvement is in the cost base of the fleet, perhaps fuel efficiency might be a starting point. From these findings, measures to reduce the cost base relative to income appear to be the most effective option to improve the competitiveness of the under 10m creel fleet, if such an improvement is desirable.

However, it should be not taken from these results that relatively weak competitiveness equals a ‘bad’ fleet segment. The fleet segment, as will be seen in Chapter 5, contributes to the economy of Scotland through its gross value-added (GVA) and consultations have highlighted the benefits that the under 10m creel fleet can provide to peripheral communities around the coast of Scotland. However, its capacity to invest and achieve long-term sustainability could be improved if its competitiveness, particularly its economy, could be improved.

Figure 3-26: Competitiveness of each fleet segment, derived from measures of economy and efficiency, using a 3-year average, 2013-2015



3.9 Access to commercial fishing opportunities

Clearly one critical requirement in the competitiveness of a fishing business is to have access to fishing opportunities. There are three key factors that combine to create access. These are:

- access to quota;
- access to good fishing grounds; and
- access to the right gear to catch target species.

These are each discussed in turn in the remainder of Section 3.4.

3.9.1 Access to quota

Quota is often a contentious issue in fisheries. However, in recent times, access to quota is not as challenging for the nephrops fleet as it has been in some fleet segments. Relative to other species, consultees believe that leasing nephrops quota is more affordable, relative to the potential returns, than other species as there is less demand in the system. However, with the introduction of the landing obligation (i.e. a ban on discards) fully implemented in 2019, the nephrops fleet is identified as one in which quota for potential choke species is either not available or expensive (this is discussed further in chapter 6)

A summary of the nephrops quota uptake for Scottish Producer Organisations (POs), the non-sector and under 10m sector is presented in Table 3-3. As shown earlier, all nephrops activity in the North Sea is trawl-based, however on the West of Scotland there is a mix of nephrops trawl and creel. The majority of quota is allocated to vessels that are members of POs. However, creel vessels do not tend to be members of POs, and are generally allocated quota through the over-10m or under-10m non-sector pools.

As presented in Table 3-3, the overall quota uptake in 2015 by Scottish vessels in the North Sea was 75% and 84% in the West of Scotland (bold in table). Assuming FPOs represent the trawl fleet segments and the non-sector pools represent the creel fleet the findings suggest:

- quota uptake in 2015 by trawl fleet segments in the North Sea was 73%;
- quota uptake in 2015 by trawl fleet segments in the West of Scotland was 85%; and
- quota uptake in 2015 by creel fleet segments in the West of Scotland was 82% (average of over-10m uptake of 75% in and under-10m uptake of 88%).

Table 3-3 demonstrates how quota uptake appears to be increasing for the trawl fleet segments in the four years to 2016. A lighter colour in the Table represents relatively low quota uptake, with a darker colour representing relatively high uptake. Compared to 2015, quota uptake by trawl vessels in the North Sea increased to 84% and quota uptake by trawl vessels in the West of Scotland increased to 89%. In 2016, the under-10m non-sector fleet, assumed to represent the under-10m creel fleet, also increased quota uptake from 88% to 94%. However, quota uptake by the over-10m non-sector fleet, assumed to represent the 10-15m creel fleet segment, decreased from 75% in 2015 to 65% in 2016.

The quota uptake calculation is based on the quota held by Scotland at the end of each year. This incorporates the initial nephrops quota allocated to Scotland and any swaps of quota made during the year. Therefore, the percentages shown in Table 3-3 include an element of quota trade. This follows the approach used by MMO and Marine Scotland as end of year (i.e. "Adapted") quota is used to measure uptake that includes in year swaps.

Table 3-3: Summary of North Sea and West of Scotland nephrops end of year quota uptake 2013-16 by segment

	North Sea				West of Scotland			
	2013	2014	2015	2016	2013	2014	2015	2016
Scotland FPOs	48%	78%	73%	84%	81%	81%	85%	89%
Scotland non-sector >10m	80%	95%	90%	90%	79%	69%	75%	65%
Scotland non-sector <10m	97%	97%	92%	100%	92%	94%	88%	94%
Scotland Overall	51%	80%	75%	86%	82%	81%	84%	88%
UK Overall (incl. Scotland)	52%	81%	64%	87%	72%	76%	76%	83%

Source: Marine Scotland and MMO sea fisheries statistics

Table 3-3 indicated a relatively strong uptake of quota in 2016. Figure 3-27 and Figure 3-28 demonstrate the trend in overall Scotland quota uptake against total quota at the end of year in tonnes. The end of year quota proportion allocated to Scotland against the UK has varied in the period 2013-16 from 60% to 72%.

Figure 3-27: North Sea end of year quota (tonnes) and the percentage of Scotland quota uptake, 2013-16

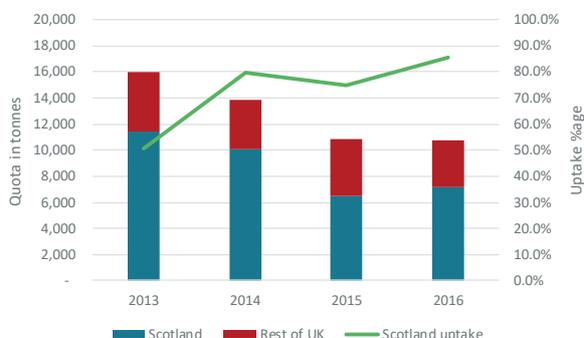


Figure 3-28: West of Scotland end of year quota (tonnes) and the percentage of Scotland quota uptake, 2013-16



Source: Marine Scotland uptake statistics (2017)

To understand the influence that quota swaps has on quota uptake, initial quota allocation is compared to end of year quota allocation in Figure 3-29 and Figure 3-30. The figures show that the UK has not required more quota than was initially allocated, i.e. end of year (EoY) quota does not exceed 100%, which equates to initial quota allocation (IQA). In 2016, Scotland end of year quota was 2% more than initial quota allocation.

For Scotland in 2015, the end of year North Sea nephrops quota was only 56% of the initial quota allocation, with the remainder used in swaps. Between 2013-16, the proportion of initial quota allocation retained in Scotland has varied with an average retention across the four years of 82%.

The picture on the West of Scotland is far more stable as end of year allocation tends to equal initial quota allocation. This demonstrates a minimal level of swaps.

Figure 3-29: North Sea end of year quota compared to initial quota allocation for Scotland and total UK (tonnes), 2013-16 (IQA=100%)

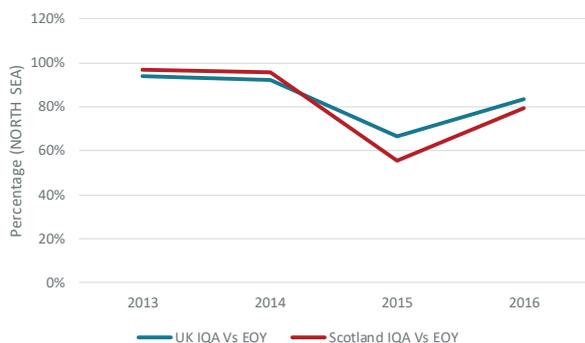


Figure 3-30: West of Scotland end of year quota compared to initial quota allocation for Scotland and total UK (tonnes), 2013-16 (IQA =100%)



Source: Marine Scotland uptake statistics (2017)

The findings on quota uptake and quota swaps combine to indicate:

- the North Sea trawl fleets currently receive sufficient quota to meet requirements and that Scotland is currently also benefiting by being able to swap unused quota;

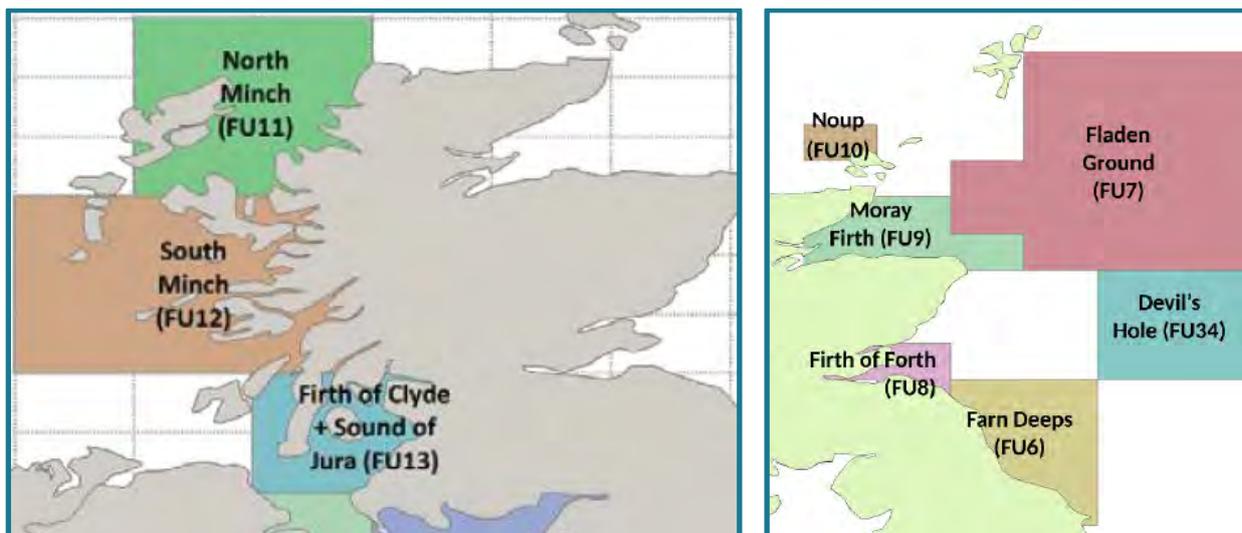
- the West of Scotland trawl fleets currently receive sufficient quota to meet requirements and unused quota and relatively little excess quota exists (88% of end of year quota was used in 2016, which was 90% of initial quota allocation);
- the West of Scotland under-10m nephrops creel fleet, assumed to be represented by non-sector under-10m nephrops quota, used 94% of its end of year quota in 2016, up from 88% in 2015; and
- the West of Scotland 10-15m nephrops creel fleet segment, assumed to be represented by the over-10m non-sector fleet, used 65% of its end of year quota in 2016, down from 75% in 2015.

3.9.2 Access to good fishing grounds

Section 2.3 highlighted how much of the global catch of nephrops is caught in Scotland. Clearly Scotland is fortunate to have good and accessible fishing grounds for nephrops and a biomass that supports relatively extensive fishing activity.

Nephrops stocks are assessed by functional unit (FU) which is typically a small geographic area. The FUs most relevant to Scottish nephrops vessels are shown in Figure 3-31. The remainder of the section provides a summary of the status of nephrops in each of these main functional units organised by West of Scotland and North Sea and as reported by ICES in 2017. The assessments are primarily undertaken by UK fisheries research agencies: Marine Scotland, CEFAS and NI. However, those FUs falling in Scottish inshore waters are undertaken by Marine Scotland. Under water tv (UWTV) surveys, observer on board trips, survey trips, market appraisals and use of logbook data are the primary methods of data collection for the assessments. These assessments then feed into the ICES assessment process that provides advice to the European Union on stock status and the setting of yearly TACs for nephrops. Note that TACs are provided at the area levels of North Sea (ICES Area IV) and West of Scotland (ICES Area VI) and quota is allocated and managed at that level, not by FU. See above for further information on allocations and uptake of nephrops quota in Scotland. ICES (2017) advise that “management should be implemented at the functional unit level”.

Figure 3-31. Main Scottish nephrops functional units on West of Scotland (left) and North Sea (right)



Source: ICES (2017)

A detailed overview of the types of substrates and fishing undertaken in each of the nephrops functional units is provided by Ungfors et al (2013).

A summary of the nephrops stock status by functional unit is presented in Table 3-4. In general, the West of Scotland FUs appear in a stronger state than the North Sea FUs. In the West of Scotland, the North Minch, South Minch and Firth of Clyde all show fishing pressure less than the MSY target and in each case stock size is close to the highest level seen. Current stock size is greater than 80% of the highest stock size in all three FUs. In the North Sea the status of the nephrops stocks appear less strong as the harvest rates in the Firth of Forth and Farn Deeps are above the MSY target and the stock size in the Farn Deeps is at the lowest level recorded and below the MSY target. In the Fladen Ground and Moray Firth, although within MSY targets for both fishing pressure and stock size, the stock size is considerably lower than the highest stock levels in each case. On average, the North Sea nephrops stock size by functional unit averages 47% of its highest level recorded, with only the Firth of Forth above 50% (at 75%). In the Fladen Ground, at least, this reduction in stock size may reflect the aftermath of the peak in North Sea landings evident at both a Scottish and global level between 2006 and 2010.

Table 3-4: Summary of nephrops stock status by functional unit (Source: ICES, 2017)

Functional Unit	Fishing pressure 2015	MSY fishing pressure	Stock size 2016	MSY stock size (Btrigger)	Highest stock size (in year)
North Minch	7.6% ✓	10.8%	1,422 ✓	540 (1996)	1,762 (2006)
South Minch	6.4% ✓	11.7%	2,118 ✓	1,020 (2012)	2,558 (2004)
Firth of Clyde	12.4% ✓	15.1%	1,946 ✓	580 (1995)	2,165 (2011)
Fladen Ground	3.5% ✓	7.5%	2,990 ✓	2,767 (2012)	7,360 (2008)
Moray Firth	9.1% ✓	11.8%	347 ✓	262 (1997)	869 (2005)
Firth of Forth	16.8% ✗	16.3%	664 ✓	292 (1998)	881 (2008)
Farn Deeps	13.0% ✗	8.1%	568 ✗	858 (2015)	1,657 (2005)
Devil's Hole	9.1% ✓	11.8%	347 ✓	262 (n.a.)	n.a.
Noup	?	Not defined	Landings = 15 tonnes ?	Min Landings = 13 tonnes (2012)	Max Landings = 494 tonnes (1994)

Notes: stock sizes in millions of individuals, except for Noup where no abundance assessment is undertaken. MSY fishing pressure is measured as harvest rate.

Note that Devil's Hole is not assessed as widely as the other functional units and therefore data is not as readily available, however the stock appears at acceptable levels. Noup also has very limited data, but considering the very low levels of nephrops landings compared to historic levels (15 tonnes in 2016 compared to 494 tonnes in 1994), the stock appears at a low level.

Overall, the West of Scotland fleet segments, both trawl and creel, appear to have greater advantages due to the health of the stock, compared to the North Sea fleet segments.

3.9.3 Access to the right gear to catch target species

As discussed previously, the nephrops fleet in Scotland uses two primary methods to catch nephrops, static gear i.e. creel, and mobile gear, i.e. trawl. Our consultations suggest that both methods of fishing have options for gear.

For creel fishing in more tidal waters, a heavier creel will be used, in more sheltered waters a lighter, and less expensive creel may be deployed. There can also be differences within the creel design, such as the inclusion of parlours that can reduce fighting and damage to the catch, and a business owner will often test which design of creel is most productive in the fishing grounds that they target.

There are also several options available to nephrops trawl vessels, although choice of gear is more heavily influenced by regulation in the trawl fleet. Single-rig trawl is understood to be more commonly

used by smaller trawl vessels, whereas larger vessels are more likely to use twin-rig trawl, which was developed in the 1980s to target bottom-living species. However, in each type of trawl there are various modifications that can be made and the choice will be influenced by the conditions under which each business operates. A business wishing to catch a more diverse catch composition such as those in the larger North Sea trawl fleet segment will rig its trawl to have a larger opening in the mouth of the net so that it captures more whitefish and flatfish, a trawl business wishing to avoid such catch will operate a long low net.

Although nephrops live in a muddy sediment, nephrops trawling can also occur on 'hard-ground'. However, hard-ground means a rocky seabed with large areas of mud where nephrops can be caught. In these locations, a nephrops trawler will operate a rock-hopper trawl to avoid damaging its gear on the rocks.

