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Creel Fishing Effort Study

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Contents

Executive Summary	3
1. Introduction	6
2. Approach and Survey Sample	6
3. Analysis of Creel Effort.....	9
3.1 <i>Nephrops</i> Fishery – West Coast of Scotland	9
3.2 Crab and Lobster Fishery – West Coast of Scotland	16
3.3 Crab and Lobster Fishery – East Coast of Scotland.....	22
3.4 Additional Creel Fishing Data	26
4. Reporting - Fish1 Forms	29
5. Business Confidence and Management Concerns in the Creel Sector	31
5.1 Key Concerns for Static Fishing.....	31
5.2 Confident and Business Development.....	32
5.3 Opinions on Spatial Management of Static Gear	32
5.4 Opinions on Effort Management of Static Gear.....	33
6. Stakeholder Workshop.....	35
6.1 Topic: Suitable Legislation to Support Inshore Crab/Lobster Management .35	
6.2 Topic: Implementing Appropriate Management for Crab/Lobster Fisheries .36	
6.3 Topic: Integrating Inshore Fishing and Wider Marine Spatial Management .37	
6.4 Topic: Changing Consumer Demands and Market Opportunities	37
7. Summary of Findings.....	39
7.1 Creel Effort.....	39
7.2 Future Reporting of Creel Effort	39
7.3 Views on Future Management	40
7.4 Conclusion	41

Executive Summary

Measuring fishing effort is important for assessing the environmental sustainability of fish stocks and the socioeconomic efficiency of fishing activity. This report presents results from interviews carried out in four regions in Scotland with fishers on their current creel fishing activity targeting shellfish, their views on management and two stakeholder workshops on future fisheries management. Fishing effort describes the amount of fishing gear used on a fishing ground over a given unit of time. In this report effort is defined as number of creels hauled per day per 4 km².

The aim of this work is to define the type and volume of effort being deployed to help inform future management proposals. The survey interviewed 198 creel vessel skippers from four regions, two on the west and two on the east coast of Scotland. The regions on the west coast were selected based on the presents of multiple marine users and those on the east coast due to user conflicts within and between fishing sectors.

Nephrops Fishery: West Coast of Scotland - The number of *Nephrops* creels that vessels deployed (in water capacity) at any one time to target *Nephrops* ranged from 50 to 2,500 creels per vessel and average number of deployed creels across all surveyed vessels was 925. All of these vessels used the industry standard D-shaped prawn creel to target *Nephrops*. When broken down, vessels operated by 2 crews, deployed an average of 1,167 creels and those operated by 3+ crews deploying an average of 1,693 creels per vessel. Around 10% of surveyed vessels deployed over 2,000 creels, 25% deployed between 1,000 to 1,999 creels and the remaining 65% deployed under 1,000 creels. Gear haul rates per 4 km² ranged from 0.1 hauls per day in very lightly fished areas to 640 creels hauled per day per 4 km² in highly fished areas.

Crab and Lobster Fishery: West Coast of Scotland - The total number of creels deployed at any one time ranged from 40 to 900 creels per vessel and the average number of creels deployed across all surveyed vessels was 294. Vessels used the industry standard D-shaped lobster creels (54%), a mixture of D-shaped lobster creels with parlour creels (28%) or parlour creels exclusively (18%). When broken down, vessels operated by 1 crew member deployed an average of 476 creels, and vessels operated by 2+ crews, deployed a much lower average at 219 creels, due to these bigger vessels working in the *Nephrops* fishery in addition to the crab and lobster fishery. Gear haul rates per 4 km² ranged from 0.1 to 3 hauls per day in lightly fished areas, up to 47.6 hauls per day in highly fished areas.

Crab and Lobster Fishery: East Coast of Scotland – The number of creels deployed in this fishery ranged from 10 to 2,300, with an average across all surveyed vessels of 455. The majority of vessels fished exclusively with parlour creels (67%), followed by those who used lobster creels (19%). Only 8.4% of surveyed vessels deployed more than 1,000 creels, 31.6% deployed between 500 and 999 creels and

the remaining 60% deployed under 500 creels. When broken down, vessels operated by 1 crew member deployed on average 437 creels, vessels operated by 2 crew members deployed 609 and for 3+ crews the average was 1,088 deployed. Gear haul rates ranged from 1 to 234 hauls per day per 4 km².

Business Confidence and Management Concerns in the Creel Sector – The primary concern from interviewed fishers was the number of creels being deployed in all three shellfish fisheries. Gear saturation in available grounds was reported as high with fishers no longer able to move gear to rest fishing grounds as in the past. Conflict between the creel and mobile fishing sectors was the second most cited concern and the third was the number of part-time and hobby fishers, which in the case of the former, compete with full-time fishers for markets during the summer months and for the latter a lack of understanding of fishing regulations and reports of the illegal selling of catches.

Around 40% of fishers interviewed had confidence in their businesses and business development. Between 26-30% were not confident in their businesses and they attributed this to gear saturation, conflict between fishing sectors and finding reliable crew as some of the reasons. The remaining 30% were content to maintain their business, but did not want to develop further.

The majority of interviewees supported the use of effort management mainly in the form of creel limits whilst some citing a mixture of spatial and effort management. Many whom supported creel limits also felt that without permit limitations (limits on the number of new boats) in tandem, creel limitation will fail due to people obtaining additional licences to access a higher number of creels. Interviewees gave their views on how creel limits could be implemented and were divided in views between allocating creel numbers by crew members, the most favoured, or by size of vessel. The high proportion of interviewees were against spatial management aimed at static gear, mainly because of displacement, non-compliance and poor enforcement. This opinion was most expressed on the west coast, potentially because of the presents of more types of spatial management e.g. marine protected areas, compared with the east coast, where more interviewees were willing to consider different types of spatial management in line with other controls on effort.

Stakeholder Workshops – Key issues discussed in the workshop were:

- current legislation not being responsive to the needs of fishers
- new management measures taking too long to introduce
- insufficient punishments for wrong doers.
- the need to balancing livelihood, e.g. how to balance creel limits with full-time, part-time and unlicensed fishers.
- challenges in accessing new markets
- dependency of overseas markets with little opportunity to sell products locally.

Future Management - There was a clear view that current management needs to be reviewed, if not a direct request for management intervention. Most fishers highlighted the need for a flexible system that reflects the hazards and natural complexity of the marine environment, but also regulations tough enough to deal with rule breaking. This report makes two key conclusions: 1) creel fishing is, predominantly, a local issues and any future management should be tackled at the local level. A management trial should be prioritised in a region where fishers support is high and voluntary agreements would be supported and respected. Support would be required by both Marine Scotland and the Inshore Fisheries Group (IFGs) and suitable sites identified; 2) Effort monitoring should continue and total effort deployed in Scottish inshore waters quantified. This will allow meaningful integration of inshore fishing activity with wider marine spatial planning and provide more evidence of the value of creel fishing in these waters.

1. Introduction

To implement effective fisheries management in Scotland's inshore waters there is a requirement for better information on fishing effort within the static gear sector, in particular, those vessels fishing with creels. Fishing effort describes the amount of fishing gear used on a fishing ground over a given unit of time¹. Measuring effort is important for assessing the environmental sustainability of fish stocks and the socioeconomic efficiency of fishing activity. In the case of the former, too much fishing effort increases the risk of overfishing, damaging the reproductive capacity of the stock and impacting on its long-term productivity. In the case of the latter, too much fishing effort will reduce 'catch per unit effort' (CPUE) the catch rate per creel, which means each unit is not fishing at its optimal capacity reducing the social and economic returns per unit of gear in the water. To mitigate the risks of either scenarios it is important to understand the amount of fishing effort being deployed on different fishing grounds throughout the year.

This report presents data collected to address four questions on creel effort: 1) what fishing effort is currently being deployed in the *Nephrops* and crab and lobster fisheries in Scotland; 2) what is the spatial and seasonal distribution of effort in these fisheries?; 3) are fishers concerned about the sustainability of these fisheries? and; 4) what management approaches are required to improve the sustainability and performance of these fisheries?

Data were collected in four regions in Scotland by interviewing fishers about their current creel fishing activity and gathering their views on management. These data were analysed and results were presented to wider marine stakeholders at two one-hour workshops on fisheries management in order to solicit their views on future management.

2. Approach and Survey Sample

Data for this report were obtained from two sources, interviews with static creel fishers and feedback from stakeholder workshops. The interviews with creel fishers were undertaken on the west coast in October to November 2015 and, after requests by industry, extended to the east coast in June to September 2016. The regions surveyed are shown in Figure 1. The regions on the west coast were selected based on the presents of multiple marine users and those on the east coast due to user conflicts within and between fishing sectors.

Lists of all active vessels registered in the four regions were created using the Fisheries Information Network (FIN), Scotland's central database for fishing activity, and sent to regional fishery offices to review and exclude any vessels not operating

¹ FAO (2017) <http://www.fao.org/fishery/cwp/handbook/N/en>

at the time of survey. These revised lists became the target list for each regional survey and the aim was to get as close to a census as possible.

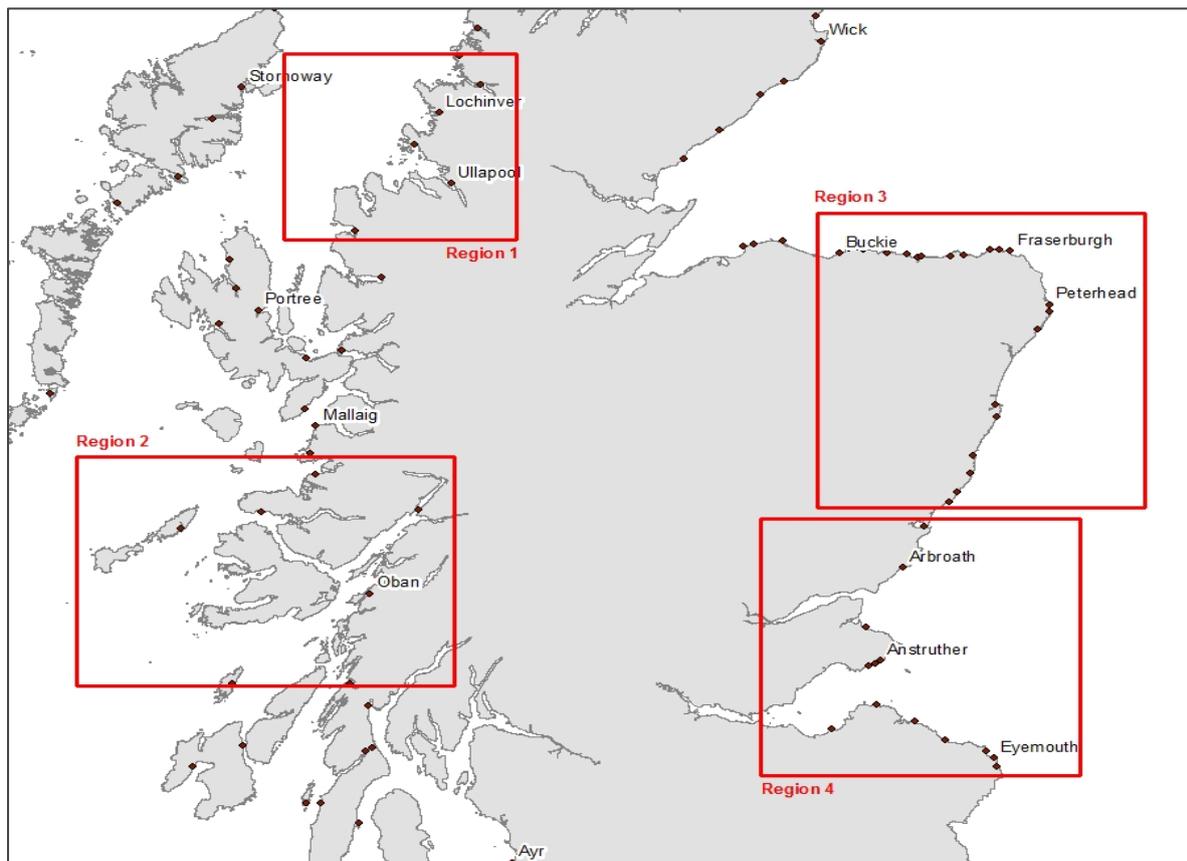


Figure 1: Map of survey regions. Region 1 – Achilitebuie to Gairloch (North West); region 2 – Oban to Isle of Mull (South West); region 3 –Buckie to Gourdon (North East); and region 4 – Arbroath to Eyemouth (South East)

Table 1 presents the target population and the achieved survey sample by: number of vessels; landed weight, and; total catch value in 2015. Each interview was undertaken at the quayside with the vessel skipper. The survey collected data on fishing effort, fishing patterns, views on management and lastly each fishing ground and its associated fishing effort were mapped in ArcGIS. Interviews lasted between 30 minutes to 1 hour.

Table 1: Target population and achieved sample by vessel number (#), landed weight (tonnes) and landed value (£) in 2015

Regions	# Vessels			Landed weight (tonnage)			Landed value		
	Target	Surveyed	%	Target	Surveyed	%	Target	Surveyed	%
1. North West	48	31	65	945	450	47	£2,652,534	£1,354,115	51
2. South West	74	41	55	659	477	72	£2,910,867	£2,043,498	70
3. North East	250	82	33	1,715	1,315	77	£5,152,380	£3,963,801	77
4. South East	164	44	27	1,497	750	50	£5,498,483	£2,892,856	53
Species	Target	Surveyed*	%	Target	Surveyed*	%	Target	Surveyed*	%
WoS <i>Nephrops</i>	100	55	55	369	283	77	£3,320,293	£2,626,997	79
NS crab/lobster	314	126	40	1,823	1,325	73	£7,111,566	£4,661,925	66
WoS crab/lobster	85	39	46	1,255	390	31	£2,327,578	£780,308	34

*These figures total more than the 198 sampled vessels as some vessels took part in more than one fishery. These figures reflect the amount of vessels taken into account in the analysis of each fishery.

The second data set came from two, one-hour stakeholder workshops held at the Scottish Inshore Fisheries Conference in Inverness on the 27-28th April 2017. Due to available time these workshops focused on future management in the crab and lobster fisheries only on both the west and east coasts. The other key fishery, the west coast *Nephrops* creel fishery, was not discussed. Stakeholders were asked to pre-register for the workshops and each session had around 30 participants from a range of backgrounds including active fishers, industry associations, fishing representatives, community groups and environmental non-government organisations. At each workshop a 20 minute presentation on the results of the fishing effort survey (Section 3) was followed by a 20 minute round table discussion on particular topics and then 20 minutes group feedback. The topic discussions focused on four areas: 1) suitable legislation to support crab/lobster fisheries management; 2) implementing appropriate management in the crab and lobster fishery; 3) integrating inshore fishing with wider marine spatial management, and; 4) responding to changing consumer demands and market opportunities.

The findings from the data are summarised in five sections, addressing the questions outlined in the introduction and are as follows:

- Section 3 presents creel effort from the two survey periods from a sample of vessels ($n = 198$) and the spatial and seasonal distribution by fishery (*Nephrops* and crab/lobster) and coast (East and West Scotland)
- Section 4 presents catch and effort reporting methods and updates to the current system to improve long term data collection
- Section 5 presents fishers' ($n = 198$) views on the fisheries and their opinions on management
- Section 6 presents the views from wider stakeholders from the two one-hour workshops on crab and lobster fisheries management
- Section 7 summarises the key findings from all sections

3. Analysis of Creel Effort

3.1 *Nephrops* Fishery – West Coast of Scotland

Scottish *Nephrops* (*Nephrops norvegicus*), which developed as a commercial fishery from the 1960s, is now Scotland's second most valuable species with over 15,000 tonnes landed in 2015, worth £40.6 million. Scotland is allocated the majority of Europe's total allowable catch (TAC) for this species and takes over one third of *Nephrops* landings worldwide². *Nephrops* are caught by trawlers operating in both the North Sea and West of Scotland waters, but those caught by creels and sold to the live market are significant on the west coast of Scotland.

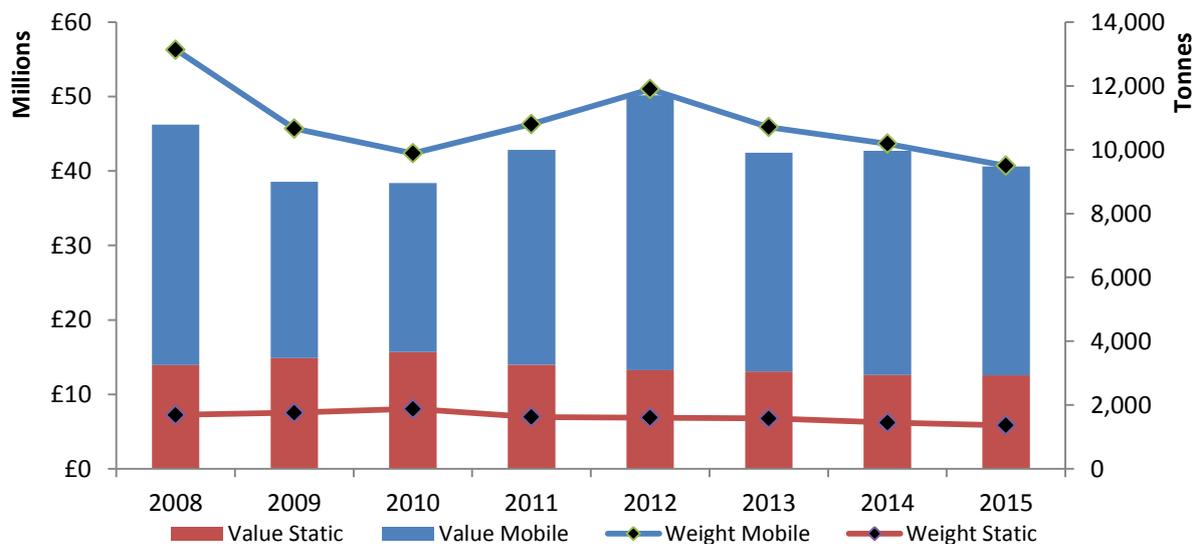


Figure 2: Volume and value of *Nephrops* (*Nephrops norvegicus*) landings from the west coast by all UK vessels into Scotland from 2008-2015 broken down by creel (static) and trawled (mobile) gear.

Nephrops landings from both mobile (trawled) and static (creel) vessels operating on the west coast are presented in Figure 2. Landings have remained relatively stable from static gear vessels at around 1,600 tonnes, whilst mobile gear landings have fluctuating between 10,000 and 13,000 tonnes between 2008 to 2015. The value of the fishery has also remained relatively stable over the same period for static gear vessels at around £14 million whilst mobile gear values have ranging from £23 million to £32 million with a spike in 2012 of £37 million (Fig. 2).

Effort analysis from the two survey regions found 54 of the 72 surveyed static vessels used creels to target *Nephrops*. These vessels accounted for 77% of landings into these regions in 2015. All of these vessels used the industry standard D-shaped prawn creel (Fig. 3) to target *Nephrops*. Around 30% of vessels surveyed had some form of adaptation to their fishing gear, which was mainly escape panels which, in most cases, were inherited from previous owners involved in a scheme, or reduced size of the hard-eye (from 85 to 65 mm) in the entrance panels.

² <http://www.gov.scot/Topics/marine/marine-environment/species/fish/shellfish/nephrops>

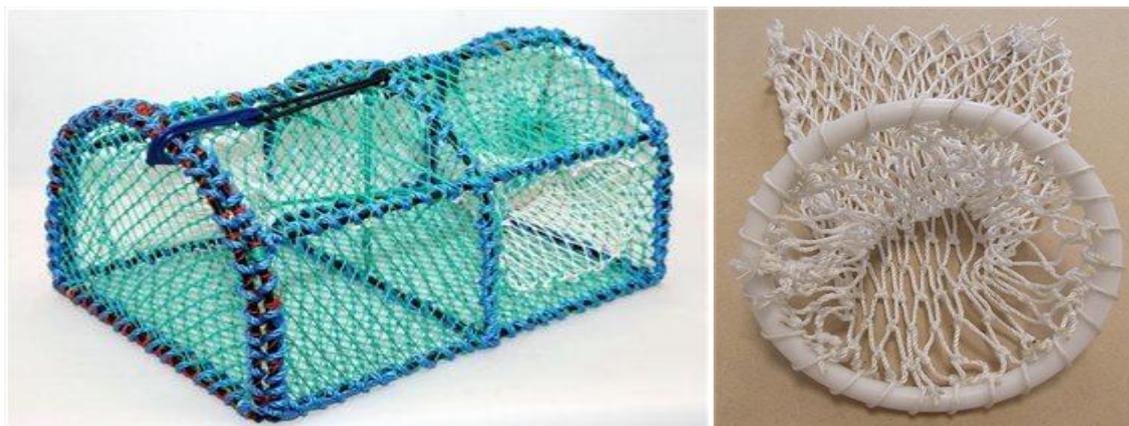


Figure 3: Standard D-Shaped prawn creel (left) and hard-eye (right). ©Gael Force - www.gaelforcegroup.co.uk

The total number of creels that vessels have access to i.e. owned or could rent was used to represent maximum fishing capacity at any given time. This ranged from 50 to 3,000 creels per vessel and the number deployed i.e. the amount actively fishing in the water, ranged from 50 to 2,500 creels per vessel. Creel numbers at the lower end (50 - ~450) were on vessels generally targeting other species as their main catch but which operated a few prawn creels in suitable grounds, whereas vessels working 1,000s of creels were concentrating exclusively in the *Nephrops* fishery. The average (mean) number of creels that surveyed boats had access to was 1,009 creels whilst the deployed capacity i.e. the amount of creels in the water, was a mean of 925 creels (Table 2).

Table 2: Mean number of *Nephrops* creels per vessel by length and number of crew

	Mean number of creels (access to)	Mean number of creels (deployed)
All vessels	1,009	926
Length of Vessel		
<5 m in length	778	705
5-9.9 m in length	933	906
10-12 m in length	1,339	1,186
>12.1 m in length	1,583	1,469
Number of Crew		
1 crew member	644	617
2 crew members	1,128	1,167
3+ crew members	2,093	1,693

Fishing capacity is often associated with the size of vessel because of the size of the deck space for handling gear or the number of crew employed because of the man power available to haul and clear creels. When broken down by length of vessel and number of crew, the mean number of creels for under (<)5 metre vessels was 778 (705 deployed), slightly higher than the mean for vessels which supported 1 crew member at 644 (617 deployed). Vessels between 5 and 9.9 metres in length have access to a mean of 933 (906 deployed) creels. Vessels with length 10 to 12 metres and over (>)12 metres had mean creels number of 1,339 (1,186 deployed) and 1,583 (1,469 deployed), respectively. For vessels with 2 crew, creel numbers were much lower at 1,128 (1,167 deployed) and substantially higher with 3+ crews with access to 2,093 creels, but deploying a mean of 1,693 creels per vessel (Table 2).