Further modifications to trawl gear include a coverless trawl which allows a large proportion of fish to escape or large size square mesh panel in the top of the net to allow smaller fish to escape. It is understood that once in the net, whitefish are inclined to swim upwards, whereas nephrops stay low. There is increasing awareness that fewer fish in the net improves the quality of the nephrops and retains more nephrops, thereby supporting better returns from each haul. The use of lighter gear is also becoming more common, after years of increasing the weight and durability of the gear, knowledge about the species and market requirements, and access to new stronger materials, is encouraging change. The switch to lighter weight gear by some vessels is also designed to improve the quality, and ultimately the value, of the catch.

Another interesting development in the trawl sector is trials designed to test a net that will help avoid unwanted bycatch in the more mixed North Sea nephrops trawl fleet, once the landing obligation is fully implemented. A trawl with two cod-ends, the lower one with smaller mesh for nephrops and the upper cod-end with larger mesh to allow smaller whitefish to escape, has been trialled and shown to have an impressive range of benefits. Of interest to this study was the positive effect of the gear upon the quality, and subsequent value, of the nephrops catch. However, this gear can only currently be used under a derogation, as current regulations do not allow this gear design. The Gear Innovation & Technology Advisory Group (GITAG) in Scotland is the mechanism through which industry can trial different methods of decreasing discards, of which this example is one.

Recent gear developments by the trawl sector include short-hauls by smaller vessels in certain areas around Scotland. These very short hauls followed by a short-time between catch and landing are allowing trawlers to tube live nephrops, the product until recently solely provided by the creel sector. Consultees believe this opportunity will only ever be limited to specific areas and a certain type of vessel but those who have developed these facilities onboard to handle live catch are reporting positive returns from such activity in the latter part of the year. Furthermore, more trawl vessels are expected to deliver tubed nephrops to market in the latter part of 2017, than did so in 2016.

Overall, our consultations suggest that the developments in trawl gear indicate that there are opportunities to improve the quality and value of trawl caught nephrops than there are to improve the quality and value of creel caught nephrops. Furthermore, under the landing obligation, it will be essential that trawl businesses that previously caught unwanted fish find a way to avoid them. However, regardless of current and potential developments, it remains likely that a well-handled nephrops landed by a trawl will always be worth less than a well-handled creel caught nephrops in the market-place. Despite this, developments in trawl gear may continue to reduce the extent of the difference in price between creel and trawl caught nephrops over time. Detailed analysis of the price paid for nephrops product by gear type is presented in Chapter 4.

3.10 Access to good sales routes

Fish auctions and markets are not used for nephrops. Instead the vessel businesses sell direct to buyers, the majority of which have a base in Scotland. Our consultations suggest that vessel businesses tend to be loyal to a buyer. Equally the buyers tend to take the catch provided by the vessels with which they have a relationship. Although not integrated businesses in the formal sense, our consultations and experience of the industry suggests there is a high degree of loyalty and cooperation between the buyers and vessels, however ongoing cooperation and loyalty is dependent on both parties meeting the requirements of the other.

Information from consultations suggest that the first sale of creel caught nephrops is usually to an agent or processor. The vessel will have packed the nephrops into tubes (square mesh grids in boxes) and kept a constant supply of seawater washing over the catch until it is landed. In most circumstances the buyer will wash, grade, repack and potentially chill the creel caught nephrops before they are shipped by air, or road and sea, most commonly to the European continent.

In 2015 there were 110 buyers of Scottish landed nephrops, the majority of which were based in Scotland:

- 109 of the buyers bought whole nephrops and 54 bought tails;
- 46 buyers bought less than one tonne of nephrops; and
- nine buyers bought 68% of all landings (10,208t liveweight) which represented 58% of whole nephrops and 80% of tails.

For trawl caught nephrops, much greater weights are involved and therefore the processors tend to have larger more extensive facilities. For the small number of trawlers handling tubed nephrops onboard the process is the same as for creel vessels. For trawl vessels landing chilled nephrops, the product is graded, packed and chilled with ice onboard. Some vessels are now equipped with their own ice making facilities create more room onboard by avoiding the storage of ice. Consultees also stated that a small number of vessels have their own freezing facilities onboard to improve the quality of catch landed. Once the trawl fleet has landed its whole or tailed product, processors will wash, grade, pack and if appropriate freeze the nephrops before they are shipped by road to their European or UK destination. The primary processor of trawl caught whole nephrops can offer a wide variety of pack sizes, from anything from a six-animal retail pack to a larger several kg catering pack. Consultees also stated that investment in nitrogen freezing facilities better retains quality and supports the processor to obtain higher prices.

From the consultees for this study, the sales routes for creel and trawl caught products are well-established and effective. No one fleet segment appears to be particularly disadvantaged, although there are questions over why a higher proportion of West of Scotland trawled nephrops are tailed, rather than landed whole. For example, is this influenced by the value of the sales routes available to these fleets or whether the pattern of whole and tailed landings is influenced by the seasonality of the fleet's landings (see Chapter 2 for findings on tail and whole landings). Further investigation is required to understand whether the sales routes available to the West of Scotland trawl fleets are a factor or not.

4 Nephrops price and value chain

Chapter 4 provides a detailed analysis of the price paid for nephrops products landed into Scotland and an overview of the price and total value of these products as they move through the value chain. To achieve this, the following findings are presented:

- the different nephrops supplied by the fleet in Scotland;
- the price paid for the different nephrops products (whole and tailed) landed by the fleet, including the price effect of different size grades;
- the value chain for landed and processed products; and
- an overview of the markets for the end products.

4.1 Nephrops products

Four different nephrops products are landed into Scotland:

- Live whole nephrops (in tubes) – largely landed by the creel fleet but some trawlers in certain circumstances land live whole nephrops in the latter part of the year;
- Chilled whole nephrops (on ice) – referred to as live product by processors, this product is only landed by the trawl fleet;
- Frozen whole nephrops – a small number of larger trawl vessels have freezing facilities onboard, however frozen whole nephrops for market are predominantly frozen onshore by processors from the supply of chilled whole nephrops. This product is supplied by the trawl fleet;
- Tailed nephrops – the whole nephrops is processed at sea and the head is removed to leave only the body or ‘tail’ of the nephrops. This product is largely supplied by the trawl sector but there is a small weight of tails provided by the creel sector (22t in 2015).

The scale of difference in landings between creel and trawl vessels is significant. The landings of creel caught nephrops in to Scotland in 2015 was approximately 1,400 tonnes and the landings of trawl caught nephrops in to Scotland was approximately 13,800 tonnes (Note: not all landings by Scottish vessels are made into Scotland).

4.2 Price

The average price analysis in Chapter 3 looked at the average price paid to the eight Scottish nephrops fleet segments for all landings, i.e. nephrops plus other species. In Chapter 4, the price analysis is focused upon nephrops only and presents findings at the different levels:

- liveweight price for landed nephrops achieved by the eight Scottish nephrops fleet segments;
- liveweight price for nephrops landed into Scotland (Scottish and non-Scottish vessel landings) by size grade and type of product, by gear type; and
- the price of UK processed nephrops in the UK and export market.

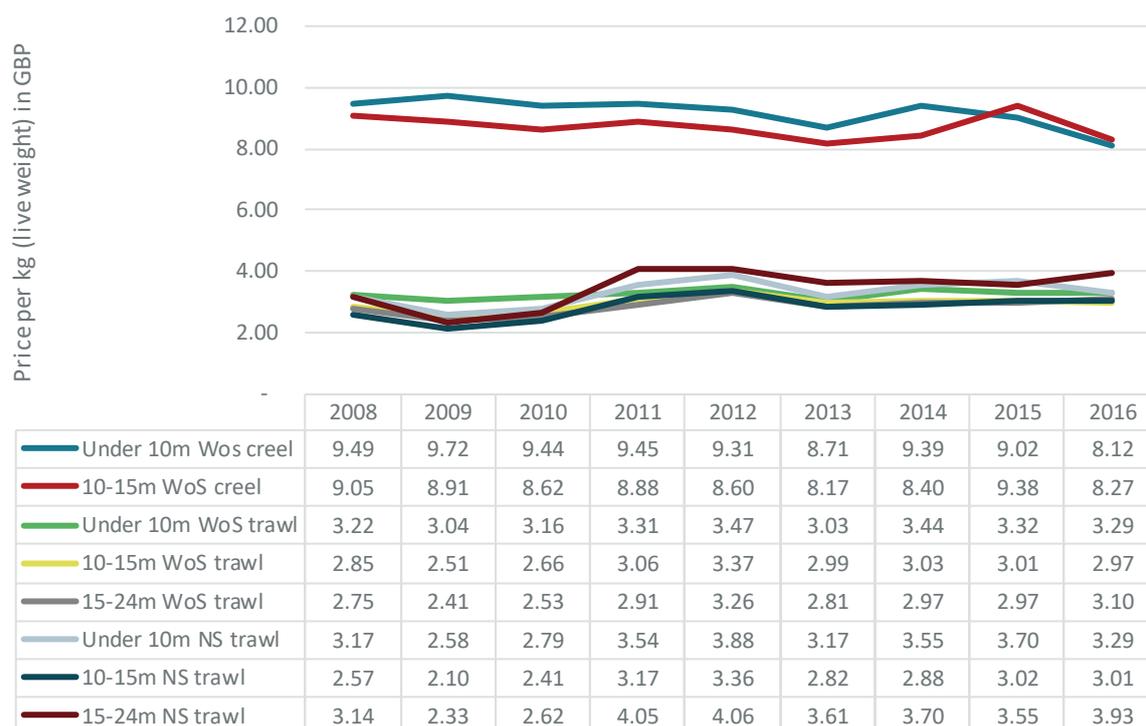
4.2.1 Price achieved by eight Scottish nephrops fleet segments for nephrops

As shown in the competitiveness analysis in Chapter 3, the price obtained by the creel sector supports the competitiveness of the creel fleets, whereas the competitiveness of the trawl fleet is more dependent on the efficiency it can achieve. The following price analysis shows the extent to which price differs between different fleet segments. All values are shown for the liveweight of the product.

A summary of the liveweight landings value by fleet segment is presented in Figure 4-1. In 2016, the average liveweight landed price per kg was £8.20 for the creel fleet segments. The price per kg of creeled nephrops varied between £8.12 and £9.72 in the nine-year period to 2016. In contrast, in 2016, the average liveweight price per kg was £3.27 for the trawl fleet segments. The price of trawled nephrops in the latter half of the period (i.e. 2011-16) was between £3 and £4 per kg of liveweight landings. The price for trawled nephrops from the North Sea is shown to have a higher price on average than trawled nephrops from the West of Scotland, £3.41 versus £3.12 respectively in 2016. The reason for this is the difference between the proportion of whole and tailed nephrops that are landed by the two fleets.

In addition to the clear difference between the price paid to the creel fleet and the price paid to the trawl fleet, one further observation from the price analysis is that the average price for creeled nephrops in 2016 is at its lowest for the period and down 11% from the price obtained in 2015. In contrast, the average price for trawled nephrops has remained stable or increased. For example, the average price paid to 15-24m North Sea trawlers increased to £3.93 in 2016, an increase of 11% from 2015. The increase in the price paid to trawlers can perhaps be explained by the more positive exchange rate available to exporters in 2016, or other improvements achieved by the fleet or processing sector. However, the reduction in the price paid to creel fleet segments in 2016 is more difficult to understand, for some reason the exchange rate has not benefited the creel fleet segments. The observed decline in price paid to creel vessels in 2016 may be indicative of a reduction in price for live 'langoustines' in key export markets. If prices in 2017 do not recover, this would be a concern, particularly for the under-10m creel fleet segment which has already experienced a reduction in its economy in recent years (see Chapter 3). Another observation is that in 2015, for the first time, the 10-15m creel fleet achieved a higher average price for its landings of nephrops than the under-10m creel fleet segment (Figure 4-1).

Figure 4-1: Price per kg for landed liveweight nephrops by Scottish vessels (2008-16)



Source: Seafish fleet economic performance dataset

4.2.2 Price and type of product landed

As discussed in Chapter 2, trawl caught nephrops from the North Sea are much more likely to be landed as whole nephrops whereas trawl caught nephrops from the West of Scotland are much more likely to be landed as tails. This section looks at the price paid for different types of product and different size grade of products. The analysis is based on Marine Scotland data for all landings made in to Scotland.

Landings and price of nephrops by type of product are presented in Figure 4-2 and Figure 4-3 for West of Scotland and North Sea respectively.

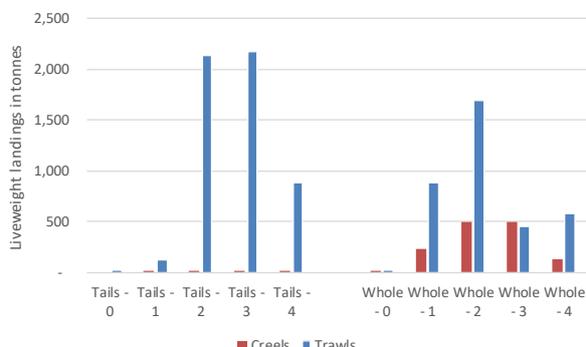
Figure 4-2 shows the distribution of landings of West of Scotland nephrops by type of product (tailed or whole nephrops), by size grade of product (0-4, with 0 being the largest size), and by type of gear (creel or trawl) in 2015. The figure confirms that it is trawl vessels that are landing nephrops tails, although there are very small amounts of tails landed by creel vessels. Further observations are:

- A significant majority of size zero and size one West of Scotland nephrops were landed as whole nephrops;
- a similar weight of size two nephrops was landed as tails as was landed whole;
- the smaller size three nephrops were more likely to be landed as tails by the trawl fleet; and
- a relatively high proportion of the small size four West of Scotland nephrops were landed as whole nephrops by the trawl fleet. This appears to go against the trend evident in the other three size groups which suggested that as nephrops get smaller, the percentage that is landed as tails goes up.

In Figure 4-3, the left-hand section shows that the creel and trawl fleets achieve a similar price for the different sizes of tailed nephrops, approximately £2 per kg (liveweight) across all size grades for West of Scotland nephrops. However, the right-hand section of Figure 4-3 shows the difference in the price paid

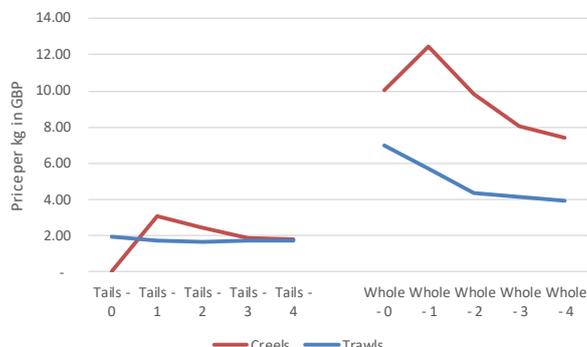
to the creel and trawl sector by size-grade, for grade one nephrops the difference between the price is approximately £6, for grade three nephrops the price difference is approximately £4.

Figure 4-2: West of Scotland nephrops landings in to Scotland by product type and size grade, and by type of gear, in 2015 (liveweight tonnes)



Source: Marine Scotland data, 2015

Figure 4-3: Price achieved for West of Scotland nephrops landings in to Scotland by product type and size grade, and by type of gear, in 2015 (£)

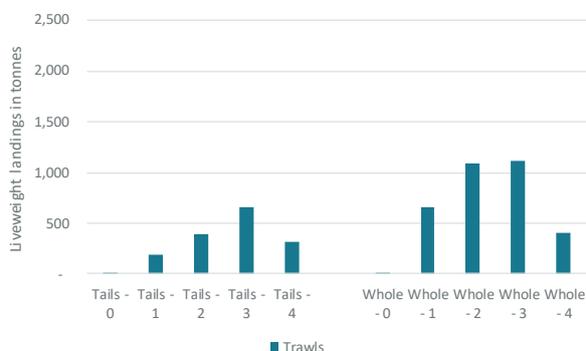


For North Sea nephrops there was only trawl landings in 2015. The difference in the proportion of tails and whole nephrops landed by the North Sea and West of Scotland trawl fleets, as discussed in Chapter 2, is again evident when comparing Figure 4-2 and Figure 4-4. The preference to land North Sea nephrops as whole product rather than tails is shown in Figure 4-4, further observations are:

- few size zero or size one nephrops are tailed at sea;
- size two nephrops are mostly landed whole;
- size three nephrops are most likely to be landed as tails; and
- a relatively equal number of size four nephrops are tailed at sea as are landed whole. As shown in the West of Scotland, there is clearly very little market for tailed size four nephrops or there is more of market for whole size four nephrops than there is for whole size three nephrops.

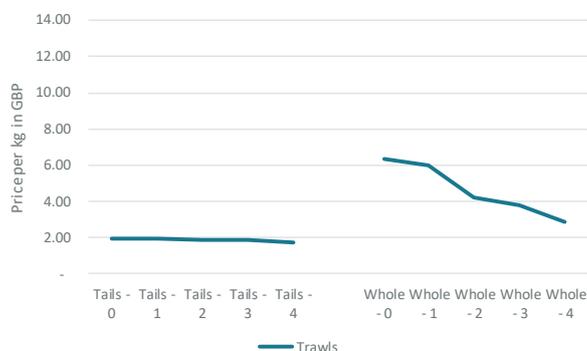
As seen in West of Scotland nephrops, North Sea whole nephrops of size grades zero and one command a significantly higher price. The price of tailed nephrops, regardless of size, is relatively static

Figure 4-4: North Sea nephrops landings in to Scotland by product type and size grade, and by type of gear, in 2015 (liveweight tonnes)



Source: Marine Scotland data, 2015

Figure 4-5: Price achieved for North Sea nephrops landings in to Scotland by product type and size grade, and by type of gear, in 2015 (£)



It is often suggested that the relatively high selectivity of nephrops creel vessels enables targeting of larger size nephrops for specific markets. However, the findings presented in Figure 4-6 show that as a proportion of total landings both the trawl and creel fleets land a very similar proportion of landings

across the different size grades. Perhaps surprisingly, the trawl fleet landed a higher proportion of grade two nephrops and the creel fleet landed a higher proportion of the smaller grade three nephrops.

Figure 4-6: Percentage of total West of Scotland nephrops landings in to Scotland by size grade and type of gear, in 2015 (liveweight tonnes)

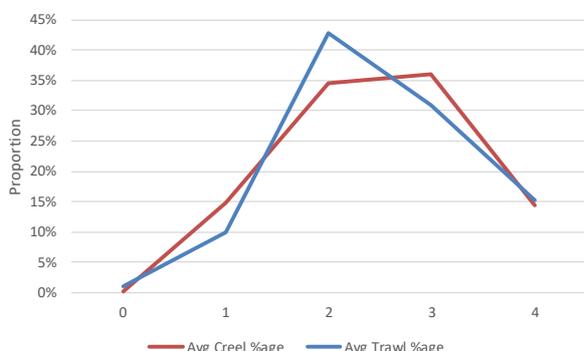
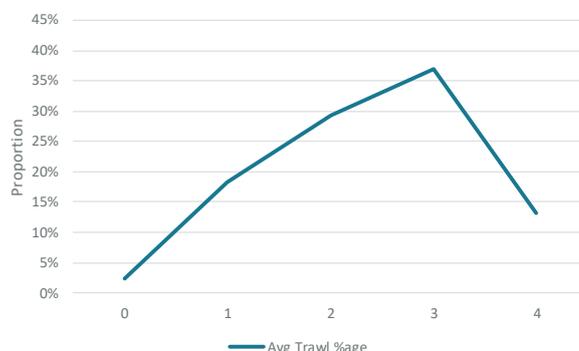


Figure 4-7: Percentage of total North Sea nephrops landings in to Scotland by size grade, in 2015 (liveweight tonnes)



Source: Marine Scotland data, 2015

4.2.3 The export market and its impact on price

Exports of fresh and frozen nephrops are presented in Figure 4-8 and Figure 4-9. The main codes in the HMRC Tradeinfo database for nephrops are:

- Frozen Norway lobsters "*Nephrops norvegicus*" (03061590), and
- Norway lobsters "*Nephrops norvegicus*" (03062590), live, fresh, chilled, dried, salted or in brine

UK exports of fresh (whole) nephrops are estimated to be 4,810 tonnes in 2016 with an average price of £8.94 per kg. Given that the landings of Scottish creeled nephrops are only 1,500 tonnes approximately 69% of the exports of fresh nephrops are from the Scottish trawl fleet.

UK exports of frozen (whole and tailed) nephrops are estimated to be 8,300 tonnes with an average price of £6.94 per kg. It is not published how much is whole versus tailed however consultation with industry indicates that it is mostly whole (note also that EUMOFA in their trade database indicate that it is mostly whole). Given that most creeled nephrops are sold fresh and whole it is assumed that all frozen nephrops originate from trawled landings. The price per kg obtained for exports of frozen nephrops is still significantly higher than that obtained by Scottish nephrops trawlers.

Figure 4-8: Exports of fresh nephrops by weight and price per kg, 2012-2016

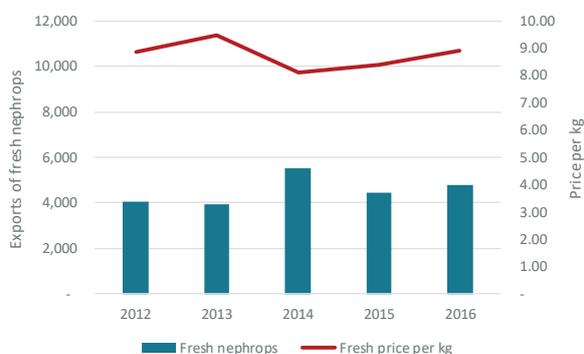
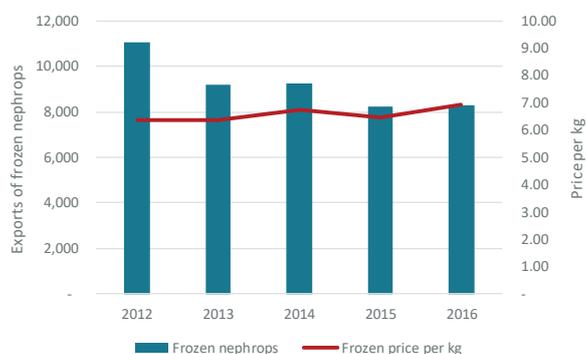


Figure 4-9: Exports of frozen nephrops by weight and price per kg, 2012-2016



Source: HMRC Tradeinfo Statistics (2017)

4.3 Product and price in the value chain

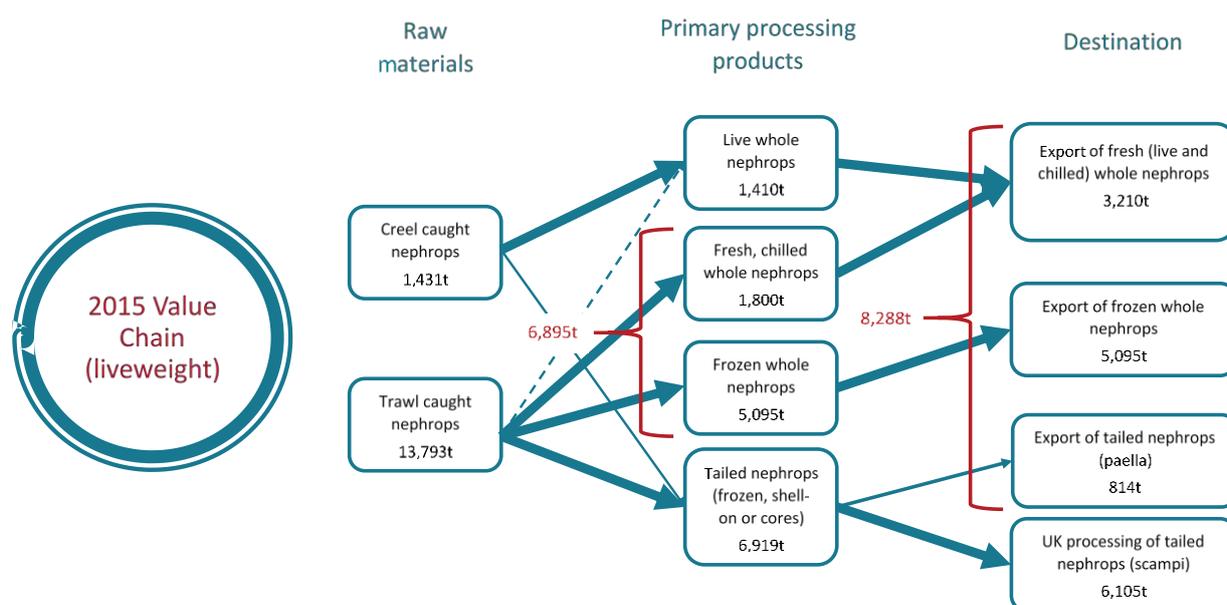
This section builds on the price and export analysis undertaken in the previous sections and develops a view of the value chain for nephrops in Scotland.

The value chain for Scottish nephrops in 2015 is presented in Figure 4-10 and Figure 4-11, liveweight landings and value respectively. Several assumptions were required to develop the analysis. For the estimates included in the liveweight value chain, the following assumptions were applied:

- HMRC trade data is available for fresh and frozen nephrops for the UK. It is assumed that Scotland and the rest of the UK export similar proportions of landings, hence a proportion of Scottish landings against the UK landings is used to estimate Scottish exports of fresh and frozen nephrops(*);
- All creel caught whole nephrops go to the live whole nephrops export market;
- The difference between fresh nephrops exports (using *) and creel caught whole is used to estimate the weight of trawl caught whole nephrops destined for the export market;
- The difference between total whole nephrops landed by trawl and fresh nephrops exports (above) is used to estimate the weight of frozen nephrops destined for the export market;
- The majority of trawl caught nephrops tails go to the UK market, however it is known that some are exported – the difference between frozen exports (using *) and estimated frozen whole (from landings data assumption) is the weight of exported frozen tails;
- An allowance for waste in the process stage is included as follows: 10% for whole nephrops and 0% for tails; and
- Nephrops landings from gear other than creels and nephrops trawl is not included.

Using the assumptions noted above, it is estimated that of the 8,305t of whole nephrops landed in Scotland (6,895t of trawl caught and 1,410t of creel caught) that 8,288t was exported (99.8%). Of the 6,919 liveweight tonnes of tails landed in Scotland (6,897t of trawl caught and 22t of creel caught), it is estimated that 6,106t (88%) remains in the UK market for further processing (Figure 4-10).

Figure 4-10. Value chain of nephrops landed in Scotland, 2015 (liveweight tonnes)



Nephrops is the second highest value species in Scotland by landings value and there is significant primary processing activity in Scotland. The value of nephrops at each stage of chain is presented in Figure 4-11.

Assumptions used to estimate “average” prices in the value view of the Scottish nephrops value chain are:

- “Price IN” to processing are assumed to be equal to those obtained on average by nephrops fleet segments;
- “Price OUT” builds on the above assumptions used in the landings weight value chain:
 - Price of live whole and fresh chilled whole nephrops is calibrated using the volumes indicated against the value of fresh exports indicated in the HMRC trade info;
 - The frozen whole nephrops price is equivalent to the HMRC average price of frozen exports of nephrops; and
 - The price of processed tails is calibrated to a similar price to exported frozen nephrops with rounding error accounting for differences to ensure total collate correctly.

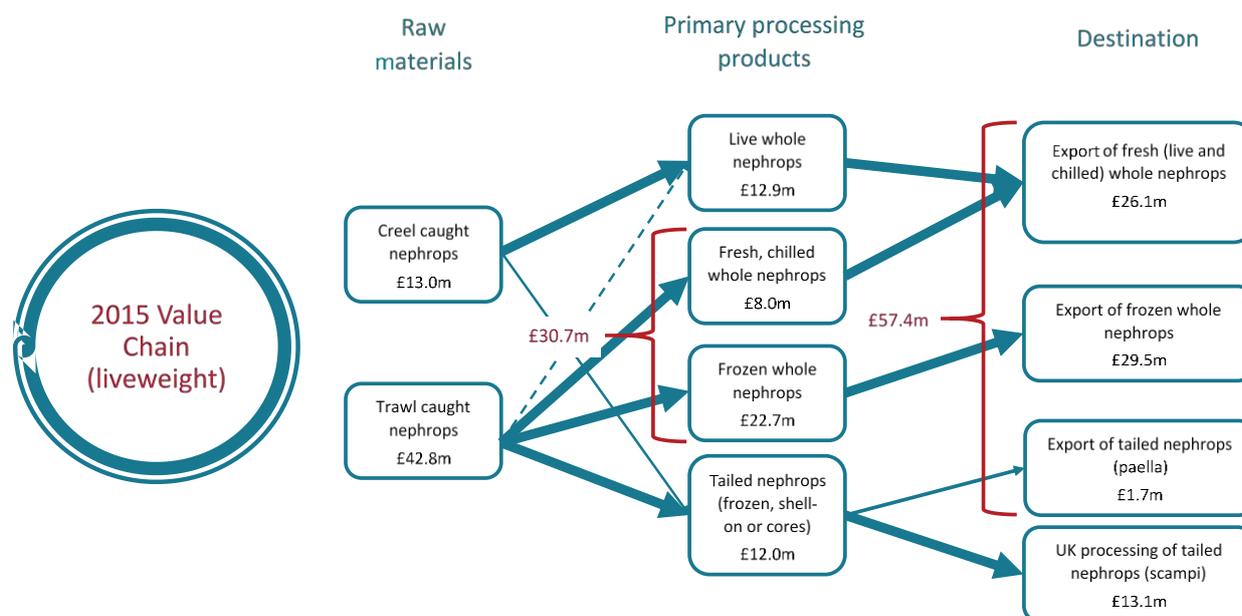
Without detailed data series, the calculated prices are thought to be representative of prices obtained on average. Differences will undoubtedly exist across processors specifically when dealing with nephrops of certain size grades. These prices are therefore assumed to provide a lower bound on the value of nephrops products in the value chain.

The application of the above assumptions, estimates that £14.7 million is added to the value of Scottish nephrops production by primary processors. Of this it is estimated that trawled nephrops makes up approximately £13.7 million and creeled nephrops £1.0 million. It is estimated that the majority of exported nephrops leaves from Scotland, however many of the tails destined for the UK market are shipped to processors in England and Northern Ireland for processing.

The export market alone is estimated to result in a value of £57.4m to Scotland, which adds value of £12.3m to the value of the catch. The UK market is estimated to result in a value of £13.1m to Scotland, which adds value of £2.4m to the value of the catch.

Therefore, the total added value by primary processing to Scottish landings of nephrops is estimated to be £14.7m, an increase of 26.4% over the raw material cost (Figure 4-11).

Figure 4-11: Value chain of nephrops landed in Scotland by value in GBP, 2015 (£)



4.4 Market

The market for nephrops has developed such that production of nephrops by Scotland, the rest of the UK and indeed Europe has grown since its beginning (see Chapter 2, FAO chart, Figure 2-5). This implies a well-established demand for the product. As described above, there are four main nephrops commodities: live whole, fresh whole, frozen whole and frozen tails. The European market mostly demands whole nephrops (estimated 60% of Scottish production) but the UK mostly demands tails or scampi (estimated 40% of Scottish production).

Scampi consumption in the UK retail sector amounted to approximately 4,185 tonnes in 2015 with a value of £44 million indicating a price per kg at retail of £10.53 per kg (Seafish Seafood Industry Factsheet, 2017). Scampi consumption in the foodservice sector (e.g. pubs and restaurants) amounted to approximately 5,997 tonnes from (52 weeks to June 2016, Seafish Seafood Consumption, 2016 update). This equates to a UK demand for scampi of approximately 10,000 tonnes compared to total UK liveweight landings of nephrops of 25,863 tonnes and total landed weight of 16,320 tonnes (MMO, 2017).