A plot of all surveyed vessels' maximum number of creels deployed (Fig. 4) shows that around 10% of surveyed vessels deployed over 2,000 creels, around 25% deployed between 1,000 to 1,999 creels. The remaining 65% of vessels deployed under 1,000 creels. What this graph (Fig. 4) demonstrates is the current volume of creel capacity deployed, which is the whole area below the solid blue line. When thinking about management, care needs to be taken when defining who the management will impact and what other incentives are awarded by a management intervention. For example by applying a (hypothetical) 1,500 creel limit, you will be impacting on the capacity in the red area, but legalising and potentially incentivising an increase in capacity represented in the grey area. This may be the best option if there is little likelihood that low capacity vessels will increase their creel numbers, but a full understanding of the capacity of the fleet and likely incentives of a management intervention is required to assess this risk.

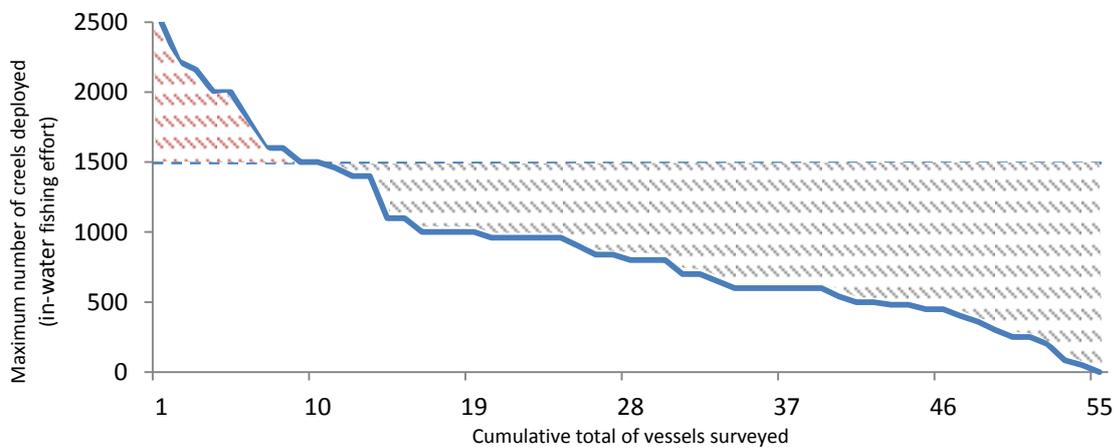


Figure 4: Plot of the reported number of creels deployed by each vessel surveyed in the west coast *Nephrops* fishery. Red shaded area – demonstration of impacts to creel capacity if 1,500 creel limit imposed, grey shaded area is the potential additional creel capacity legalised by such a regulation.

Total number of creels deployed per month by all vessels surveyed showed small increases throughout the year from around 49,000 creels in December up to 53,600 creels in May (Fig. 5). There was a small drop in creel numbers (~1,730) during June and July due to some vessels fishing during spring months only. In the case of August it appears that most vessels increase their fishing effort during that month.

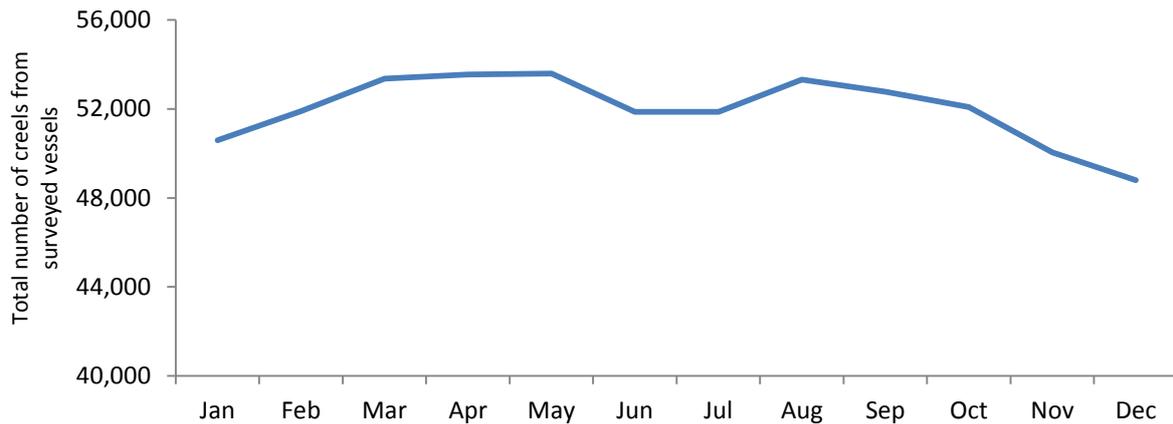


Figure 5: Total number of *Nephrops* creels from surveyed vessels deployed per month

From the 31 vessels who gave details of their daily hauling patterns, the mean number of creels hauled per day, per person, was 401, with 700 creels quoted as the maximum hauled by one crew member in a day. Most vessels stated that they hauled gear on alternative days, so creels generally had a 48 hour soak time, and they fished five days a week, resulting in some creels soaking for 72 hours at weekends. Fishing patterns varied seasonally and weather was cited as the most significant factor for changing fishing patterns, although some respondents also mentioned markets, low quality or poor fishing as factors which led them to deviate from normal fishing patterns. A number of skippers discussed leaving gear for weeks in bad weather as *Nephrops* gear generally fishes at depth on soft substrate, so is unlikely to get damaged by strong currents.

Applying the haul rates and monthly creel numbers per vessel, Figure 6 maps an estimate of average number of crab and lobster creels hauled per day by all vessels surveyed. This is produced by calculating total reported hauls per month multiplied by the total number of pots deployed per month in each fishing ground per vessel. This is then totalled for all 12 months and divided by 365 days to get an average haul rate per day per vessel. This total is divided across the reported fishing ground. A grid is then placed across the whole area and the total number of hauls per day from all fishing vessels is calculated for each cell in the grid. Each cell cover a 4 km² area of sea so presents the average number of hauls of *Nephrops* creels per 4 km².

For the *Nephrops* fishery the lighter areas displayed in Figure 6 show average hauls rates ranging from 0.1 to 35 hauls per day per 4 km². The medium coloured areas show ranges from 36 to 107 hauls per day per 4 km² and for the dark areas show ranges from 108 to 419 haul per day per 4 km².

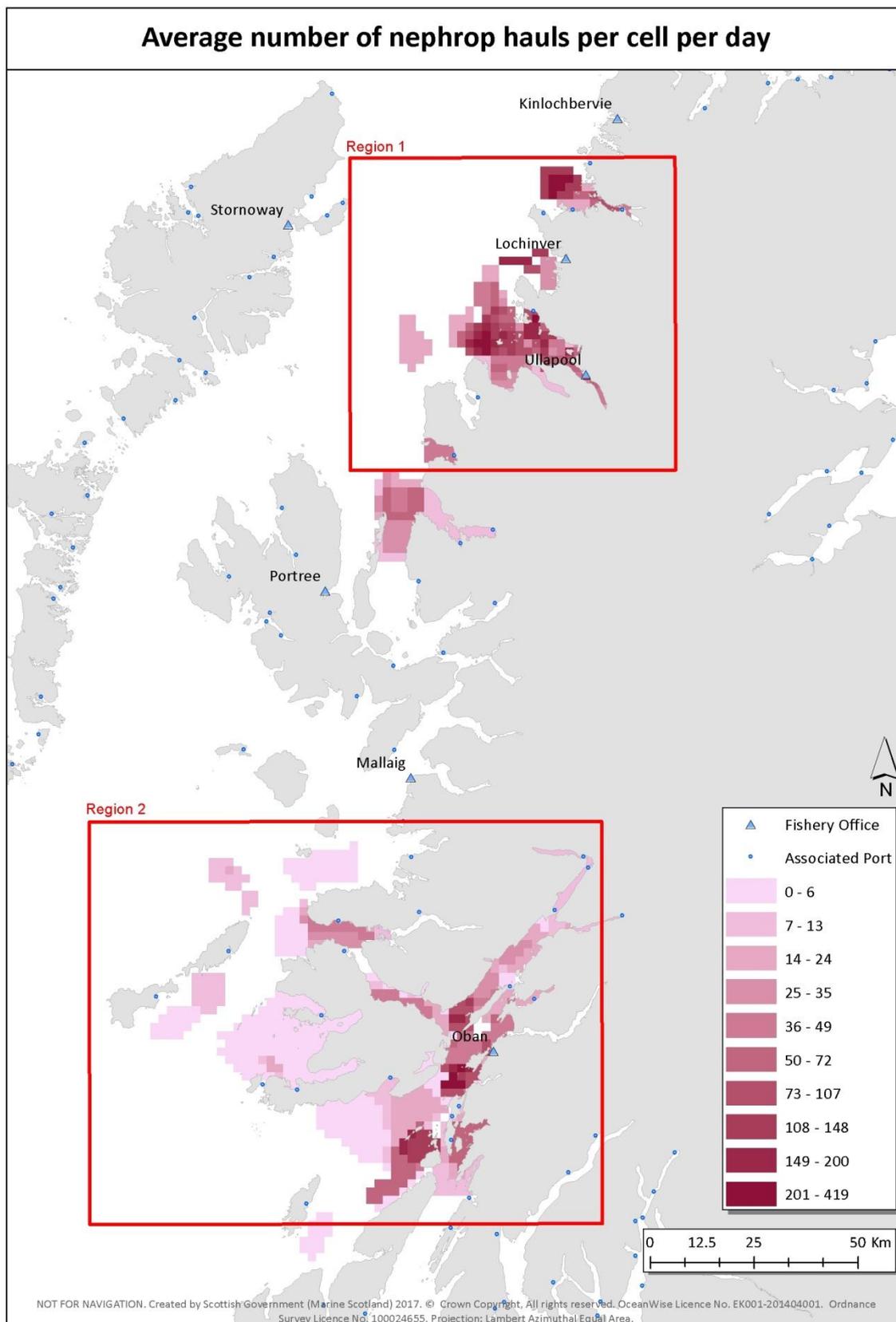


Figure 6: Average number of *Nephrops* pots hauled per day per cell (4 km²) from the 55 surveyed vessels. This does not represent effort from all vessels in the fleet.