In 2016, the destination of exports of fresh nephrops is reported (by HMRC Tradeinfo, 2017) to be France (66%), Spain (20%), Italy (7%) and Ireland (5%). For frozen nephrops, export destinations in 2016 were Italy (36%), Spain (35%), France (7%), India (7%) and China (6%).

Monthly average prices obtained for whole nephrops and tails are shown in Figure 4-12 and Figure 4-13. In these charts, both the weight of landings and the price of landings are provided by month for Scottish nephrops in the West of Scotland and North Sea. The price of tails is relatively constant throughout the year, however for whole nephrops the average price per kg is at its highest around Christmas (i.e. December and January) with lowest prices obtained in the summer (i.e. June and July). For the West of Scotland, the decline in price coincides with a peak in landings.

The consistent price of nephrops is largely a result of the product being frozen and the more variable price of whole largely a result of demand for fresh chilled and live nephrops. The mix of fresh and frozen nephrops is one that reduces risk for processors and fishermen alike in particular in getting the product from vessel to consumer across the year.

Figure 4-12: Landings of West of Scotland nephrops in 2016 to Scotland by month (liveweight tonnes and landed prices)



Figure 4-13: Landings of North Sea nephrops in 2016 to Scotland by month (liveweight tonnes and landed prices)



Source: *Seafish Summary of Scottish Nephrops Landings 2016*

The prices of nephrops products are specific to the markets that they are sold in. For example, live nephrops gain a higher price than frozen nephrops which gain a higher price than tails. Some of this may be attributed to size grade (e.g. tails) however, as shown in the landings by size grade (Figure 4-2), this is likely correlated to product type and market. The economics of demand and supply in established markets suggest that as supply increases prices decrease. For growth markets it may be different. Nephrops is relatively well-established but the quality of the Scottish products is high. Therefore, the potential to increase prices for each product is unclear. However, for example, the UK scampi market appears to have relatively stable prices (indicated by prices of tails above) and a considerable market in weight supplied – 2013-15 average price of £1.88 per kg from the North Sea, and £1.70 per kg from the West of Scotland.

5 Economic value of the nephrops industry in Scotland

From a Scottish perspective, it is not only the performance of the nephrops fleet and the value of its products that is of interest but also the additional value that the activity of the nephrops fleet, and its constituent fleet segments, provide to Scotland.

The fleet provides employment, creates economic activity in peripheral communities, buys in goods and services from local suppliers and provides raw materials to Scottish-based processors. This chapter provides estimates for the economic value of the nephrops industry in Scotland. The chapter begins with an overview of the financial performance of the fleet and the processing sector and then presents the findings from the economic value analysis as follows:

- the economic value of the fleet:
 - GVA (direct); and
 - Employment (direct, indirect and induced).
- the economic value of primary processing:
 - GVA (direct); and
 - Employment (direct, indirect and induced – excluding the effect of raw materials).

In the economic value analyses, the GVA (gross value added) figures provided are the GVA generated directly by the fleet and processors. However, the employment figures include the employment in the fleet and processors (direct), the employment generated in suppliers to the fleet and processors (indirect effect) and a calculation of how the increased employment will result in increased spend on final goods and services, through increased household income which in-turn supports further employment (induced effect). The total direct, indirect and induced employment is estimated using a Type II economic multiplier which is applied to the direct employment figure. In the analysis presented, upstream effects are focused upon. The employment multipliers for fishing and fish processing are taken from Scottish Government Multipliers published in 2017 for 2014.

(<http://www.gov.scot/Topics/Statistics/Browse/Economy/Input-Output/Multipliers>)

NOTE: the findings presented in Chapter 5 are for 2015, which was, as established in earlier analyses, a particularly poor year for total nephrops landings by Scottish vessels. This undoubtedly affects the measure of economic value of the nephrops industry in 2015. In more successful years for the fleet, it could be reasonably assumed the economic value of the nephrops industry would be higher.

5.1 Economic performance

Prior to calculating direct GVA and direct, indirect and induced employment it is first necessary to estimate the overall financial performance of the sectors. Table 5-1 presents the turnover of the fleet and processing sector, split by creel and trawl.

The turnover generated by the fleet is the turnover generated from all species landed. It is assumed that the vessels only generate non-nephrops landings because of their nephrops activity. This assumption is supported by the dominance of nephrops in the value of the catch in each fleet segment.

In contrast, the values associated with the processing sector do not represent business units, the processing values have been estimated from only the weight and value of nephrops that are landed into Scotland, i.e. it is assumed that nephrops processing does not directly increase the processing of other species – this may be a conservative assumption given the dominance of nephrops in Scotland. The total estimated turnover for these segments is £133 million, and of this (as presented in chapter 4):

- the fleet generates total sales of £62.9m, of which nephrops was £55.8m; and
- the processing of nephrops generates total sales of £70.5m.

Table 5-1 also provides information on the cost of sales and the operating profit. The total operating profit of the eight fleet segments £10.2m, of which:

- £3.0m was generated by the creel fleet; and
- £7.3m was generated by the trawl fleet.

The costs relating to the fleet sector are provided from the bespoke data for Scottish nephrops fleets provided by Seafish from their economic performance dataset. Each of the cost categories for the processing sector are calculated using the average cost per FTE reported in the Seafish 2016 Seafood processing industry report. The number of FTEs in the processing sector related to nephrops is estimated from the average turnover per FTE (£233,283) as similarly reported in the Seafish 2016 Seafood processing industry report.

The total operating profit, calculated from turnover minus costs, generated from the processing of nephrops is estimated to be £4.5m, of which:

- £0.9m was generated by the creel fleet; and
- £3.5m was generated by the trawl fleet.

Table 5-1: Summary of economic performance of nephrops Fleet segments and Processors of nephrops in Scotland in 2015 (values in £ million)

Variable	Fleet sector		Processing sector	
	Creel (£m)	Trawl (£m)	Creel landings (£m)	Trawl landings (£m)
Turnover (sales)	£13.382	£49.530	£13.968	£56.507
Raw material costs	-	-	£11.051	£44.706
Labour costs	£3.972	£12.788	£1.050	£4.248
Energy costs	£1.744	£8.308	£0.104	£0.420
Other operating costs	£4.684	£21.170	£0.874	£3.535
Operating profit	£2.982	£7.263	£0.890	£3.599

Source: Seafish fishing fleets economic performance data and own calculations using Seafish processing sector data

The financial performance is one measure of the success of the nephrops sector, however, it is insufficient to understand the wider economic value of the nephrops industry. The full economic value of the nephrops industry is better indicated by GVA and employment. The remainder of this chapter uses information from financial performance to calculate GVA and employment in the fleet and through the processing of nephrops.

5.2 Economic value of the fleet

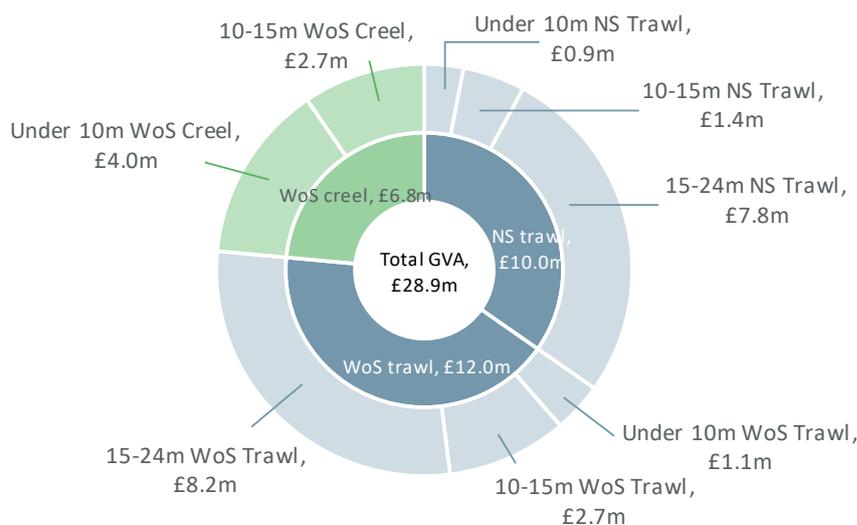
5.2.1 GVA by the fleet

GVA is one way to measure the direct contribution to society of an industry or business. In the fishing industry, a vessel business hunts for its raw material and in the process of doing so, buys in goods and services. The business owner does this to generate financial return, via the sale of catch, which is then distributed in the form of wages (crewshare) and profit. It is the combination of crewshare and operating profit that constitutes GVA, the direct added-value of the business in financial terms.

The eight nephrops fleet segments directly generated on average £28.9m of GVA per annum in the three years 2013 to 2015 (Figure 5-1):

- The North Sea trawl fleet segments contributed £10.1m of GVA, of which £7.8m was generated by the 15-24m fleet segment;
- The West of Scotland trawl fleet segments contributed £12.0m of GVA, of which £8.2 was generated by the 15-24m fleet segment; and
- The West of Scotland creel fleet segments contributed £6.7m of GVA, of which £4.0m was generated by the under-10m fleet segment.

Figure 5-1: GVA generated annually by nephrops fleet segments, using a 3-year average, 2013-2015



Source: Seafish fleet economic performance dataset

The larger businesses in each of the three main fleet segments, North Sea trawl, West of Scotland trawl and West of Scotland creel, land more catch and create more profit and employment at an individual business level. Figure 5-2 shows the increase in GVA per business by size of business. The highest average GVA per vessel was generated by the 15-24m North Sea trawl fleet segment, with an average annual GVA of £147.2k per vessel. The lowest average GVA per vessel of £22.4k was from the under 10m West of Scotland creel fleet. However, this analysis is heavily influenced by the size of the vessel. An alternative analysis, which removes the influence of the size of vessel is to consider how much GVA is generated by each FTE post.

A more balanced basis for comparison is the GVA generated by each FTE post in each fleet segment (Figure 5-3). Once the value generated by FTE post is considered, the findings presented in Figure 5-3 show greater parity between the GVA contribution of the fleet segments. The average GVA

contribution by FTE across the eight fleet segments is £23k. The lowest GVA per FTE is found in the 10-15m West of Scotland trawl fleet and the under 10m North Sea trawl fleet and the strongest GVA per FTE is found in the 10-15m West of Scotland creel fleet and the 15-24m North Sea trawl fleet. Overall in this analysis, the creel segments do not stand out as particularly different from the trawl segments in the generation of GVA per FTE post.

Figure 5-2: GVA per vessel business, using a 3-year average, 2013-2015



Figure 5-3: GVA per FTE post, using a 3-year average, 2013-2015



Source: *Seafish fleet economic performance dataset*

5.2.2 Employment in the fleet and its supply chain

The Scottish nephrops fleet supported 1,266 direct FTE posts onboard vessels in 2015. The process of catching nephrops by creel is more labour intensive than catching the same quantity by trawl. However, as discussed in the analysis of competitiveness, this does not necessarily disadvantage the business if it can obtain a premium price for the creel caught product.

In 2015, of the 1,267 FTE posts in the nephrops fleet (further detail on employment by fleet segment is provided in the individual fleet segment analyses in Appendix C):

- 308 were employed in the creel fleet;
- 637 were employed in the West of Scotland trawl fleet; and
- 321 were employed in the North Sea trawl fleet.

Applying the type II employment multiplier for fisheries (1.35) to calculate total direct, indirect and induced employment in the fleet and its supply chain indicates that the fleet and its supply chain supports a total of 1,744 FTE posts, of which:

- 417 were employed in and in support of the creel fleet or its supply chain; and
- 1,297 were employed in and in support of the trawl fleet or its supply chain.

5.3 Economic value of the nephrops primary processing sector

Given that nephrops is the second highest value species in Scotland and the UK, it is not surprising that there is a considerable amount of onshore activity that surrounds landings. The findings presented below estimate the GVA and employment associated with the primary processing of nephrops once they have been landed.

5.3.1 GVA generated by the primary processing of nephrops

In the same way as GVA is generated by the fleet, the processing sector generates added value that is then distributed as wages and profit. The GVA generated by nephrops processing (not the GVA of secondary processors that process nephrops, which may involve a mix of other products) is estimated using a ratio of total turnover to labour costs and other operating costs with which GVA can be derived from the Seafish processing report (<http://www.seafish.org/research-economics/industry-economics/processing-sector-statistics>).

The estimate of GVA generated by the processing sector from nephrops products in 2015 was £9.8m, of which:

- £1.94m is estimated to be generated by the processors of creel nephrops product; and
- £7.85m is estimated to be generated by the processors of trawl nephrops product.

5.3.2 Employment in processing and its supply chain

As with the estimate of GVA for the processing of nephrops, the estimate of employment is only linked to the volume and value of nephrops moving through the processing sector. It is not derived from business units, which could include the value of other species.

Estimates of employment in processing were calculated from a ratio of turnover to employment derived from the Seafish processing report (see above link). The estimates suggest that the employment created in the direct processing of nephrops in 2015 was 302 FTE posts, and of these posts:

- 60 were employed in the processing of creel caught product; and
- 242 were employed in the processing of trawl caught product.

In the estimation of processing employment associated with creel caught and trawl caught product, no adjustment was made for the different types of processing conducted for creel caught and trawl caught products as it would be difficult to account for efficiency in the estimates.

Note that applying the type II employment multiplier for fish processing (2.12) to calculate total direct, indirect and induced employment from processing would double-count the employment generated in the fleet. Therefore, an adjustment was made to the multiplier to remove the effect of raw materials from the supply chain of the processors. The adjustment calculates that a multiplier of 1.2 is appropriate for the estimate of direct, indirect and induced employment linked to the processing of nephrops, excluding the employment in the fleet⁸.

The analysis indicates that the primary processing of nephrops supports a total of 363 FTE posts, including processor employees and other employees in the supply chain, of which:

- 72 were employed through the direct, indirect and induced effects of processing creel caught product (excluding the indirect and induced effects of the purchase of nephrops); and
- 291 were employed through the direct, indirect and induced effects of processing trawl caught product (excluding the indirect and induced effects of the purchase of nephrops).

⁸ The fish processing employment multiplier provided by the Scottish Government Multipliers (2017) is 2.12. In order to take account of the fishing employment subsumed within this, the average employment cost from goods and services in the combined fleet segment (i.e. $1,000,000 * (1.74 + 8.31 + 4.68 + 21.17) / (308 * 1.35 + 959 * 1.35) = £80,239$) is used to recalibrate the processing multiplier (i.e. for trawl $(242 + (1,000,000 * (0.42 + 3.54) / 80,239)) / 242 = 1.20$.)

5.4 Summary of economic value from nephrops

Given that nephrops is the second highest value species in Scotland and the UK, it is not surprising that there is a considerable amount of onshore activity that surrounds landings.

As described, the direct GVA generated by each FTE post in each fleet segment (Figure 5-3) shows a reasonable degree of consistency between the fleet segments with an average GVA contribution by FTE of £23k. The total direct GVA generated by the nephrops fleet and related processing amounts to an estimated £36.8m. For a single species, this is a strong contribution to the Scottish economy. Of this total, the fleet contributes £27.0m. The total estimated GVA generated by creel activity across the fleet and the processing sector is £8.9m, and from trawl activity is £27.9m (Table 5-2)

The results in Table 5-2 estimate the direct, indirect and induced total employment generated from catching and primary processing nephrops in Scotland. In total, it is estimated that 2,077 jobs are supported in Scotland by the nephrops industry with 1,267 of those jobs in fishing, 302 in processing and 508 jobs in supply chain companies. Splitting the total jobs by creel caught and trawl caught nephrops results in approximately 489 jobs supported by the creel sector and 1,588 jobs supported by the trawl sector. This estimate only includes the employment effects in the nephrops fleet, the processing sector and their supply chains. Therefore, the knock-on effect in the downstream economy is not considered.

Table 5-2: Value to Scotland of nephrops in 2015 (values in £million)

Value to Scotland	Fleet sector		Processing sector		Total
	Creel	Trawl	Creel landings	Trawl landings	
GVA (£m) (direct)	£6.954	£20.051	£1.940	£7.846	£36.792
Employment (FTEs) (direct)	308	959	60	242	1,569
Employment multiplier	1.35	1.35	1.20	1.20	na
Direct, indirect and induced employment generated (FTEs)	417	1,297	72	291	2,077

Source: Creel and trawl data from Seafish fleet economic performance dataset (2017), processing figures calculated using ratios from the Seafish Processing Report (2016), employment multipliers are informed by Scottish Government Multipliers (2017) and total employment generated is calculated using actual or adjusted multipliers.

5.5 Economic activity in peripheral communities

In addition to the quantitative analysis of economic value provided above, it is also important to consider where much of the economic activity associated with nephrops occurs. The communities where the Scottish nephrops fleet (creel and trawl) is based, and where much of the primary processing is located, are peripheral communities on the coast of Scotland. In some of the more economically fragile communities, even a part-time job can be vital to keeping a family in an area. Both trawling and creeling are fundamental to the make-up of these rural communities. For this reason, a simple quantitative analysis of output and employment in the fishing industry and primary processing sector will underestimate the wider value of the economic activity to these communities.

6 Outlook for the nephrops industry

Information collated from consultations and supported by published information inform an appraisal of the outlook for the nephrops fleet. This chapter looks at some key indicators and, acknowledging uncertainty, identifies opportunities and threats to the nephrops fleet. The factors that are considered below include political, environmental and economic influences.

6.1 Biomass / stock status

The nephrops stock status is mixed between the West of Scotland and the North Sea as indicated in recent ICES (2017) data. As indicated in Table 3-4, the stocks in the Minches and Firth of Clyde are at the higher end of numbers of nephrops recorded. All West of Scotland functional units are within sustainable limits for fishing mortality and stock level. However, in many of the North Sea functional units (i.e. Fladen Ground and Farn Deeps) the numbers of nephrops are at their lower levels, although stock sustainability and fishing mortality in most cases is within the reference level indicating that stocks are being fished within maximum sustainable yield (MSY) limits (i.e. all except Farn Deeps and Firth of Forth).

With the goal to reach MSY by 2020 a target of the Common Fisheries Policy, in 2016 most nephrops stocks appear to already be within sustainable limits for most functional units and moving in the “right” direction. However, ultimately quota will be advised by ICES and set according to the stock size of nephrops in each functional unit. In the West of Scotland, this seems positive. However, as the stock sizes in the North Sea are at their lower levels, this will be reflected in quota available to fleets. With fishing mortality below the target, it could be expected that stock sizes could increase, however recent fluctuation (e.g. in the Fladen Ground) indicate that there is some uncertainty in year-on-year stock development.

Stakeholder views of the nephrops stock situation are summarised in the following comments:

- West of Scotland “stock is up and down – it’s very good now”
- “We’ve seen in the Clyde, Irish Sea and Farn Deeps that there have been unpredicted increases in biomass, in fact massive jumps in stocks. There appear to be more upswings rather than downswings”
- “All stocks are in a good position. Nephrops is massively abundant in Clyde. North Sea is not easy to understand – it fell so quickly in Fladen. The Farn Deeps is confusing!”

6.2 Policy and regulation

The issues at the forefront in policy for the Scottish nephrops fleets at the current time are: the introduction and management of MPAs in inshore and offshore waters, the landing obligation, the Scottish inshore fisheries bill, and Brexit.

The above four issues seem like they could have a major impact on fishing, however one stakeholder commented that “on the regulation side, are there ever seismic changes?”. However, we address these issues below.

6.2.1 Landing obligation

The landing obligation is effectively a discard ban, where all catch is required to be landed against quota held. Therefore, if a vessel doesn't have quota for a stock caught and it's likely to catch it again then it would have to stop fishing. As most quota stocks are fish species such as cod, haddock, plaice, anglerfish etc, nephrops creels do not result in many discards. However, given that nephrops trawl uses trawl gear with mesh size between 80-99mm there is a high possibility of unwanted catch. In the West of Scotland, the species estimated to result in highest discards based on scientific assessment are whiting (99.7% discard rate) and haddock (95.6% discard rate).⁹ In the North Sea, the species estimated to result in highest discards based on scientific assessment are cod (98.3% discard rate), haddock (86.3% discard rate), whiting (82.7% discard rate) and hake (95.9% discard rate).⁹

Seafish (2016) identified a potential choke situation in 2019 for nephrops trawl fleets on the West of Scotland at 23% against 2015 effort in the baseline and 43% under the most favourable scenario. So even under the most favourable scenario a vessel fishing for 200 days in 2015 might be restricted to just 86 days under the landing obligation in 2019. This assumes that vessels won't have access to additional quota or be able to change their behaviours (e.g. selectivity, time and location of fishing). There are policy tools such as "de minimis", "survivability" and "inter-species flexibility" that can be used to increase fishing opportunity. The results of the Seafish study also assume that the number of vessels in the nephrops fleets remain constant. However, a reduction in vessels might be a result if vessels become unviable and quota is re-allocated. If policy makers can use the policy tools noted above along with TAC uplift levels (which are supposed to align quota to catch levels that include discards) then the impact may well be reduced further. It is likely however that a mix of the above will improve the situation of fleets under the landing obligation. Work is ongoing at a policy level within Regional Groups and at an industry level through gear development to reduce the potential impact of choke species and this will hopefully improve the outlook for the nephrops fleet segments under the landing obligation.

In the North Sea, a choke point of 10% of 2015 effort in 2019 in the baseline and 30% in the most favourable scenario was reported (Seafish, 2016). So even under the most favourable scenario a vessel fishing for 200 days in 2015 might be restricted to just 60 days under the landing obligation in 2019. Similar observations can then be considered as described above.

Note that there is considerable sensitivity in high discard rates. For example, 1 tonne of landings of a given species with a discard rate of 90% requires 2 tonnes of catches, but with a rate of 95% 10 tonnes of catches are required but if the rate is 99.5% then 200 tonnes of catch is required. Therefore, if vessels and fleets can reduce average discard levels through improved selectivity or changes to time and location fished then adaption to the landing obligation could be helped.

6.2.2 Area restrictions

There are a multitude of marine conservation areas that have recently been implemented in Scottish waters (as described in Section 2). There are also seasonal restrictions and weekend restrictions in place in some areas, particularly for mobile gear, that have been in place since 1984. In many cases these were implemented typically for stock or gear conflict reasons. However, recent area restrictions have been implemented primarily for "conservation reasons" but in most cases, have an impact on mobile gear (i.e. nephrops trawl) in inshore waters. There are fewer restrictions on creel fishing but some exist. It is likely that such area restrictions will increase rather than decrease, however it was often mentioned

⁹ Taken from reported landings and STECF FDI database (2017)

in stakeholder consultation that if consulted on with the fishing industry then a reasonable outcome could be reached. However, if not consulted then a less than optimal situation resulted for everyone.

- “MPAs implemented in the Clyde has displaced effort – it would be good to try to re-arrange them if possible in future. There is a question of how much damage has it done to areas outside MPA. It seems that monitoring is undertaken in the MPA but not outside.”
- “A weekend ban works in some areas but 22 days per month rather than a weekend ban might be more suitable for some areas”
- “They are closing areas very quickly with no real research”
- “Conservation is basically a way to stop mobile gear”
- “The six-month closed area in the Minches makes vessels steam across and fish in less safe waters.”
- “The impact of MPAs varies across vessels and areas.”
- “Can work with planners, but if there’s no debate then poor implementation and vessels displaced.”
- “I’ve had no problems yet, mostly good relationship with planners.”

6.2.3 Inshore fisheries bill

Since 1984, inshore fisheries in Scotland have been regulated primarily through the Inshore Fishing (Scotland) Act (1984). It is recognised by Marine Scotland in their 2015 strategy document (Scottish inshore fisheries strategy 2015) that this requires updating. It is currently being considered by the Scottish Government and the exact details are not available. However, it is understood to build on some of the key outcomes of the 2015 strategy that included:

- a fresh legislative framework by 2020 to support “sound fisheries management”,
- an improved evidence base (e.g. vessel monitoring) by 2020 to ensure MSY is attained,
- better governance with new regional fisheries groups involved in the marine planning process,
- responding to national and international obligations, for example the Marine Strategy Framework Directive and its goal to achieve MSY by 2020 as well as the Natura Directive and establishing marine protected areas,
- improved data to inform interactions between sustainable fishing and other activities for management purposes, and
- maximising support from European funding.

In consultation with the industry, the ideas of fairness of management across all marine use activities and management solutions to deal with different activities was an accepted one.

6.2.4 Brexit

At time of writing, the details of Brexit are far from known. However, the economy is changing particularly in terms of currency exchange rates which in September 2017 are at their lowest with the World’s major currencies for some years. This makes exports cheap but imports expensive which is good for the fishing industry (e.g. high value species such as nephrops) but less good for processors relying on

imports and ultimately for consumers buying imported fish. It's worth noting that most of the UK's top 5 species (salmon, tuna, prawns, cod and haddock) is imported.

Trade is often talked about as being one of the biggest issues in trade negotiations, however for the fishing industry it is often spoken about as an opportunity to balance regulation. For example, "to realign quotas and tip the balance back in favour of UK fishermen, many of whom believe Britain gave up too much when quotas were carved out in the 1980s"

(<http://www.telegraph.co.uk/business/2016/10/01/what-the-uks-fishing-industry-wants-from-brexite/>).

There are many similar stories, however there is some reality in that all the fisheries regulation on the European books needs to be introduced into UK legislation.

Uncertainty is spoken about from all industries, including fishing, as being a barrier to investment and development as future conditions are not known and not set. Regarding accessing markets, one issue may be that border controls delay movement of fresh product thus impacting the risks of transporting fresh products, e.g. in the case of nephrops.

Member States already have some control over the regulation used in inshore areas (e.g. Scottish inshore fisheries bill). However, a process to agree quotas across shared stocks will likely have to continue as they cross other Member States' exclusive economic zones (EEZs). There is an issue for nephrops as it is assessed by functional units, some of which fall in Scottish waters, but quota is allocated at sea area level (i.e. West of Scotland and North Sea).

6.3 Innovation

Innovation in fleets typically follow a need to adjust to regulation or to adapt to changing fishing conditions but also in a healthy industry innovation is part of the natural investment process to improve economic performance and safety of crew.

There appears to be few technical innovations that might be made in the creel segment as creels are of a certain design and size and well-suited for nephrops. Quality of the catch of live nephrops is critical to a high performing creel sector.

For both creel and trawl vessels, improvements are constantly being made. Typically, new vessels are more efficient than older vessels whether in terms of fuel use or fishing effectiveness or safety. This requires some confidence in the sector to invest in (see section below) but is crucial in high performing fisheries.

There appears more prospect for improvements in gear for nephrops trawls with various developments being made to improve selectivity of nephrops and reduce drag to increase fuel efficiency. The Gear Innovation & Technology Advisory Group (GITAG) is the mechanism where industry can trial different methods to improve selectivity thereby decreasing "discards". It is reported that bigger panels are now in the trawl to allow for escape and there has been a general investment in lighter gear to reduce drag and fuel consumption. Also, it is reported that, nets are smaller mainly because of twin rig, there are square panels and a panel behind the headline has made a significant difference. The use of a square mesh 200mm is common and it is reported that some use 300mm without it reportedly appearing to affect nephrops. With the landing obligation, and the potential issue of quota not being available to nephrops trawlers for certain stocks, this may drive technical improvements in the gear even faster.

Fewer tails are landed from the North Sea than from the West of Scotland by nephrops trawl vessels. It is unclear whether this is a constraint of local processors (e.g. with lack of cold store facilities or other

logistical issue) or if it is a business choice of vessels. Innovations regarding the infrastructure of primary processing (e.g. cold stores) can improve the choices being made by vessels.

In consultation with stakeholders, there appears to have been developments in West of Scotland trawlers landing live nephrops during some seasons (e.g. pre-Christmas period) when the prices are high and the additional costs of doing so make it worthwhile. It does not appear to be an activity that all nephrops trawl vessels can undertake for logistic (e.g. distance from processors) and technical reasons (e.g. storing the catch live). Issues such as this relate to onboard handling of the catch and innovations to improve the quality of the nephrops catch are typically sought. Examples include chilling or freezing the product on board as well as storing.

6.4 Market conditions

Market conditions for nephrops are generally stable and good. The biggest market is frozen nephrops (whole and tails), then fresh, then live. There is a long-established UK market for scampi and a long-established export market for mostly whole nephrops. A strong live market for nephrops in Spain (and France) is sometimes referred to as “a niche one with high prices” but it forms an important component of the demand for Scottish nephrops. It is more subject to risk during shipment, e.g. delays at borders, but is a high-quality product. Further, the whole fresh market is one that can fluctuate in response to market conditions (e.g. prices and local economy). For example, one stakeholder commented that “in Spain, if prices of nephrops get too high then good quality prawns would be a cheaper substitute”. The frozen market is the largest for both whole and tails and subject to least risk as it can be controlled during transportation more easily.

However, the Scottish nephrops product is a good one and is sought after in France, Spain, Italy and UK, as it has been for the past 50-60 years. The pound is weak at present which makes the market more sensitive.

Supply is a key issue with regard to current regulation. The landing obligation may reduce supply as trawlers, that historically catch and discard unwanted fish may not be able to without quota for the unwanted fish. Creel vessels would not be able to catch as many nephrops as trawlers which would limit supply and impact both the fishing and onshore industries in Scotland. This would then impact markets for nephrops around Europe in particular.

Other issues relevant to changing market conditions include: trade issues such as tariffs which will increase prices to buyers of exports or decrease prices to sellers; lack of supply which will increase prices but if buyers cannot be supplied they will move on to other products; and oversupply which will reduce prices in response with traders possibly moving to other markets

Comments from stakeholders regarding markets included:

- “Lots of small whole landed this year (2017) in West of Scotland, causing a problem on market which means stuff is being put in cold store”
- “Spend time and resource fire-fighting when could be spending developing the market”
- “Prices depend on markets - since EU referendum - best it's been - all processors doing well as a result of exchange rate”
- “When the market is flooded there are issues with a lack of demand so planning is required”
- “In ‘80s tied up at one point in prawn market - too many prawns!”

- “Marine Conservation Society -too many acronyms! They say don't eat them May-Sept! But all seafood exhibitions/festivals are on then. Such communication is damaging to the fishery.”
- “the Spanish market, and the Barcelona market in particular, is a high value, niche market for nephrops”
- “Much more difficult to sell 10 tonnes of whole fresh prawns to UK market than it is to sell it to rest of Europe”
- “We need to promote the Scottish product more – trade shows, niche markets”

6.5 Business confidence and investment

Business confidence is important to allow for development in any industry. There are several issues discussed in this chapter that impact on business confidence and investment (e.g. new regulations, Brexit, etc), however in consultations with stakeholders, it appears that at this time the situation is good. It is reported that the number of new vessels delivered and on order is increasing, there are good prices attained and fishing in 2017 has been good.

Regarding business confidence of onshore activities, including primary processors, it is stable with good supply which is critical to continued activity. The trawl fishery maintains a regular supply through all weather conditions and provides for products both in the UK and European markets. The supply is more seasonal on the West Coast and less so on the East Coast (see Section 2).

Observations from stakeholders included:

- “I’m building new boat, and I know another fisherman has recently ordered a new boat”
- “An inshore group proposed a regulating order in the Clyde area. This would affect licenses and would affect fishing big-time – a real threat to businesses. Now this threat has disappeared people have begun to invest again.”
- “Well being of the industry needs investment and new guys”
- “Investment and licenses is the biggest issue. Need to go back to basics. Give an opening. Same for creelers and trawlers.”