Average number of nephrop pots per cell during peak period (August)

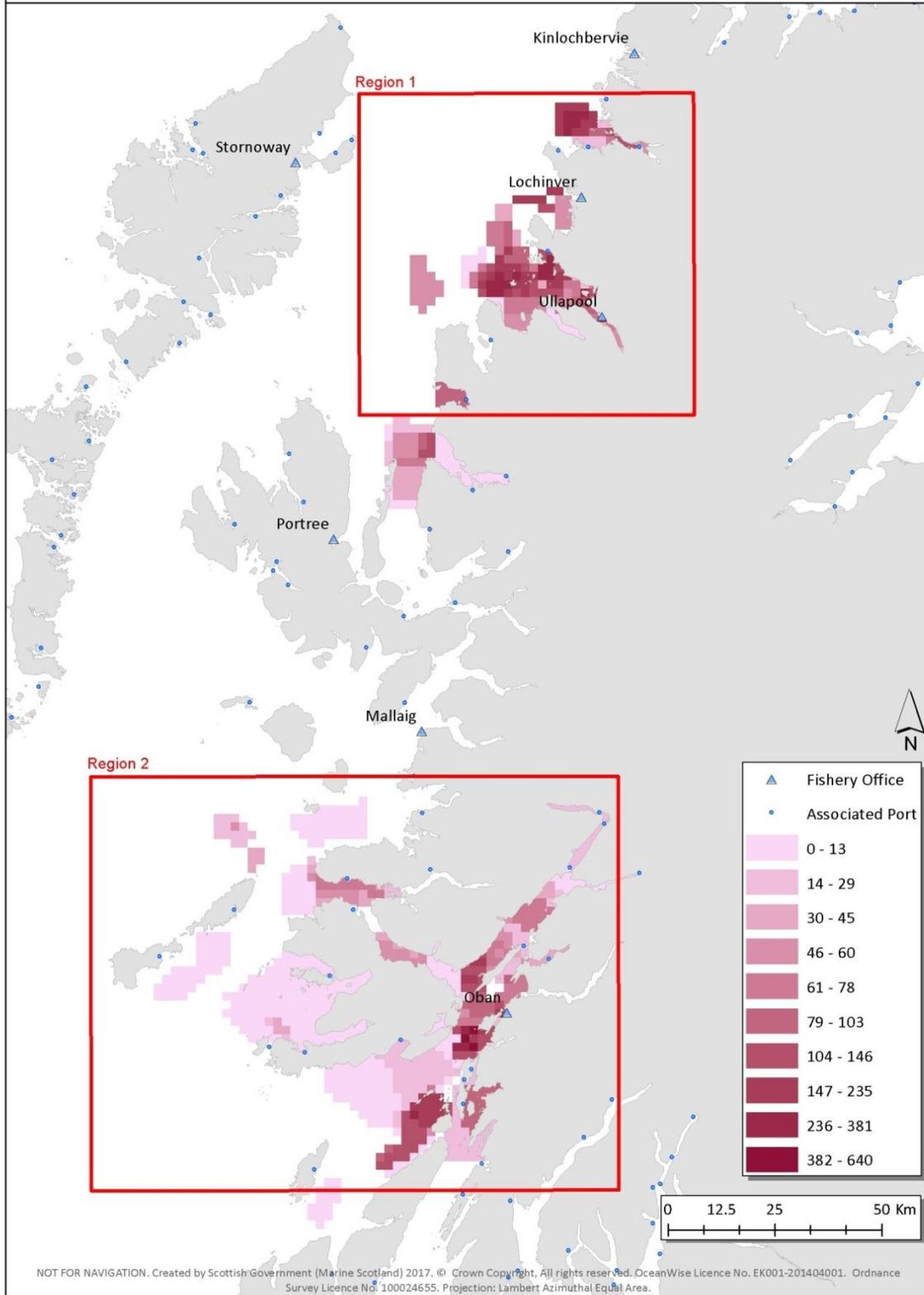


Figure 7: Average number of *Nephrops* creels in the water per cell during the peak season (August) from the 55 surveyed vessels. This does not represent effort from all vessels in the fleet.

Figure 7 presents the average number of creels deployed per 4 km² during the peak month of August. This represents the amount of gear surveyed fishers said they had in the water during this month. Gear deployment rates in the lighter areas ranged from 0.1 to 45 creels per 4 km². The mid-intensity coloured areas show ranges from 46 to 103 creels per 4 km² and the dark areas range from 104 to 640 creels per 4 km². These top rates can be considered as maximum fishing capacity during this month estimated from surveyed vessels across these fishing grounds.

3.2 Crab and Lobster Fishery – West Coast of Scotland

Crab and lobster are important fisheries in Scotland, brown crab (*Cancer pagurus*) because of the volume landed, European lobster (*Homarus gammarus*) because of its high value and velvet crab (*Necora puber*) as a relatively recent seasonal fishery. Landings of brown crab into Scotland totalled 11,000 tonnes in 2015 with a value of £14 million (Fig. 8). The majority of brown crab comes from West of Scotland waters (54%) the remaining from the North Sea (46%). Catch rates have remained relatively stable since 2011 after an increase in tonnage landed. The value of these landings has increased from around £11 million in 2008 to £14 million in 2015 (Fig. 8). This fishery is long established and traditionally most brown crab was caught using creels in inshore waters but from the mid 1980s technological advances allowed the fishery to expand to offshore fishing grounds. Inshore grounds now accounts for around two thirds of brown crab landings and the remaining is caught offshore³.

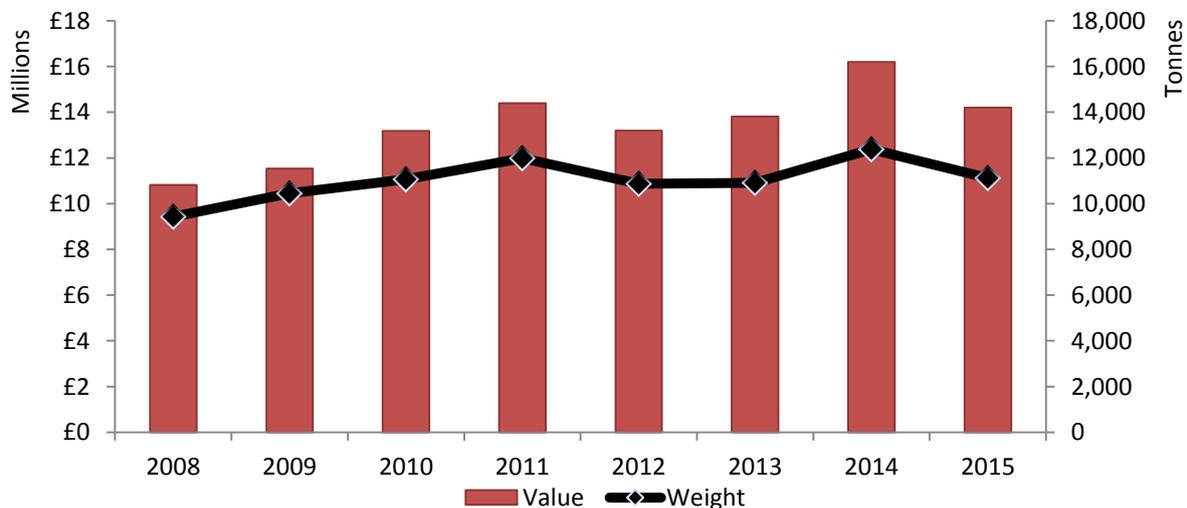


Figure 8: Volume and value of brown crab (*Cancer pagurus*) landings from all UK vessels into Scotland from 2008-2015

The European lobster is an important fishery to Scotland worth around £11 million in 2015 from just over 1,000 tonnes of landed lobster (Fig. 9). The majority of lobster was taken from the North Sea (71%) and the remaining from west of Scotland waters (29%) in 2015. Lobster landings have remained relatively stable since 2008, with the exception of a small dip in 2013, fluctuating between 1,000 and 1,200 tonnes per year. Prices have also fluctuated between £10 million and £13 million over the same period (Fig. 9).

³ <http://www.gov.scot/Topics/marine/marine-environment/species/fish/shellfish/BrownCrab>

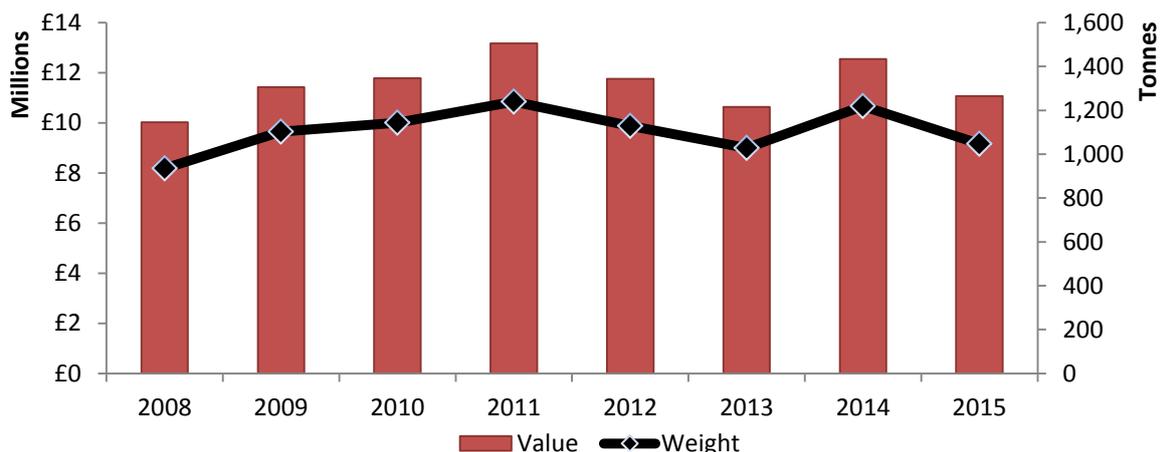


Figure 9: Volume and value of European Lobster (*Homarus gammarus*) landings from all UK vessels into Scotland from 2008-2015

Velvet crab, traditionally considered a ‘pest’ species, is now a seasonal fishery which became financially viable in Scotland because of stock collapse in the Spanish fishery in the early 1980s. Scotland now supports the largest velvet crab fishery in Europe⁴. In 2015, 1,500 tonnes of velvet crab were landed into Scotland with a value of £3.7 million. Landed weight in this fishery has been on the decline year on year from 2,700 tonnes in 2008 (Fig. 10). This is also reflected in the value of the fishery although prices per tonne have held or increased over this period.

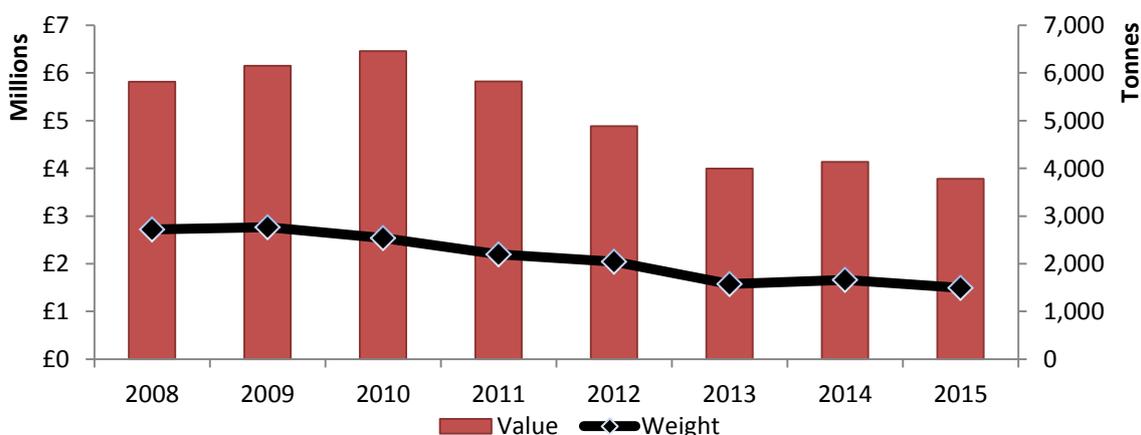


Figure 10: Volume and value of Velvet crab (*Necora puber*) landings from all UK vessels into Scotland from 2008-2015

Effort analysis from the two surveyed regions on the west coast of Scotland recorded 39 boats using creels to target brown crab, velvet crab and lobster. The majority of vessels used the industry standard D-shaped lobster creels (54%) or a mixture of D-shaped lobster/crab creels with parlour creels or crab pots (28%) (Fig. 11). The remaining 18% used parlour creels exclusively. Very few vessels had any forms of adaptation to their gear (7%), which consisted of changes to entrances. These compositions of lobster/crab creels and parlour creels are jointly referred to as ‘creels’ in the remaining analysis.

⁴ <http://www.gov.scot/Topics/marine/marine-environment/species/fish/shellfish/VelvetCrab>



Figure 11: Standard D-shaped lobster/crab creel (top left). Parlour pots with hard eye entrances (top, right) and 24 inch crab and lobster creel with soft eye entrances (bottom left) ©Cornwall Creels - www.cornwallcreels.co.uk.

The number of creels that vessels had access to i.e. owned or could rent, which were used to represent maximum fishing capacity to target crab and lobster ranged from 30 to 1,200 creels and the maximum number deployed i.e. the amount actively fishing in the water, ranged from 40 to 900 creels. A plot of each surveyed vessel's maximum creel numbers deployed shows small number (13%) of vessels deploy 600+ creels and a large number of vessels (49%) deploying less than 200 creels (Fig. 12).

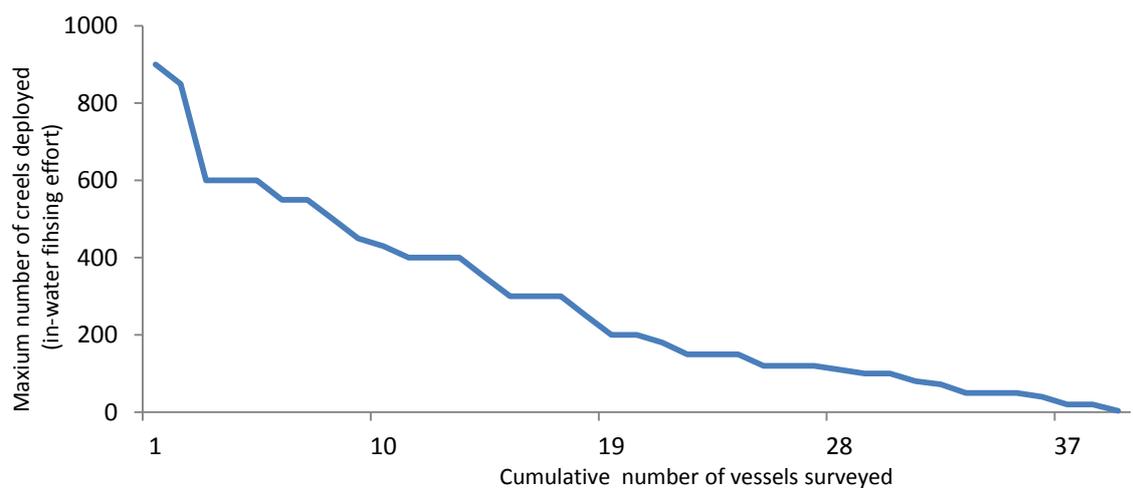


Figure 12: Plot of the reported number of creels deployed by each vessel surveyed in the west coast crab and lobster fishery

As with the *Nephrops* fishery, individual vessels which worked across a number of fisheries generally deployed lower numbers of crab and lobster creels (40 to 600)

than those which worked exclusively in the crab or lobster fishery, which ranges between 60 to 1,200 creels. The average (mean) number of creels a boat had access to was 359 whilst the numbers deployed averaged 294 creels (Table 3).

Table 3: Average (mean) number of crab and lobster creels by vessel length and number of crew

	Mean number of creels (access)	Mean number of creels (deployed)
All vessels	359	294
Length of vessel		
<10 min length	379	302
>10 min length	260	254
Number of crew		
1 crew member	593	476
2 crew members	247	219

When broken down by length of vessel and number of crew, the average (mean) number of creels that an under(<) 10 metre vessel had access to was 379 (294 deployed) and for vessels over(>) 10 metres in length they had access to an average of 379 (302 deployed) creels. For vessels worked by 1 crew member the average number accessed was 593 (476 deployed) and for worked by 2+ crews, average creels accessed was much lower at 247 (219 deployed) (Table 3). This was mainly due to bigger vessels working in other fisheries, such as *Nephrops* as well as working crab and lobster creels.

Information on hauling patterns showed that the majority of vessels reported hauling their crab and lobster creels 3 to 5 days a week during summer months and once or twice a week during winter months. Generally those targeting crabs were hauled more regularly whereas those targeting lobster were left longer before being cleared. Fishers targeting velvet crab said they usually hauled their gear every day during the season, weather permitting. Most vessels stated that they hauled all their crab and lobster gear in one day and then worked gear targeting other species on the alternate day, so generally crab and lobster creels have a 48 hour soak time during the summer months. During the winter months, the time creels were left in the water increased to up to a week before being cleared with weather, seasonality of catches and markets being factors impacting on winter fishing patterns.

Applying these fishing patterns, figure 13 maps an estimate of number of crab and lobster creels hauled per day in the two west coast survey areas. As before, this is produced by calculating the total reported hauls per month by the total number of pots deployed per month for each boat in each fishing ground. This is then totalled for all 12 months and divided by 365 days to get an average haul rate per day. This total is then divided across each fishing ground, as identified by fishers. A grid is then placed across the whole area and total hauls per day from all fishing vessels are totalled for each cell in the grid. Each cell covers a 4 km² area of sea, therefore each cell present the range of average number of hauls of crab and lobster creels, per day, per 4 km².

In the light areas average effort ranged from 0.1 to 3 hauls per day per 4 km². For medium coloured celled effort ranged from 3.1 to 10 hauls per day per 4 km² and for the darker areas effort ranged from 10.1 to 47.6 hauls per day per 4 km².

Figure 13 presents haul rates and the spatial distribution from the 39 surveyed vessels in the two surveyed regions only. These effort estimate however do not indicate the full spatial distribution of total effort as not all active vessels were interviewed. These maps do however start to highlight important grounds for crab and lobster fishing around the Isle of Mull and Wester Ross bay.

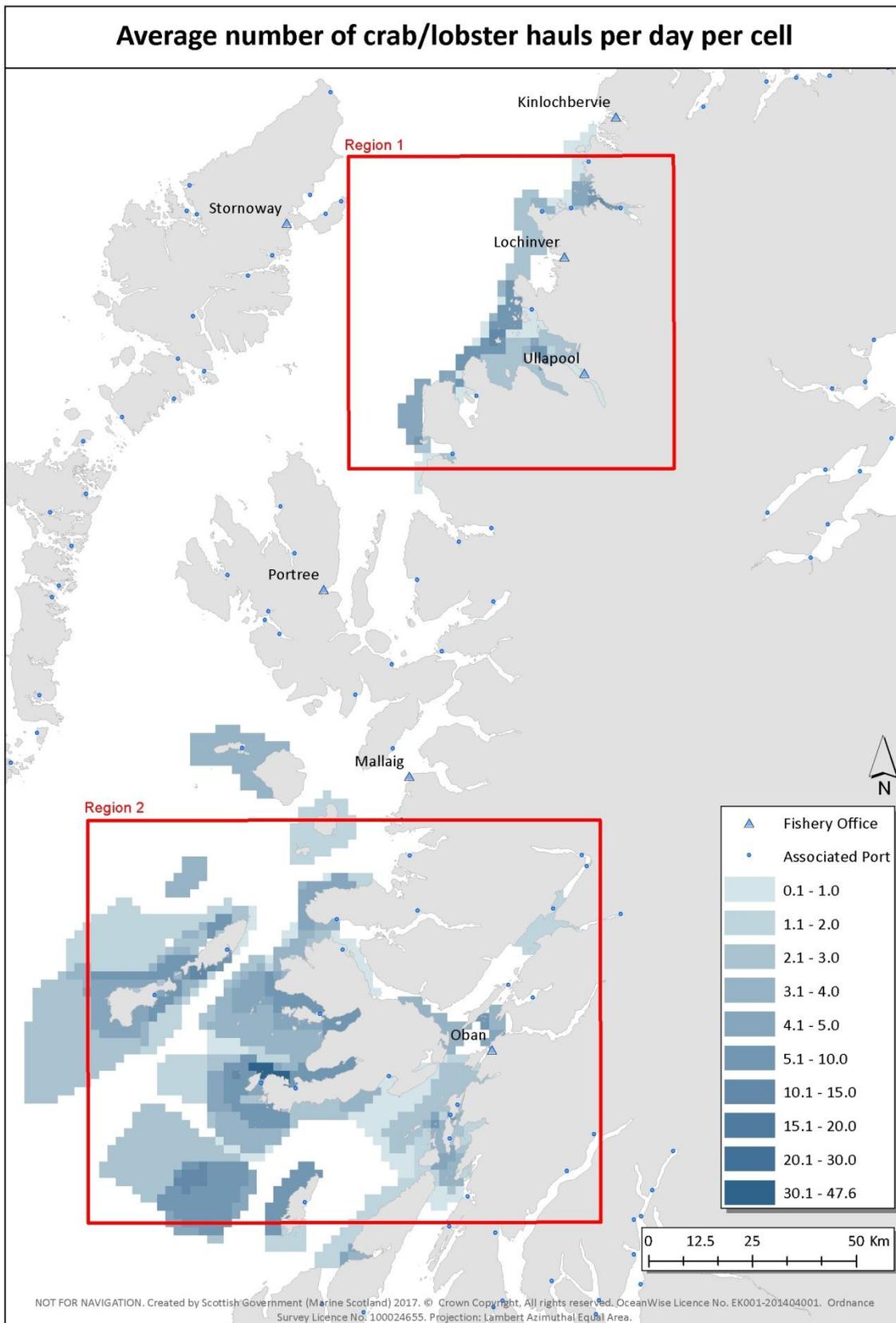


Figure 13: Estimated number of creels hauled per day per cell (4 km²) from surveyed vessels

3.3 Crab and Lobster Fishery – East Coast of Scotland

As on the west coast of Scotland, east coast creel fishers target all three species, brown crab (*Cancer pagurus*), European lobster (*Homarus gammarus*) and velvet crab (*Necora puber*). Many also target mackerel (*Scomber scombrus*) for commercial sale and as bait to use in creels.

Effort analysis from the two surveyed regions on the east coast of Scotland surveyed 130 boats using creels to target crab and lobster. The majority of vessels fished exclusively with parlour creels (67%), followed by those who used solely lobster/crab creels (19%). The remainder use a mixture of lobster/crab creels with parlour creels (14%). Around 22% of vessels had adaptation to their gear, which consisted of escape panels on some creels in their fleets. A number of interviewees said they had tied the escape panels due to high escape rates of commercial size velvet crab. As before, lobster/crab creels and parlour creels are jointly referred to as ‘creels’ in the remaining analysis.

The number of creels that vessels had access to target crab and lobster on the east coast ranged from 10 to 2,300 and the same range was reported for those deployed. Figure 14 presents the numbers of creels deployed by each vessel which varied substantially. A small proportion of vessels deployed more than 1,000 creels (8.4%), a high proportion of vessels (60%) deployed under 500 creels per vessel and the remaining 31.6% deployed between 500 and 999 creels per vessel.