6.6 Workforce

The previous chapter mentioned that the true economic value of nephrops activity in peripheral communities can greatly outweigh a simple quantitative assessment of output and employment. The location of the industry can bring challenges too. The labour market in these communities can lack opportunity and ‘the fishing’ and fish processing is not always seen as an attractive career option. Throughout the fishing industry the difficulties in attracting crew and processing employees, and particularly young people, into the industry are commonly reported. Whilst there are always exceptions, the Scottish nephrops industry is familiar with this challenge. The West of Scotland fleet is particularly constrained as, because the majority of activity is in inshore waters (within 12 miles), the fleet cannot employ non-EEA crew, however, one benefit of this is that it also restricts access to vessels that do employ non-EEA crew. One consultee stated that his investment in a new vessel was on hold because it was so difficult to find crew. Based on the consultations, this is a common problem for any vessel or processor looking to recruit, regardless of gear type or product mix.

6.7 Competition for nephrops grounds

Competition for nephrops grounds is not a new thing but it is a high-profile issue. Competition for good fishing grounds has been an issue since the beginning of the nephrops fisheries. The most high-profile concern is the trawling or dredging of creel gear. However, these days competition is not simply between different gear types, but also between the same gear type. Consultees reported that previous levels of etiquette that respected the traditional fishing grounds of a fisherman, particularly between creel fishermen, has been steadily eroded. Furthermore, there are additional demands on marine areas by many activities including, but not limited to fish farms, wind farms, resource extraction, pipes and cables. Marine protected areas are also being implemented for conservation purposes that reduce the sea area available for fishing. Creel vessels are not as affected as trawlers by MPAs but they are by other activities.

The competition between creelers and trawlers is driven by both sectors using the same fishing grounds in the West of Scotland. As creelers may leave creels on the ground for several days and trawlers are mobile it requires good communication on occasion to avoid each other. Consultees reported that in most areas fishermen use their knowledge of the local fleet and other vessels' owners to communicate via informal channels to minimise potential gear conflict. Most stakeholders recognised that, whilst competition for fishing grounds is relatively intense, that conflict is generally avoided through good communication. Fishery Officers record instances of gear conflict, but this information is not publicly available.

6.8 Fuel price

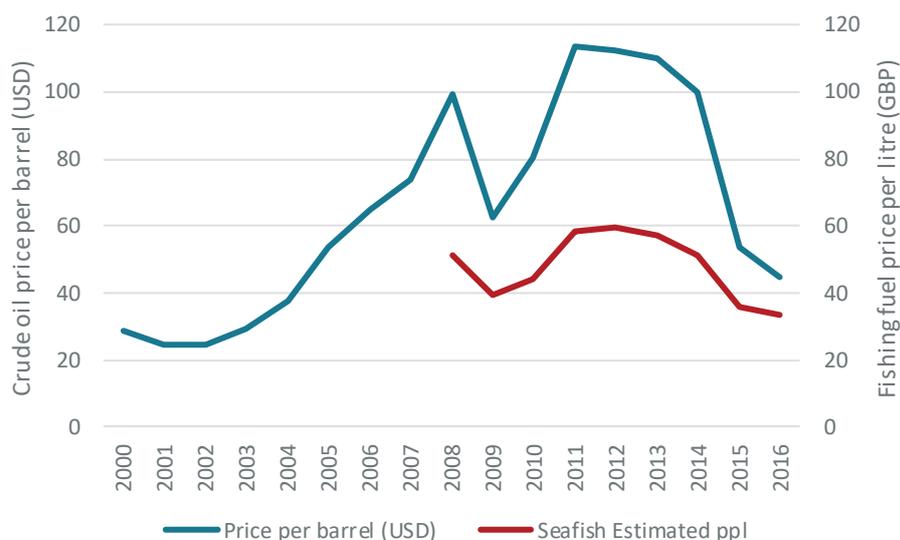
Brexit and global political developments could see a period of instability in fuel price. The hardest hit would be the least fuel efficient.

In 2006, UK fishing fleets as other EU fishing fleets were experiencing increasing fuel prices at a rate not seen previously. In response, Seafish undertook a report (Seafish, 2006) to consider "Options for improving fuel efficiency in the UK Fishing Fleet". Through a ten-year period of increasing and then decreasing fuel prices, the fishing industry, on average, is paying fuel prices per litre close to (if not lower than) those in 2006 (see Figure 6-1). As indicated, the average fuel price used by Seafish correlates to the average crude oil import price per year.

The forecasts for crude oil price are unclear however in the short to medium term prices could remain at similar although increased levels. A recent International Energy Forum (IEF) report¹⁰ indicates that the Organization of the Petroleum Exporting Countries (OPEC) forecasts crude oil prices to increase to 57 USD per barrel in 2020 and the International Energy Agency (IEA) forecasts between 73-82 USD per barrel in 2020. If fuel prices follow this increase proportionally then this could lead to an increase in fuel price of approximately a 15% to 50% in the next 3 years.

¹⁰ (https://www.ief.org/resources/files/events/seventh-iea-ief-opec-symposium-on-energy-outlooks/final-final-7th-iea-ief-opec_online1.pdf)

Figure 6-1: Crude oil import price 2000-16 (Source: OECD) and Average fishing fuel price per litre (Source: Seafish)



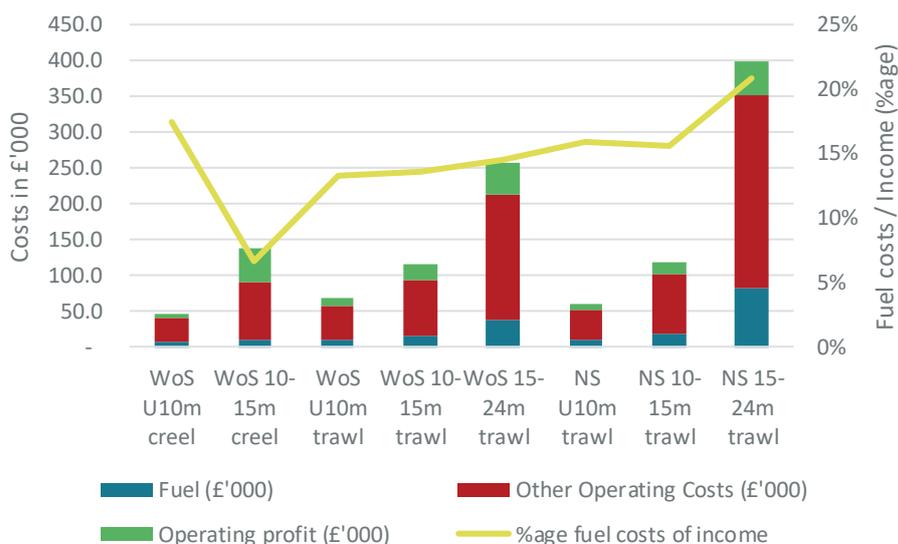
Seafish (2006) reported that the nephrops trawl fleets were being impacted by high fuel costs “having an impact on crew share and vessel financial performance” with “owners cutting back on vessel repairs and maintenance where possible to remain viable”. As shown in Figure 6-2, average fuel costs in 2013-15 for the Scottish nephrops fleets are estimated to account for between 10-20% of total income of a vessel. With operating profit over the same period also averaging 10-20%. This would suggest that fleets could withstand a small increase in fuel price and still remain viable. The North Sea 15-24m trawl fleet appears most vulnerable to remaining profitable in the face of increasing fuel costs, as fuel costs are 21% of income and operating profit half that on average between 2013-15. The WoS 10-15m creel fleet appears least vulnerable with fuel costs estimated to be 7% of income but operating profit 34% of income.

The main initiatives that Seafish (2006) propose to reduce fishing fuel costs are:

- (i) change trip planning practices,
- (ii) reduce steaming speed,
- (iii) change landing port,
- (iv) stop fishing temporarily,
- (v) modify gear, and
- (vi) preventative maintenance.

The calculations undertaken result in an average saving per vessel of approximately £5,000 per year for nephrops trawls vessels. Given that most nephrops trawl vessels have likely modified their behaviours regarding the above, it is likely that fuel savings now would be significantly less.

Figure 6-2. Average fuel costs, other operating costs and operating profit 2013-2015, with percentage fuel costs to income (Source: Seafish, 2017)



Since, the BREXIT referendum exchange rates for the Pound Sterling have decreased significantly. For example, the average exchange rate for the year until 31 March 2017 was 1.21 EUR per GBP and 1.33 USD per GBP (HMRC, 2017). The previous year averages, pre-referendum, were 1.37 EUR per GBP and 1.51 USD per GBP. On 1 September 2017, the Bank of England published the exchange rate to the Euro at 1.09 and to the US dollar at 1.30. If fishing costs, fuel or otherwise, increase as a result of the decreasing exchange rate then this could have a direct impact on fishing operations.

6.9 What if there was no fleet diversity?

The analyses contained in the earlier sections and chapters of the report confirm the diversity of the Scottish nephrops fleet but also offer no evidence to support the need for any change in fleet structure. Furthermore, with diversity also existing in the products that enter the value chain, the findings could be interpreted to support diversity. However, as discussed above, there are some who are engaged in a discussion that promotes creel fishing to be more economically advantageous than trawl fishing, a conclusion not supported in the findings of this study. However, a supply scenario was undertaken to investigate the number of vessels each of the West of Scotland nephrops fleet segments would require if it was the only fleet segment catching nephrops in the West of Scotland – assuming current levels of landings is a desirable outcome, i.e. 9,495 tonnes.

The considerably lower landings per day by creelers would require a significant increase in number of vessels to enable market supply to be met, from 168 vessels to 2,128 vessels. With comments around creel saturation and ‘creel on creel’ conflict in the West of Scotland, even a fraction of this does not appear to be a pragmatic solution. Indeed, the relative increase required in all fleet segments to land solely nephrops at 2015 levels is not a practical one, as many obstacles would block such a move, and there appears to be insufficient information to support a restructuring of the fleet. The simplistic analysis provided in Table 6-1 assumes that number of creels used and days at sea per vessel remains the same.

Table 6-1: Analysis of the vessel requirements if the West of Scotland nephrops stock was fished by a single nephrops fleet segment, 2015

Fleet segment	2015 fleets segment indicators				Scenario: ALL WoS Scottish landings available to fleet segment Estimated #vessels required
	Nephrops landings in TONNES	#Vessels	Average #days per vessel	Landings per day in KG	
WoS Under 10m Creel	762	168	161	28	2,128
WoS 10-15m Creel	537	40	178	76	709
WoS Under 10m Trawl	586	29	136	149	473
WoS 10-15m Trawl	1,641	44	148	253	256
WoS 15-24m Trawl	5,969	75	165	483	120

Note: Above fleet segment landings total 9,495 tonnes (Seafish fleet segment data), total Scottish landings in 2015 was 9,936 tonnes (source: Marine Scotland and MMO fishing quota data), 2015 Scottish end of year (i.e. "Adapted") quota was 11,770 tonnes (source: Marine Scotland and MMO fishing quota data).

7 Conclusions

The nephrops industry in Scotland, developed over the last 50-60 years, supplies a significant proportion of the global supply of nephrops. Furthermore, in terms of value, nephrops is the second most important fisheries product landed by the Scottish fleet, after mackerel.

The fleet has developed over time to become the diverse fleet that is operating today. The diversity in the Scottish nephrops fleet and the wider Scottish fleet is believed to make Scotland's fleet and Scotland's fishing communities more resilient. Diversity is generally considered to be a positive trait due to its contribution to resilience and the reduction of risk, but Scotland has a finite amount of nephrops grounds and a finite amount of quota. When either the grounds or the quota are subject to high levels of demand, the diversity within the fleet can be a source of conflict.

For example, a recent report by the Scottish Creel Fishermen's Federation called for a reallocation of quota from the trawl fleet to the creel fleet based on the lower price per kg obtained by the trawl fleet. However, the quota analysis and finding presented in earlier chapters do demonstrate that quota is not particularly constrained but rather that it is competition for grounds in certain West of Scotland areas and stock status that creates the greatest challenge. Whilst the findings in this study do demonstrate that the creel fleet and the trawl fleet achieve their levels of performance through different means, the findings do not suggest that this makes one fleet segment better for Scotland than the other. It is a combination of economy and efficiency that determine the competitiveness, and therefore the success and sustainability, of the different Scottish nephrops fleet segments.

The phrase 'comparing apples with pears', or a similar sentiment, was expressed by consultees when discussing the nephrops trawl and creel fleet segments. They use different gear, face different regulations, produce different volumes of product, achieve different prices and on the whole produce different products for different markets. It is presumed that the reason Scotland has such diversity in its nephrops fleet is influenced by a range of factors including, but not limited to local conditions, personal preferences of the business owner and economic (including market) opportunities. However, the analysis of GVA per full-time equivalent post and the analysis of competitiveness have shown that while different businesses do make different decisions, there is remarkable similarity in the GVA per full-time equivalent post across all fleet segments and in the competitiveness of the larger creel vessels and the trawl fleet segments. Furthermore, there is no indication in the analysis of business performance that any group of business owners in a nephrops fleet segment is making a 'bad' economic decision.

However, the under-10 metre creel fleet does stand out as perhaps more vulnerable than the rest, total income relative to effort has been declining in recent years and profit margin has been narrowing. With presumed limited potential to improve efficiency, the reduction in economy observed over time is a concern. A solution which can reduce the cost base of the fleet segment relative to income, improve productivity of a creel, or increase the average price achieved by the fleet would improve the economy and the competitiveness of the fleet segment, simply doing more of the same would not resolve this challenge.

At the wider economic level, the fact that the waters around Scotland can sustain such fleet diversity is likely to mean that a greater range of benefits are generated than would otherwise be possible with a more uniform fleet. Each fleet segment has its own role to play in the communities around the coast of Scotland and each supports its own value chain. Whilst the trawl fleet may support many more onshore jobs and onshore investment through its high throughput, many of which is based in rural communities, the creation of one job directly or indirectly linked to a creel vessel in a small peripheral community can make the difference between a family staying or leaving the area.

The analysis sought to understand the differences between the fleet segments that make up Scotland's nephrops fleet. The numbers certainly demonstrate the dominance and importance of the trawl fleet to fishing communities around Scotland both offshore and onshore, but this should not devalue the creel fleet and its importance to fishing communities around Scotland. Perhaps the most surprising finding is that, for all the diversity that exists, the performance of the different Scottish nephrops fleet segments share many similarities.

Most of the analyses conducted for the study focused upon 2015, or a three-year average which included 2015. Undoubtedly 2015 represented a relatively low point in recent times for much of the Scottish nephrops fleet, particularly the North Sea trawl fleet segments. The one exception to this was the 10-15m West of Scotland creel fleet which appeared to have had an exceptionally good year in 2015. Where data was available for 2016 there are strong indicators of improved performance and consultees from all areas commented on good fishing in 2017, and new market opportunities for Scottish nephrops. This was reflected in a general confidence in the future of the nephrops industry in Scotland from all consultees, despite several challenges including competition for nephrops grounds and uncertainty around the future of European trade. The evident business confidence is having a knock-on benefit for Scotland through continuing investment and innovation which, if these challenges can be overcome, could lead to an even more positive analysis of the Scottish nephrops industry in the next two to three years.

Appendix A: Sources of information

Consultees

Name	Organisation
Angus Campbell	Chair of Western Isles Fishermen's Association, Kilbride Shellfish
Anne McLay	Marine Scotland
Craig Burton	Seafish Industry Authority
Dale Bellamy	Scottish Fishermen's Organisation
Dan Whittle	Whitby Seafoods
Donald Matheson	Fishing vessel
Duncan McInnes	Western Isles Fishermen's Organisation
Elaine Whyte	Clyde Fishermen's Association
Helen Dobby	Marine Scotland
Jean-Yves Daniel	Scottish Fishermen's Organisation
Jess Sparks	Seafish Industry Authority
Jim Prentice	Prentice Shellfish
Jim Watson	Marine Scotland
John Watt	Macduff Shellfish (Scotland)
Kenny Coull	Scottish Fishermen's Federation
Kenny McNab	Clyde Fishermen's Association
Kevin McDonnell	West of Scotland FPO
Lynne Forman	Macduff Shellfish (Scotland)
Mark Robertson	Chair of Mallaig & North-West Fishermen's Association
Mike Montgomerie	Seafish Industry Authority
Paul Macdonald	Scottish Fishermen's Organisation
Ruari Finlayson	Fishing vessel
Tony Kenning	Fishing vessel and Chair of Scottish Fishermen's Organisation

We are also extremely grateful to the following individuals for the provision of bespoke analysis and industry insight.