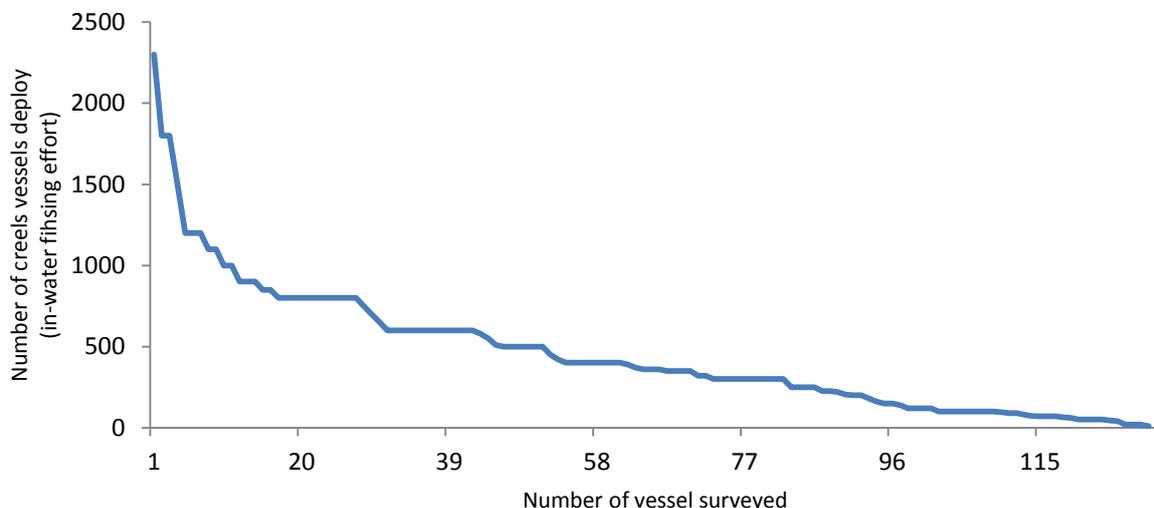


Figure 14: Plot of the reported number of creels deployed by vessels surveyed in the east coast crab and lobster fishery

The total number of creels deployed per month by all vessels surveyed increased by almost a third from 41,500 in February up to 60,000 in the peak month of August (Fig. 15). Peak season appears to run for five months from May through to September where on average 59,700 creels (all vessels combined) are deployed per month. This is in comparison to the low season, the seven months from October to

April where an average of 47,500 are deployed by all surveyed vessels per month. This is an additional 12,000 creels in high season compared to low season.

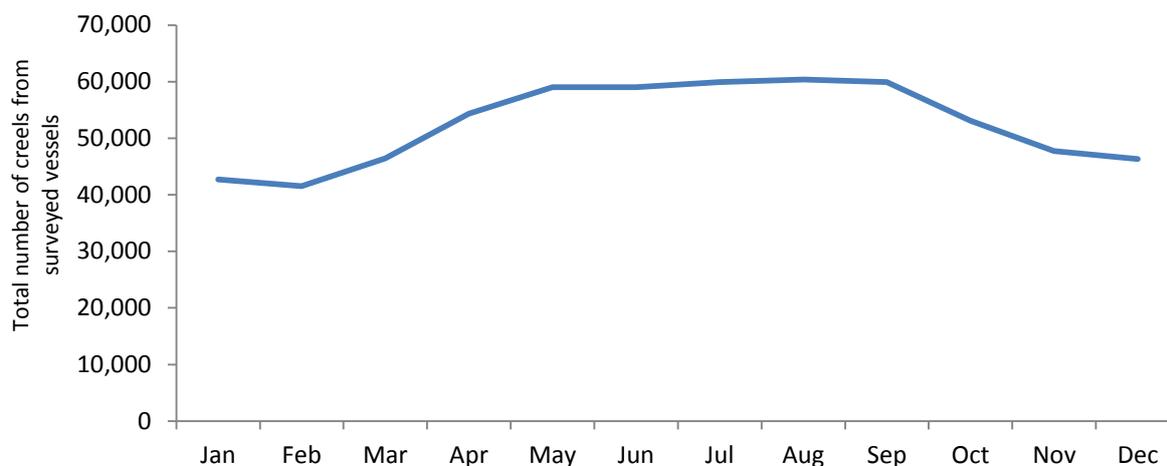


Figure 15: Total number of creels deployed by surveyed crab/lobster east coast vessels by month

The number of creels a vessel had access averaged 542 creels whilst the deployed 'effort' was an average of 455 creels (Table 4).

Table 4: Average (mean) number of crab/lobster creels per vessel by length and crews east coast

	Mean number of creels (access)	Mean number of creels (deployed)
All vessels	542	455
Length of vessel		
<5 m in length	267	261
5-9.9 m in length	506	415
>10 m in length	1,294	1,161
Number of crew		
1 crew member	437	360
2 crew members	716	609
3+ crew members	1,137	1,088

As before, Table 4 shows the average number of creels accessed and deployed by length of vessel and number of crew for the east of Scotland crab and lobster fishery. Hauling patterns from the vessels who supplied this data ($n = 120$) show much variation in days fishing and hauling rates. For fishing days, around 35% of the vessels surveyed fished during the spring and summer months only and was split between those who fished 6 to 7 days a week and those who fished between 3 to 4 days a week. The remaining 65% fished all year round. Fishers who worked all year, gave either an average annual figure of fishing days per week (24%) or two figures: one from summer and one winter (76%). Those who gave just one figure: the majority said they fished on average 3 to 4 days a week whilst a very small proposition said they fished 5 to 6 days a week. Those who gave summer and winter figures: the majority (90%) fished between 5 to 7 days a week in the summer and between 3 to 4 days in the winter. The remaining 10% fished less days during both summer (>4 days a week) and winter (>3 days a week).

Hauling rates per day varied with the average (mode - the most commonly reported figure) of 300 creels per vessel which ranged from 20 to a maximum of 500 creels hauled by on vessel in one day. When broken down according to number of crew, the most commonly reported haul rate per day was 200 creels for a 1 crewed vessel, 300 creels for a 2 crewed vessel and 500 creels for a 3+ crewed vessel (Table 5).

Table 5: Average (mode) haul rates per day for all surveyed vessels broken down by crew number

	All vessels	1 crew	2 crew	3+ crew
Range	20 - 500	20 - 500	70 - 580	360 - 500
Most common (mode)	300	200	300	500

Mapped estimates of crab and lobster creels hauled per day per 4 km² for the east coast areas are presented in figure 16. Haul rates ranged from 1 to 234 hauls per day per 4 km². For the light areas average hauls rates range from 0.1 to 11 hauls per day per 4 km². For medium coloured cells this ranges from 12 to 40 hauls per day per 4 km² and for the dark areas this ranges from 41 to 234 haul per day per 4 km². Haul rates per day in inshore waters are substantially higher, compared with offshore areas on the east coast.

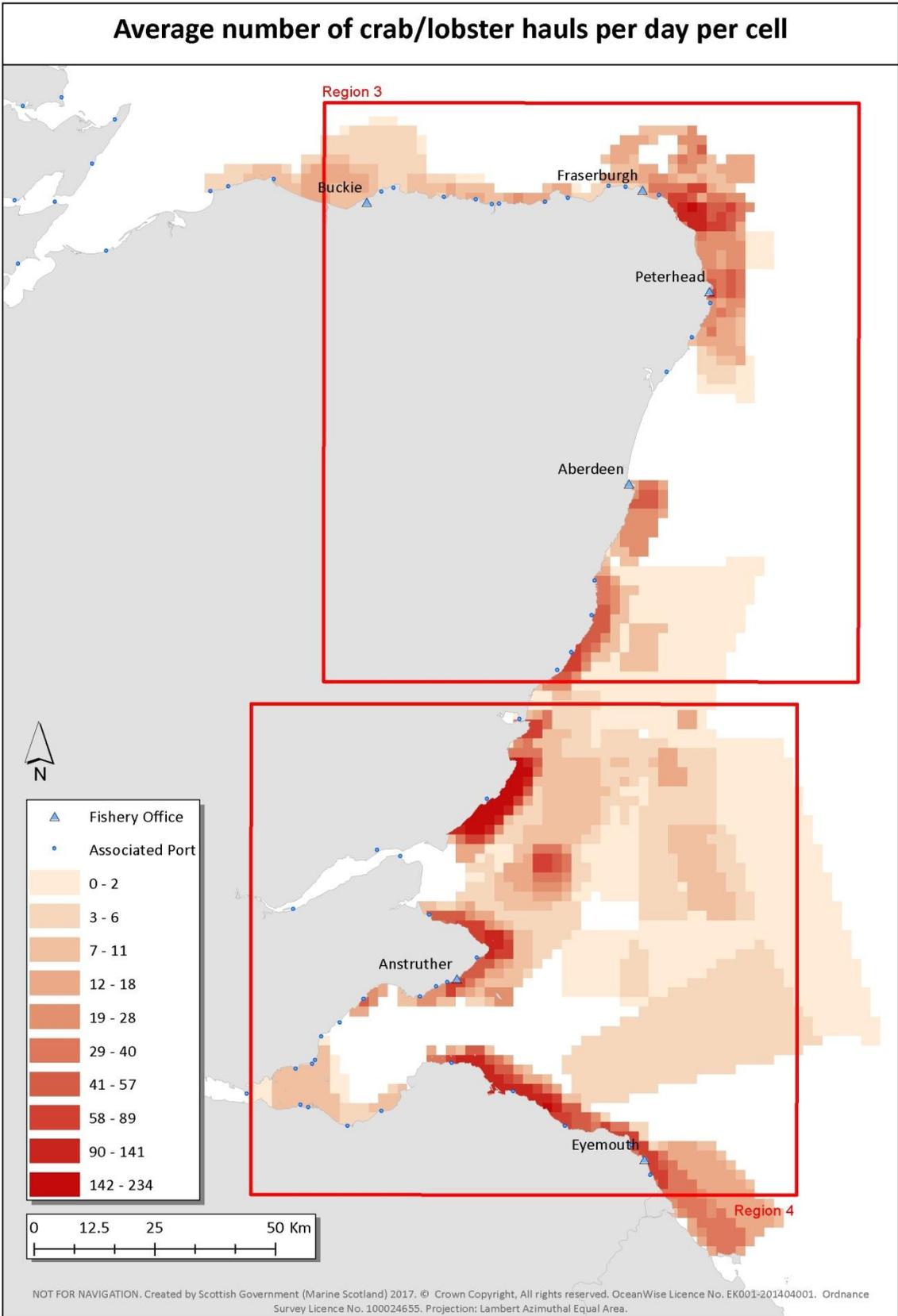


Figure 16: Estimated number of creels hauled per day per cell (4 km²) from surveyed vessels

3.4 Additional Creel Fishing Data

Creel fishing requires bait to attract target animals and encourage them to enter the creels. Figure 17 shows the composition of species fishers said they used to bait creels in each of the fisheries. For the West of Scotland *Nephrops* fishery (left chart) the species most commonly used as bait was herring, followed by mackerel and saithe and the majority of bait is salted to deter crab. Species in the 'other' category included, scad, swimming crab, gurnard and pout.

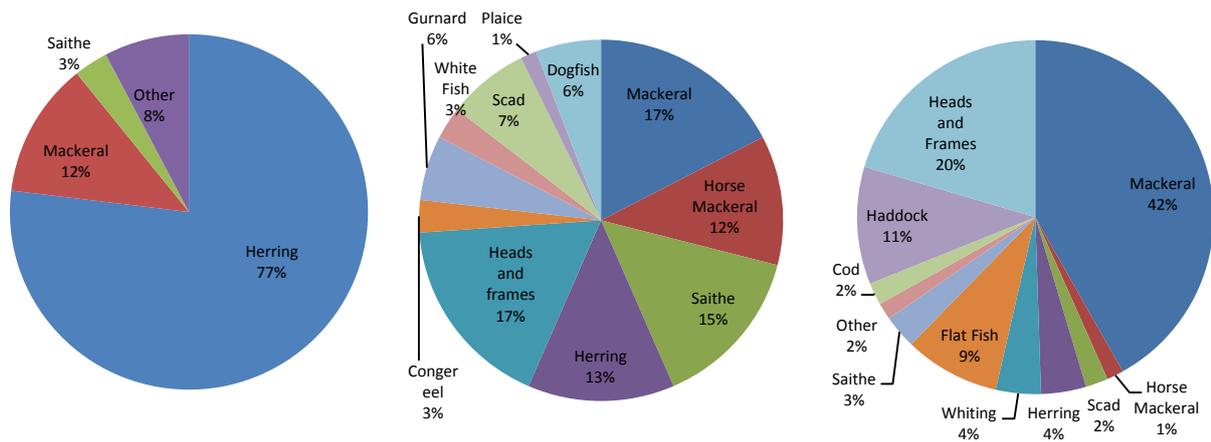


Figure 17: Breakdown of species used as bait in the West of Scotland *Nephrops* fishery (left), the West of Scotland crab and lobster fishery (centre) and the East of Scotland crab and lobster fishery (right).

The middle chart shows the species used to bait crab and lobster gear on the West of Scotland. The species composition is much more mixed than the *Nephrops* fishery, with both oily (mackerel, horse mackerel and herring) and white fish (saithe, gurnard and scad) making up the majority of species. The heads and frames of salmon and whitefish were also used to bait creels in this fishery. The right charts shows the composition of species used to bait crab and lobster gear on the east coast. Mackerel is the dominant species which is used both fresh and salted. Heads and frames mainly of haddock were the second most used bait species, followed by fresh haddock. Flat fish were also regularly used by some fishers and a mixed of other whitefish species at lower volumes.

To gather data on the interactions of *Nephrops* creels with other marine species, fishers were asked what other species they commonly encountered when hauling their creels. Squat lobster was the species most cited by fishers, followed by brown crab, octopus and cod (Fig. 18). Most fishers reported an increase in cod/codling (juvenile cod) over recent years compared to the past. Others discussed the increase in octopus which predate on *Nephrops*. A total of 27 species were cited as interacting with *Nephrops* gears.

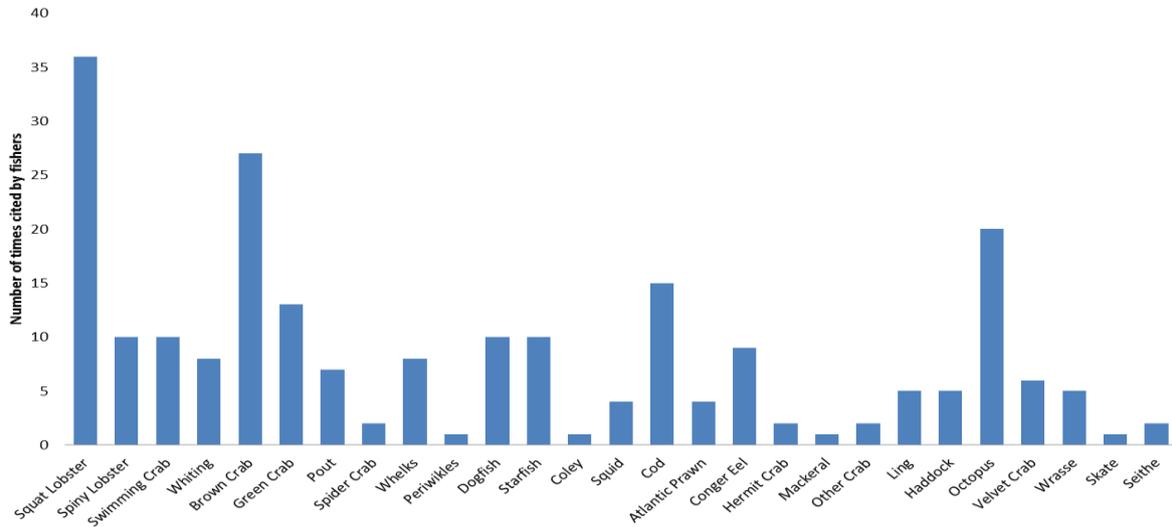


Figure 18: Most commonly encountered species in *Nephrops* gear cited by interviewees

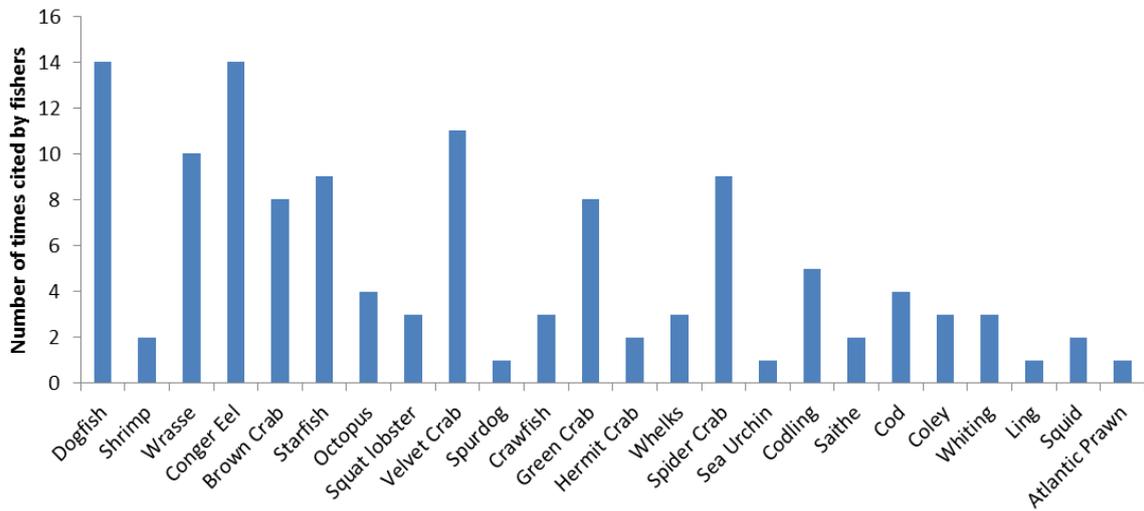


Figure 19: Most commonly encountered species in West of Scotland crab and lobster gear cited by interviewees

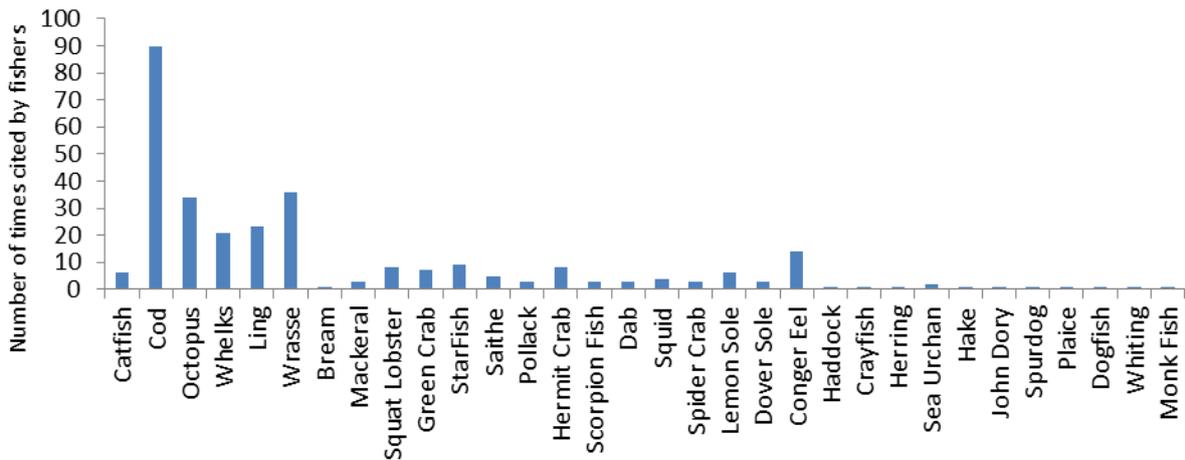


Figure 20: Most commonly encountered species in east coast crab and lobster gear cited by interviewees

In the West of Scotland crab and lobster creels, 24 species were cited by fishers as encountered (Fig. 19). The two most common species were dogfish and conger eel, followed by wrasse, velvet crab, spider crab and green crab. Velvet and brown crab were included on these by-catch lists as they were undersized and therefore discarded.

On the east coast, 32 species were cited by fishers as encountered in crab and lobster creels (Fig. 20). The most common species was cod listed 90 times, followed by wrasse, octopus, ling and whelk (20-30 times each). A much wider range of other species were listed as interacting with east coast creels compared to the west coast. This could be due to higher survey sampling on the east coast, data collection methods (all species encountered rather than most common) or higher retention rates in parlour creels, which dominate on the east coast as opposed to D-shape prawn creels which dominate on the west coast.

4. Reporting - Fish1 Forms

The reporting of effort data for creel vessels has been inconsistent to date. Basic effort information is submitted via electronic logs for vessels over 12 metres in length, via paper logbooks for 10-12 metre vessels and via Fish1 forms for under 10 metre vessels in Scotland. Reporting effort data (creel numbers) on Fish1 forms has been voluntary because of the perceived burden to small-scale fishers and given this, limited guidance was supplied to clearly communicate the type of data required. During this survey, fishers were asked if they previously submitted this voluntary information on their Fish1 forms, if so, what is represented by the data they reported.

Data showed that 63% of those vessels surveyed submitted effort data (creel numbers). Of those, 53% of vessels said they reported their deployed (in water) effort. 26% reported this figure as the average amount of creels hauled per day, 16% as the number of creels owned and 5% reported that they did not know what was reported as someone else completed the form.

Because of these inconsistencies, in June 2016, based on the preliminary finding from this survey, a new Fish1 form was introduced to improve reporting of effort data in creel fisheries. Data requirements were reviewed and changes have now been made to licence agreements so effort reporting is now mandatory. Under this agreement, fishers are now required to report: 1) total number of creels deployed each week; 2) total number of creels hauled to obtain the reported catch and; 3) the start location (latitude and longitude) of deployed creels (Fig. 21).

In addition to this new data source for monitoring effort, a research programme called Scottish Inshore Fisheries Integrated Data System (SIFIDS) funded by the European Maritime Fisheries Fund (EMFF) has commenced which aims to develop an integrated system for the collection, collation, analysis and interrogation of data from the Scottish inshore fishing fleet. The project will focus on the inshore fleet where data on the location of fishing activity and effort is currently lacking. This is set to assist in: 1) marine spatial planning in an increasingly busy marine environment; 2) Marine Scotland's intention to implement vessel monitoring to inform on the footprint of inshore fishing to ensure that stocks are exploited sustainably (fished at Maximum Sustainable Yield); and, 3) improving stakeholders participation in fisheries governance. The SIFIDS project will work alongside fishers to develop and test technology to automatically collect and collate data on board vessels, thereby reducing the reporting burden on fishers. For more information on this project please see the project website at: <http://www.masts.ac.uk/research/emff-sifids-project/>.

5. Business Confidence and Management Concerns in the Creel Sector

All surveyed fishers were asked for their views on the status of the fisheries that they operate in, how confident they were in their business and their views on management of the fisheries either spatially i.e. regulations in specific areas, or by controlling effort i.e. creel limits, limits on licences, amount of time allowed to fish etc. Below is a summary of the findings.

5.1 Key Concerns for Static Fishing

West Coast - 40% reported the number of creels to be a key concern with no creel limits causing people to overfish and hold fishing ground. In the south west region, this was a concern for prawn creelers and seasonal fishers. About 7% of those stated that the prospect of regulations in the form of creel limits was their key concern. In the north west region a number of interviewees said the high number of deployed creels has resulted in fishers not being able to move gear as in the past or rest grounds. 26% identified gear conflict (between static and mobile vessels) as their main concern with both scallop dredgers and trawlers blamed for the loss of creels, although a number of interviewees did state that this was less of an issue than in the past because of better communication between mobile vessel skippers and creel fishers. 15% stated that there were no key concerns in the area, although some interviewees mentioned gear saturation, habitat destruction from mobile vessels, and overfishing as potential concerns. Of the remaining 12%: 6% mentioned unlicensed fishers or unlicensed boats which was associated with hobby fishers targeting both scallops and lobster; and 6% stated that MPAs and weather as their key concerns, the former as an effort control issue and the latter through damage to fishing gear.