Name	Organisation
Arina Motova	Seafish Industry Authority
Marta Moran Quintana	Seafish Industry Authority
David Turnbull	Marine Scotland
Ross Parker	Marine Scotland
John Anderson	Scottish Fishermen's Organisation
Malcolm Morrison	Scottish Fishermen's Federation
Anne-Margaret Anderson	Scottish White Fish Producers Association

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Appendix B: Inshore fisheries prohibitions

Inshore Fishing (Scotland) Act 1984 Sea Fisheries Prohibitions (as reported in Symes and Ridgway, 2003)

	Issue		
	Protect stocks	Ease gear conflict	Other
Mobile Gear Prohibition			
Ban (Mar-Aug) on mobile gear boats in Luce Bay.	X		
Ban on mobile gear boats (except those dredging for mussels and oysters) in Loch Ryan.		(X)	X
Ban (Feb-Apr) on mobile gear boats in Ballantrae Bank.	X		
Ban on mobile gear boats in the Gare Loch.			X
Ban (on weekend days) on mobile gear boats in Firth of Clyde.	X	X	
Ban on boats over 70ft fishing in Firth of Clyde (except those fishing for pelagic species).	X		
Ban (Oct-Mar) on mobile gear boats, and ban on suction dredging, and ban on demersal trawlers over 12m, and ban on fishing with more than a single trawl in the southern Inner Sound and Lochs Carron, Kishorn, Duich, Alsh and Hourn;		X	
Ban on mobile gear boats (except those fishing for scallops in a defined area) and suction dredging in the northern Inner Sound and Loch Torridon		X	
Ban on mobile gear boats in Loch Gairloch	X		
Ban (Oct-Mar) on mobile gear boats, and ban on suction dredging in Little Loch Broom and Gruinard Bay	X		
Ban (Oct-Mar) on mobile gear boats, and ban on suction dredging in Enard Bay	X		
Ban (Oct-Mar) on mobile gear boats, and ban on suction dredging, in Eddrachilis Bay	X		
Ban (Oct-Mar) on mobile gear boats, and ban on suction dredging in Loch Laxford	X		
Ban (Mar-Oct) on mobile gear boats (except those fishing for sandeels), and ban on suction dredging from Stuley Island to Barra Head and Gurney Point	X	X	
Ban (Mar-Oct) on mobile gear boats (except those fishing for scallops) and ban on suction dredging between Loch Maddy and Stuley Island	X	X	
Ban (Mar-Sept) on mobile gear boats (except those fishing for scallops) and ban on suction dredging in Sound of Harris	X	X	
Ban on mobile gear boats in Broad Bay.	X		
Ban on mobile gear boats in Loch Roag.	X		
Ban on mobile gear boats in Thurso and Dunnet Bays.	X	X	
Ban on mobile gear boats in Sinclair Bay.	X		
Ban (May-Sept) on mobile gear boats from the Berry to Costa Head.	X	X	
Ban on mobile gear (except those dredging for mussels), and ban on suction dredging, in the Dornoch Firth.	X		
Ban on mobile gear boats (except those dredging for cockles and mussels) and ban on suction dredging in the Cromarty Firth.	X		
Ban on mobile gear boats (except those dredging for cockles & mussels) and ban on suction dredging in the Inverness Firth.	X		
Ban (Oct-Mar) on mobile gear boats from Aberdeen to Mons Craig.	X		
Ban on mobile gear boats between Mons Craig and Doolie Ness.		X	
Ban on mobile gear boats within 0.5 mile, and ban (Oct-Mar) on mobile gear boats within 1 mile between Doolie Ness and Lang Craig		X	
Ban on mobile gear boats between Lang Craig and Arbroath.		X	
Ban on mobile gear boats in St Andrews Bay.	X		
Ban on boats over 55ft fishing in Firth of Forth (except those fishing for pelagic species)	X		
Ban on mobile gear boats in St Abbs/Eyemouth area.		X	
Static Gear Prohibition			
Ban on creel fishing North of Rona		X	
Ban (Dec-Mar) on creel fishing around Flannan Isles.	X		
Ban (July-Sept) on creel fishing from Bragar to Dell.	X		

Appendix C: Fleet segment analyses

Appendix C provides a more detailed analysis of the eight fleet segments included in the analysis. Each analysis looks at:

- the trend in vessel numbers;
- the characteristics of an average vessel in each fleet segment in 2016, for example size, power, days at sea landings and income. The characteristics shown in this section are known and are not provisional for 2016, so the most up-to-date information is presented;
- the business performance of the fleet segment between 2008 and 2016. Seafish provides estimates for 2016 but at this time these are provisional so the commentary is focused upon 2015;
- the analysis also considers what has affected business performance over time, for example the landings per kWdas, the operating cost per kWdas and the average price per tonne achieved; and
- the GVA of a vessel in the fleet segment over time is also presented.

The information in the analyses is used to inform the analyses provided in the main report.

Notes on the Seafish economic performance dataset

- All values have been estimated based on MMO data and economic sample collected by Seafish.
- Values are estimated based on samples collected by Seafish.
- 2016 values are projections based on MMO landings and effort in 2016, observed fuel price in 2016 and economic sample survey for 2015.
- Financial values have been adjusted to 2015 values.
- Adjusted values are calculated using Gross Domestic Product deflators consistent with DEFRA publications. Further details on this method can be found on the HM Treasury website (<https://www.gov.uk/government/collections/gdp-deflators-at-market-prices-and-money-gdp>).

C1 West of Scotland: under 10m nephrops creel fleet segment

In 2016 there were 156 vessels in the under 10m West of Scotland nephrops creel fleet segment. In the nine years to 2016, the number of vessels has declined from 213 to 156.

C1.2 West of Scotland under 10m nephrops creel vessel in 2016

On average in 2016, an under 10m nephrops creel fleet vessel spent 151 days at sea and landed 9.1 tonnes of catch. The average price achieved per tonne landed was £6,167, which was relatively low for the nine years to 2016. The average total fishing income per vessel was £55,900.

Average per vessel	
Length (m)	8.2
Power (kW)	82
Days at sea	151
Landings (t)	9.1
Ave. price per tonne (£)	6,167
Fishing income (£)	55,900

In 2016, nephrops represented 89% of the total value of all catch by the under 10m West of Scotland nephrops creel fleet.

C1.3 Business performance, 2008-2016

Figure C-1 shows that since 2008 the margin between income and operating cost per kWdas narrowed to 2015. In 2015, the operating profit per kWdas was at its lowest since 2008 (Table C-1).

In 2015, landings per kWdas reduced by approximately 27% compared to 2014. An increase in the average price achieved for landings was not sufficient to compensate for the reduction in landings and fishing income per kWdas reduced. A reduction in total operating costs per kWdas, largely via fuel and other non-crew costs, allowed the fleet to achieve operating profits in 2015.

Figure C-3: Operating costs compared to income per kWdas (£)



In 2016, the estimates provided by Seafish suggest that performance indicators will have improved due to an increase in landings per kWdas and despite a reduction in the average price.

In 2015, the GVA of the under 10m nephrops creel fleet in the West of Scotland was £21,300, which was the lowest figure since 2008, but expected improvements in profitability in 2016 will increase GVA to an estimated average of £28,600 per vessel.

Table C-3: Business performance indicators for under 10m West of Scotland nephrops creel fleet segment

	2008	2009	2010	2011	2012	2013	2014	2015	2016
Landings per kWdas (kg)	0.79	0.70	0.72	0.70	0.72	0.74	0.66	0.48	0.66
Total income per kWdas (£)	6.33	5.90	6.03	5.74	5.23	4.89	4.13	3.33	4.19
Total operating cost per kWdas (£)	4.58	4.08	4.42	4.36	4.32	3.95	3.50	2.87	3.47
Operating profit per kWdas (£)	1.75	1.82	1.61	1.38	0.90	0.94	0.63	0.46	0.72
Average price per tonne landed (£)	7,757	8,132	8,120	7,793	6,914	6,247	6,011	6,835	6,167
Average GVA per vessel (£'000s)	29.3	31.3	30.3	24.3	22.1	23.6	22.4	21.3	28.6

C2 West of Scotland: 10-15m nephrops creel fleet segment

In 2016 there were 43 vessels in the 10-15m West of Scotland nephrops creel fleet segment. In the nine years to 2016, the number of vessels was as high as 48 (2010) and as low as 40 (2014-2015).

C2.1 West of Scotland 10-15m nephrops creel vessel in 2016

On average in 2016, a 10-15m West of Scotland nephrops creel vessel spent 165 days at sea and landed 16.5 tonnes of catch. The average price achieved per tonne landed was £6,825 which was about average for the nine years to 2016. The average total fishing income per vessel was £112,700.

In 2016, nephrops represented 93% of the total value of all catch by the 10-15m West of Scotland nephrops creel fleet segment.

Average per vessel	
Length (m)	11.1
Power (kW)	125
Days at sea	165
Landings (t)	16.5
Ave. price per tonne (£)	£6,825
Fishing income (£)	£112,700

C2.2 Business performance, 2008-2016

Figure C-2 shows that in 2011 the margin between income and operating cost per kWdas reduced due to increased cost per kWdas, and in 2015 the margin improved due to higher fishing income. In 2015, fishing income improved due to a very strong average price of £7,951 per tonne (Table C-2). This was £1,116 higher than that average price paid to the under 10m sector, although there is some difference in catch composition as noted in the main report (Chapter 2).

In 2016, the estimates provided by Seafish suggest that the fleet achieved relatively average landings and income per kWdas, and below average operating cost per kWdas. These factors combined to support good operating profits per kWdas achieved, second only to 2015.

In 2015, the GVA of the 10-15m West of Scotland nephrops creel fleet was at its highest (£84,600) since 2008. As described, profitability in 2015 was supported by a high average price, and crew share was also strong, the two factors which combine to create GVA. In 2016, a reduction in average price and fishing income is expected to reduce GVA to an estimated average of £70,200 per vessel.

Figure C-4: Operating costs compared to income per kWdas (£)



Table C-4: Business performance indicators for 10-15m West of Scotland nephrops creel fleet segment

	2008	2009	2010	2011	2012	2013	2014	2015	2016
Landings per kWdas (kg)	0.72	0.69	0.75	0.90	0.75	0.74	0.85	0.77	0.77
Total income per kWdas (£)	5.69	5.43	5.44	5.45	4.93	5.16	5.25	6.28	5.41
Total operating cost per kWdas (£)	4.19	3.91	4.28	4.82	3.52	4.22	3.97	4.12	3.60
Operating profit per kWdas (£)	1.50	1.52	1.16	0.62	1.41	0.94	1.28	2.16	1.80
Average price per tonne landed (£)	7,816	7,806	7,035	5,989	6,462	6,814	5,994	7,951	6,825
Average GVA per vessel (£'000s)	68.0	64.9	61.5	44.7	59.7	54.2	62.3	84.6	70.2

C3 West of Scotland: under 10m nephrops trawl fleet segment

In 2016 there were 23 vessels in the under 10m nephrops trawl fleet segment in the West of Scotland. In the nine years to 2016, the number of vessels has fluctuated and was as high as 35 (2008) and as low as 22 (2013).

C3.1 West of Scotland under 10m nephrops trawl vessel in 2016

On average in 2016, under 10m West of Scotland nephrops trawl vessel spent 132 days at sea and landed 28.2 tonnes of catch. The average price achieved per tonne landed was £3,268, which was about average for the nine years to 2016. The average total fishing income per vessel was £92,100.

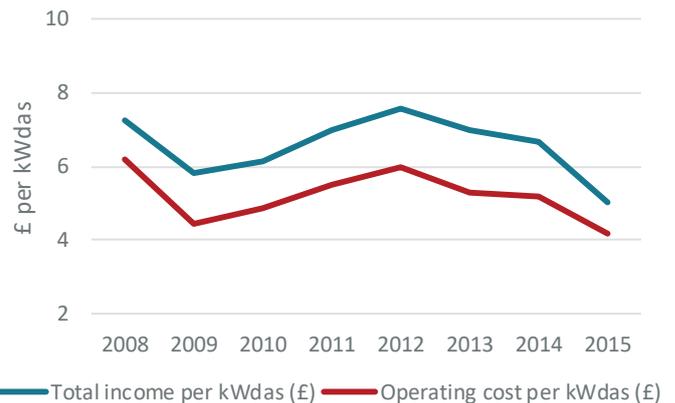
Average per vessel	
Length (m)	9.7
Power (kW)	104
Days at sea	132
Landings (t)	28.2
Ave. price per tonne (£)	3,268
Fishing income (£)	92,100

In 2016, nephrops represented 98% of the total value of all catch by the under 10m West of Scotland nephrops trawl fleet segment.

C3.2 Business performance, 2008-2016

Figure C-5 shows that since 2008 the margin between fishing income and operating cost per kWdas has remained relatively stable, with some narrowing in 2015 when fishing income per kWdas dropped to its lowest point in the nine years to 2016. Fishing income declined due to a reduction in landings per kWdas, and this was not compensated by an increase in price, indeed average price in 2015 was lower than the price in 2014. In 2015, operating profit per kWdas was at its lowest since 2008. A reduction across all main categories of operating costs supported the fleet to maintain a profit margin, albeit somewhat reduced, in 2015.

Figure C-5: Operating costs compared to income per kWdas (£)



In 2016, the estimates provided by Seafish suggest improvement in performance and fishing income per kWdas increased due to an increase in landings per kWdas. The profit margin between fishing income and total costs per kWdas also improved, despite a small reduction in average price.

In 2015, the GVA of the fleet segment was at its lowest (£29,400) since 2008, but expected improvements in profitability and crew share in 2016 will increase GVA to an estimated average of £43,400 per vessel.

Table C-5: Business performance indicators for under 10m West of Scotland nephrops trawl fleet segment

	2008	2009	2010	2011	2012	2013	2014	2015	2016
Landings per kWdas (kg)	2.23	1.91	1.91	2.07	2.13	2.16	1.80	1.51	1.99
Total income per kWdas (£)	7.27	5.83	6.11	6.98	7.58	6.98	6.66	5.01	6.55
Total operating cost per kWdas (£)	6.19	4.43	4.85	5.52	5.99	5.31	5.20	4.19	5.27
Operating profit per kWdas (£)	1.08	1.40	1.26	1.46	1.59	1.67	1.46	0.82	1.28
Average price per tonne landed (£)	3,176	3,004	3,153	3,284	3,394	3,008	3,417	3,298	3,268
Average GVA per vessel (£'000s)	36.3	38.0	39.9	40.9	48.4	50.3	45.2	29.4	43.4

C4 West of Scotland: 10-15m nephrops trawl fleet segment

In 2016 there were 43 vessels in the 10-15m nephrops trawl fleet segment in West of Scotland. In the nine years to 2016, the number of vessels has declined year-on-year from 73 in 2008.

C4.1 West of Scotland 10-15m nephrops trawl vessel in 2016

On average in 2016, a 10-15m West of Scotland nephrops trawl vessel spent 134 days at sea and landed 44.4 tonnes of catch. The average price achieved per tonne landed was £2,884, which was about average for the nine years to 2016. The average total fishing income per vessel was £128,000.

In 2016, nephrops represented 96% of the total value of all catch by the 10-15m West of Scotland nephrops trawl fleet segment.

Average per vessel	
Length (m)	12.3
Power (kW)	139
Days at sea	134
Landings (t)	44.4
Ave. price per tonne (£)	2,884
Fishing income (£)	128,000

C4.2 Business performance, 2008-2016

Figure C-6 shows that since 2008 the margin between fishing income and operating cost per kWdas has remained relatively stable despite fluctuations in income and costs per kWdas.

In 2015, and like other fleet segments in the West of Scotland, landings per kWdas reduced. However, a stable price and the ability to reduce costs meant that there was a less negative impact on the profit margin between income and operating costs in this fleet segment (Table C-6).

In 2016, the estimates provided by Seafish suggest performance improved as fishing income per kWdas increased due to an increase in landings per kWdas, the highest since 2008. Operating profit per kWdas also improved, despite a reduction in the average price and rising costs.

In 2015, the estimated average GVA was £52,900 per vessel, which was below average for the nine years since 2008. The highest GVA was achieved in 2012 (£72,000) when average price and landings per kWdas were particularly strong. In 2016, the expectation is that GVA was above average at £62,700.

Figure C-6: Operating costs compared to income per kWdas (£)

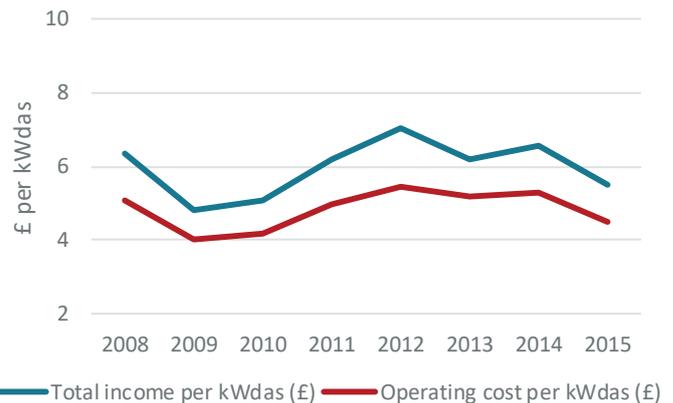


Table C-6: Business performance indicators for 10-15m West of Scotland nephrops trawl fleet segment

	2008	2009	2010	2011	2012	2013	2014	2015	2016
Landings per kWdas (kg)	2.17	1.91	1.98	2.00	2.01	2.04	2.07	1.83	2.28
Total income per kWdas (£)	6.32	4.83	5.07	6.21	7.05	6.20	6.57	5.50	6.67
Total operating cost per kWdas (£)	5.07	4.01	4.16	4.99	5.46	5.16	5.31	4.48	5.30
Operating profit per kWdas (£)	1.25	0.82	0.90	1.21	1.59	1.04	1.26	1.02	1.36
Average price per tonne landed (£)	2,830	2,503	2,517	3,054	3,306	2,905	2,963	2,975	2,884
Average GVA per vessel (£'000s)	59.7	41.0	48.5	53.7	72.0	57.6	64.7	52.9	62.7

C5 West of Scotland: 15-24m nephrops trawl fleet segment

In 2016 there were 79 vessels in the 15-24m nephrops trawl fleet segment in West of Scotland. In the nine years to 2016, the number of vessels was as high as 83 (2008) and as low as 63 (2011).

C5.1 West of Scotland 15-24m nephrops trawl vessel in 2016

On average in 2016, a 15-24m West of Scotland nephrops trawl vessel spent 134 days at sea and landed 134 tonnes of catch. The average price achieved per tonne landed was £2,433, which was about average for the nine years to 2016. The average total fishing income per vessel was £326,000.

In 2016, nephrops represented 94% of the total value of all catch by the 15-24m West of Scotland nephrops trawl fleet segment.

Average per vessel	
Length (m)	17.3
Power (kW)	252
Days at sea	180
Landings (t)	134
Ave. price per tonne (£)	£2,433
Fishing income (£)	326,000

C5.2 Business performance, 2008-2016

Figure C-7 shows that since 2008 the margin between income and operating cost per kWdas was strongest in 2011 and 2012. In 2011 and 2012, the fleet segment benefitted from a positive combination of strong average prices and high landings per kWdas.

In 2016, the estimates provided by Seafish suggest that performance improved and operating profit per kWdas could be similar to 2011. In 2016, the improvement is driven by an increase in landings per kWdas combined with an average price about average for the nine years to 2016. This supports the best operating profit per kWdas since 2012 (Table C-7).

In 2015 the average GVA per vessel was £113,900. In 2016, the estimated improvement in operating profit per kWdas is reflected in an average estimated GVA per vessel of £157,400 – the highest reported in the nine years to 2016. In 2016, relatively low fuel costs appears to be enabling higher crew share, a key component of GVA.

Figure C-7: Operating costs compared to income per kWdas (£)

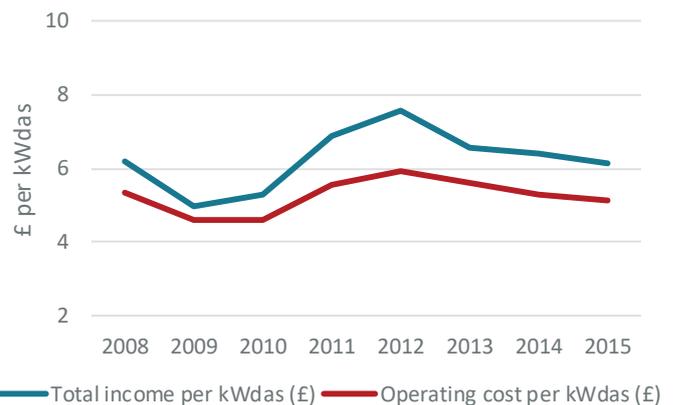


Table C-7: Business performance indicators for 15-24m West of Scotland nephrops trawl fleet segment

	2008	2009	2010	2011	2012	2013	2014	2015	2016
Landings per kWdas (kg)	2.29	2.29	2.32	2.64	2.90	2.63	2.56	2.43	2.88
Total income per kWdas (£)	6.17	4.98	5.30	6.87	7.59	6.53	6.40	6.13	7.15
Total operating cost per kWdas (£)	5.32	4.60	4.58	5.54	5.93	5.61	5.28	5.10	5.85
Operating profit per kWdas (£)	0.85	0.38	0.73	1.33	1.67	0.93	1.12	1.02	1.31
Average price per tonne landed (£)	2,630	2,157	2,239	2,561	2,478	2,411	2,320	2,474	2,433
Average GVA per vessel (£'000s)	94.8	66.9	78.1	111.1	146.9	105.1	118.4	113.9	157.4

C6 North Sea: under 10m nephrops trawl fleet segment

In 2016 there were 31 vessels in the under 10m nephrops trawl fleet segment in the North Sea. In the nine years to 2016, the number of vessels has fluctuated and was as high as 43 (2008) and as low as 28 (2011).

C6.1 North Sea under 10m nephrops trawl vessel in 2016

On average in 2016, an under 10m North Sea nephrops trawl vessel spent 136 days at sea and landed 26.1 tonnes of catch. The average price achieved per tonne landed was £3,138, which was about average for the nine years to 2016. The average total fishing income per vessel was £81,800.

In 2016, nephrops represented 82% of the total value of all catch by the under 10m North Sea nephrops trawl fleet segment.

Average per vessel	
Length (m)	9.6
Power (kW)	100
Days at sea	136
Landings (t)	26.1
Ave. price per tonne (£)	3,138
Fishing income (£)	81,800

C6.2 Business performance, 2008-2016

Figure C-8 shows that since 2008 the margin between fishing income and operating cost per kWdas was relatively narrow in 2008, 2014 and 2015. In 2015, the operating profit per kWdas was at its lowest since 2008.

In 2015, landings per kWdas reduced by approximately 24% from 2014 (Table C-8). An increase in the average price achieved for landings was not sufficient to compensate for the reduction in landings and income per kWdas reduced. A reduction across all main categories of operating costs supported the fleet to achieve operating profits in 2015.

In 2016, the estimates provided by Seafish suggest performance indicators improved and income per kWdas increased due to an increase in landings per kWdas. The profit margin between fishing income and total costs per kWdas also improved, despite a reduction in the average price.

IN 2015, the GVA of an average vessel was £24,000. In 2016, the expected improvement in operating profit per kWdas is reflected in the average estimated GVA per vessel of £37,400, the highest since 2012 (£39,600).

Figure C-8: Operating costs compared to income per kWdas (£)



Table C-8: Business performance indicators for under 10m North Sea nephrops trawl fleet segment

	2008	2009	2010	2011	2012	2013	2014	2015	2016
Landings per kWdas (kg)	1.89	2.16	1.89	1.75	1.81	1.68	1.56	1.19	1.89
Fishing Income per kWdas (£)	5.81	5.14	5.19	6.00	6.30	5.15	5.23	4.11	5.93
Total operating cost per kWdas (£)	5.21	3.98	4.29	4.92	5.28	4.40	4.63	3.57	4.89
Operating profit per kWdas (£)	0.78	1.24	0.99	1.25	1.34	1.15	1.03	0.56	1.08
Average price per tonne landed (£)	3,072	2,384	2,753	3,436	3,472	3,062	3,363	3,459	3,138
Average GVA per vessel (£'000s)	29.0	27.5	22.3	35.0	39.6	27.7	33.2	24.0	37.4

Note: Any non-fishing income per kWdas is not included in fishing income per kWdas.

C7 North Sea: 10-15m nephrops trawl fleet segment

In 2016 there were 26 vessels in the 10-15m North Sea nephrops trawl fleet segment. In the nine years since 2008, the number of vessels steadily declined from 45.

C7.1 North Sea 10-15m nephrops trawl vessel in 2016

On average in 2016, a 10-15m North Sea nephrops trawl vessel spent 119 days at sea and landed 56.4 tonnes of catch. The average price achieved per tonne landed was £2,750, which was relatively good for the nine years to 2016. The average total fishing income per vessel was £155,000.

In 2016, nephrops represented 84% of the total value of all catch by the 10-15m North Sea nephrops trawl fleet segment.

Average per vessel	
Length (m)	12.2
Power (kW)	154
Days at sea	119
Landings (t)	56.4
Ave. price per tonne (£)	£2,750
Fishing income (£)	155,000

C7.2 Business performance, 2008-2016

Figure C-9 shows a reasonable margin between income and operating costs since 2011 but this is largely supported by non-fishing income. For example, in 2013 costs exceeded fishing income although not total income. Better performance is evident since 2014, when landings per kWdas exceeded those reported in the six years since 2008.

In 2015, like other nephrops fleet segments, fishing income dipped due to a reduction in landings per kWdas, although an increase in average price is evident but was insufficient to compensate for the reduction in landings (Table C-9). A reduction in total operating costs per kWdas, largely via a reduction in fuel costs, supported operating profits in 2015.

In 2016, the estimates provided by Seafish suggest performance indicators improved and fishing income per kWdas increased due to an increase in landings per kWdas. The profit margin between fishing income and total costs per kWdas also improved, despite a reduction in the average price.

In 2015, the average GVA per vessel was below average at £43,200 but, if the estimates for 2016 are correct, the estimated average GVA went up to £62,900 per vessel, which was above average for the nine years to 2016.

Figure C-9: Operating costs compared to income per kWdas (£)



Table C-9: Business performance indicators for 10-15m North Sea nephrops trawl fleet segment

	2008	2009	2010	2011	2012	2013	2014	2015	2016
Landings per kWdas (kg)	2.87	3.18	2.79	2.57	2.41	2.74	3.21	2.42	2.98
Fishing Income per kWdas (£)	6.57	6.29	6.42	7.72	7.51	6.87	8.74	6.92	8.19
Total operating cost per kWdas (£)	6.44	5.86	6.40	7.51	7.23	7.15	7.70	6.30	7.43
Operating profit per kWdas (£)	0.35	0.71	0.34	1.53	1.35	0.89	1.68	0.99	1.19
Average price per tonne landed (£)	2,287	1,977	2,297	3,006	3,116	2,511	2,722	2,864	2,750
Average GVA per vessel (£'000s)	49.1	54.0	36.7	82.4	67.8	46.9	51.2	43.2	62.9

C8 North Sea: 15-24m nephrops trawl fleet segment

In 2016 there were 49 vessels in the 15-24 nephrops trawl fleet segment. In the nine years to 2016, the number of vessels has fluctuated but the trend is downwards from a high of 95 vessels in 2008.

C8.1 North Sea 15-24m nephrops trawl vessel in 2016

On average in 2016, a North Sea 15-24m nephrops trawl vessel spent 196 days at sea and landed 208.6 tonnes of catch. The average price achieved per tonne landed was £2,657, which was relatively good for the nine years to 2016. The average total fishing income per vessel was £554,200.

In 2016, nephrops represented 66% of the total value of all catch by the North Sea 15-24m nephrops trawl fleet segment.

Average per vessel	
Length (m)	19.6
Power (kW)	381
Days at sea	196
Landings (t)	208.6
Ave. price per tonne (£)	2,657
Fishing income (£)	554,200

C8.2 Business performance, 2008-2016

Figure C-10 shows that since 2008 the margin between total income and operating cost per kWdas was relatively stable. In 2011, there was an increase in non-fishing income which was maintained, and has supported the fleet segment's operating profit per kWdas.

Non-fishing income was particularly important in 2013-2015 the fleet was dealing with either low prices, high costs or low landings per kWdas, or a combination of these.

In 2016, the estimates provided by Seafish suggest performance indicators improved and fishing income per kWdas increased due to an increase in landings per kWdas and an improvement in average price. This had a positive knock-on effect on operating profits.

In 2015, the average GVA per vessel was £140,700, which is the second lowest GVA reported in the observed period. However, the estimated improvement in profitability in 2016 is reflected in an estimated average GVA per vessel of £235,000, which is the highest reported in the nine years to 2016.

Figure C-10: Operating costs compared to income per kWdas (£)



Table C-10: Business performance indicators for 15-24m North Sea nephrops trawl fleet segment

	2008	2009	2010	2011	2012	2013	2014	2015	2016
Landings per kWdas (kg)	2.76	3.09	2.77	2.67	2.76	2.84	2.87	2.56	2.73
Fishing Income per kWdas (£)	6.84	6.21	6.40	8.24	7.58	6.25	7.18	5.98	7.25
Total operating cost per kWdas (£)	6.39	5.68	5.95	7.51	7.05	5.99	6.90	5.62	6.63
Operating profit per kWdas (£)	0.69	0.76	0.60	1.16	1.00	0.66	0.74	0.73	1.07
Average price per tonne landed (£)	2,479	2,006	2,306	3,085	2,746	2,201	2,501	2,332	2,657
Average GVA per vessel (£'000s)	181.9	166.5	151.1	231.0	189.0	133.6	167.3	140.7	235.0

Appendix D: Methodology for multi-criteria competitiveness analysis

To conduct the multi-criteria analysis, the following analysis was conducted for each of the key efficiency (landings per FTE post and landings per kWdas) and economy (ratio of total income to operating costs) measures:

- For each measure, the average findings for the two creel fleet segments were combined and divided by two to create an average finding for the creel sector;
- Similarly, the average findings for the six trawl fleet segments were combined and divided by six to create an average for the trawl sector;
- The averages for the creel sector and trawl sector were combined and divided by two to create an overall average for the nephrops fleet. The grouping of the creel and trawl fleets together first was to avoid undue bias towards the characteristics of the trawl fleet as it has the greater number of segments;
- With an overall fleet average for each economy and efficiency measure established, a seven-point scale was used to rate each fleet segment against the average (Table D1);
- Then for each fleet segment, the scores for the two efficiency measures were added together and divided by two; and
- Then overall efficiency score was added to the economy score and divided by two to create a final single score for the relative competitiveness of each fleet segment, based on economy and efficiency.

No weighting by the number of vessels or weight of landings was undertaken so as to provide a comparison of the fleet segment's themselves.

Table D1: Seven-point scale for the multi-criteria analysis

Distance from overall sector average		Score
-70% to -100%	} Below average	1
-40% to -70%		2
-10% to -40%		3
-10% to 0	} Average	4
0 to 10%		4
10% to 40%	} Above average	5
40% to 70%		6
70% to 100%		7