East Coast – 58% of those surveyed raised creel numbers as the key concern. Deployment of more creels, along with more vessels entering the fishery, was thought to be leading to overfishing. This was stated as resulting with in-sector competition with reports of some fisher deploying creels to hold ground rather than to fish on a regular basis. 35% of fishers, mainly in the north east, reported conflicts between static and mobile gears. Many complained that visiting mobile vessels currently fished too close to the shore and towed creels which is forcing creel fishers to overcrowd smaller inshore areas to avoid losing gear. Concern was also voiced on habitat damage to crab and lobster grounds from mobile gears. Three other concerns raised were: part-time fishers (16%) which have increased and deploy large amounts of gear, putting them in direct competition with full-time fishers during summer months; Unlicensed fishers (14%) who are reported as catching undersized shellfish, illegally selling their catch, and not properly marking gear; and fishers landing berried (egg-bearing) lobster (9%) which some felt should be prohibited in order to protect breeding stock. 3% of interviewees did not raise any concerns or did not answer the question.

5.2 Confident and Business Development

West Coast - Over 37% felt confident and were able to develop their business with a number keen to: 1) buy another boat; 2) increase the number of creels they worked and; 3) adding value to catches through processing. Some of these fishers described the level of work required to develop their business as challenging and 4% cited age as a barrier due to the physical demands of the job. 30% did not feel confident in their businesses citing: creel saturation and competition for marine space; marine protected areas; gear conflict and rising costs; low prawn prices; finding reliable crew; and health and safety restrictions as reasons for low confidence. Of those who said they were not confident a small proportion (10%) stated that they would be keen to leave the industry. 23% felt their business could be maintained at the current rate stating that they were still making a suitable living and the current business commitment gave a good work-life balance. A further 6% were unsure if their businesses were sustainable due to uncertainty around changes in management and finding reliable crew.

East Coast - 40% of those interviewed felt confident to develop their business because stocks were healthy and market prices good. Several reported that they had recently purchased a new vessel but caveated that their confidence was contingent on maintaining current fishing effort and market prices remaining stable at the current level. 26% did not feel confident about their business. Reasons given were increased creel effort on the grounds; continuing conflict with mobile vessels which impacts on their ability to fish in deeper water and the expense of replacing lost gear; and inability to diversify into other fishing opportunities (e.g. mackerel, herring). 16% were content to maintain their business with no intention to develop further. For some this was because they were nearing retirement, while others simply had no desire or interest to expand. 14% were uncertain about developing their business because of the concerns in the east coast voiced in the previous question. 4% of interviewees did not respond to the question.

5.3 Opinions on Spatial Management of Static Gear

West Coast – 63% of interviewees were against spatial management aimed at vessels fishing with creels, with issues around displacement, compliance and ‘not necessary’ due to the natural cycle of fishing most commonly cited reasons. Those who felt spatial management was not necessary discussed the ‘cycle of fishing’ which meant fishers moved off grounds when quality dropped therefore areas are naturally rested and recovered. The next most cited reason for concern around spatial management, and linked to displacement was creel saturation, as vessels would need to move creels into already fished grounds causing conflict with fishers currently creeling in those areas and potentially overfishing areas not spatially managed. Some fishers also cited business viability as the key concern with spatial management of creel in grounds already saturated and displacement would fuel conflict or drive some creel vessels out of business. The remaining 37% were in

favour of some form of spatial management, mostly seasonal closures to support: 1) the moulting cycle of velvet crabs; 2) to rest ground during the summer months, and; 3) protect the market from low quality prawns and therefore protect prices. It was felt that this type of spatial management would need to be a collaboration between fishers and managing authorities to be effective. Some interviewees cited enforcement as the major weakness in any form of management and whilst in favour of spatial management did not feel confident in its implementation or/and enforcement.

East Coast - 45% of those interviewed were against spatial management of creels, because of potential displacement of fishing effort putting pressure on other areas and increasing conflict between creel fishers. Several interviewees did not think it was required because of the seasonal nature of their fishery, and the natural restrictions of weather during winter months. Regarding conflicts between static and mobile sectors, some felt these should be resolved voluntarily through improved communications, rather than formally through management. 22% supported spatial management in the form of static-only areas, to reduce interactions with mobile vessels and loss of gear. They also felt it would help reduce crowding by creel vessels. However, there was no consensus on how a creel gear-only area could be implemented, with 2, 3, 4, 6 and 12-mile limits all proposed by interviewees. 18% supported spatial management in the form of seasonal closures and felt they would be effective for 1 to 2 months during mid-summer to protect shellfish when berried and/or soft-shelled. However, effort displacement during this time was a concern. The remaining 15% of interviewees were uncertain about the role of spatial management or did not answer the question.

5.4 Opinions on Effort Management of Static Gear

West Coast – 81% of interviewees supported the use of effort management with the majority (77%) favouring creel limits and the remaining (33%) citing a mixture of spatial and effort management. 7% were against effort restrictions either because they did not feel it was needed, as the weather balanced out effort naturally, or because enforcement would be too difficult. The remaining 12% had no views or were indifferent to any forms of effort management.

Of those in favour, the bulk supported creel limits, but were concerned about unused grounds being taken by trawlers. Other felt this would enable trawlers to also utilise shared grounds that they felt everyone should be able to access in order to make a living. Many felt that without permit limitations (limits on the number of new boats) in tandem, creel limitation will fail as people will buy additional licences to access a higher number of creels. Some also voiced concern on how limits would be applied and how a fair system could be put in place. Four issues were identified: 1) creels not regularly fished and being used to hold ground – this would need to be tackled; 2) allocation of creels could be based on vessel or number of crew – the second was the more favoured approach; 3) permits to fish in particular areas could not be traded

and returned to the pool if fishers retired to allow new entrants, and; 4) market demand would need to be considered when allocating limits – one interviewee suggested Monday-Friday fishing only, so weekend catches do not flood the market and drive down prices.

When allocating limits, some fishers stated what they felt would be a fair allocation. Allocation by number of crew was most favoured over length of vessel, with 300 to 500 creels most commonly cited as a fair allocation in the *Nephrops* fishery for a 1 person vessels. It was stated that a 1 person vessel can haul up to 500 creels a day and 1500 to 1,600 creels for 2+ crews. Most felt a cap as around 1,500 was sufficient for most *Nephrops* boats and that no vessel should be allowed to work over 2,000 creels as anything over this volume is used to hold ground. Others stated that for each crew member an additional 400 creels should be licenced on top of a base limitation of 800 for a single man vessel.

East Coast – 76% of interviewees supported some kind of effort management with the higher proportion (64%) in favour of creel limitations, some (12%) of whom also thought this should be accompanied by a permit scheme. Views on how creel limits could be implemented were split between allocating per crew member, or per vessel. Other methods included allocation by length of vessel, or distance a vessel fished from the shore. The numbers suggested for a limit were varied, however, they tended to average as : 300 to 400 creels per crew (up to a max. of 1,000) or 400 to 800 per boat by north east fishers in the crab and lobster fishery; and 200 to 300 creels per crew or 400 to 800 per boat by south east fishers in the crab and lobster fishery. The key issues that interviewees foresaw for successful implementation of creel limits was enforcement and loopholes that allowed the acquisition of larger allocation of creels (e.g. by buying another boat, or from being able to trade allocations). A small portion of these in favour of effort management (12%) wanted measures that would specifically restrict the effort of part-time⁵ and unlicensed fishers. Suggestions included introducing creel limits only for part-time fishermen, and a permit scheme for unlicensed/hobby fishers. The remaining interviewees who were supportive (12%) suggested a number of other effort measures including banning the landing of berried lobster, setting ‘introductory’ creel limits for new entrants and some technical measures such as increasing the mesh sizes on creels and making escape panels mandatory.

14% of interviewees were opposed to effort management. They felt that it wasn’t required as their local stocks were healthy and being fished sustainably, and questioned how any measures would be enforced. They also raised specific concerns that limiting creel numbers could have an impact on their business, and that permits to fish in their area could lead to effort being displaced. The remaining 10% of interviewees were uncertain about effort management or did not answer the question.

⁵ Part-time was not defined by interviewees.

6. Stakeholder Workshop

Two one-hour stakeholder workshops were undertaken at the annual Scottish Inshore Fisheries Conference in Inverness on the 27-28th April. The workshop set out to discuss the management needs and option for crab and lobster on both the west and east coast⁶. The workshop was made up of participants from a range of backgrounds including active fishers, fisheries and seafood industry representatives, non-government organisations, and government officials. The workshop consisted of a 20 minute presentation on the crab and lobster analysis described in section 3 of this report, followed by round-table discussions and group feedback on four pre-selected topics: 1) suitable legislation to support crab and lobster fisheries management; 2) implementing appropriate management in crab and lobster fisheries; 3) integrating inshore creel fishing with wider marine spatial management, and; 4) responding to changing demands and opportunities. Each group in both sessions were asked to identify the **issues** for this area, outline the key **challenges** for the identified issues and then potential **solutions** for addressing these issues. The following is a summary from the eight discussions.

6.1 Topic: Suitable Legislation to Support Inshore Crab/Lobster Management

Both groups held general discussions on what the issues with current legislation were (including a view that there were no issues). There was a general consensus that:

- 1) Current legislation is not responsive to the needs of fishers;
- 2) It takes a long time to introduce new management measures;
- 3) There are insufficient punishments for wrong doers – particularly unlicensed/hobby fishers who sell their catches.

Key challenges highlighted were:

- How the science community and fishers work together – some felt fishers need proper representation;
- Taking into consideration the socioeconomics needs of crab and lobster fishing;
- Generating high quality data, there needs to be robust evidence to support management;
- Implementing management controls over a period of time that fishers can adapt to whilst maintaining their livelihoods;
- Understanding what is the appropriate scale for crab and lobster fisheries management, many issues of a local nature;
- Too many people involved in the industry are only interested in a quick gain; and

⁶ Given the time limitations at the event, the west coast *Nephrops* fishery was not discussed at this time.

- Not enough enforcement.

Some potential solutions proposed by the groups were:

- More responsive management;
- Joint management between scientists and fishers;
- Permit powers could provide a solution but need to be wary of patchwork management - some aspects of regulating orders would be appropriate (permits);
- Greater enforcement and greater punishment dispensed.

6.2 Topic: Implementing Appropriate Management for Crab/Lobster Fisheries

Two issues were discussed by the two groups:

- 1) Balancing livelihoods – for example how to balance creel limits with full-time, part-time and unlicensed fishermen and;
- 2) The inappropriateness of quotas in crab and lobster fisheries.

The key challenges with these issue were:

- Quotas - work against fishing communities and providing an extra hurdle to people entering the sector. Need to avoiding measures that prevent/hinder new entrants;
- Accounting for regional differences (e.g. national vs. local creel limits - nationwide creel limit unlikely to be appropriate for all areas);
- Avoiding unexpected consequences, e.g. creel limits that lead to increased effort such as switching from prawn creels to parlours, or encourages fishers to purchase up to the maximum allowed;
- High quality historical/current fishing data in order to inform and monitor management decisions;
- Resources to effectively enforce management and prevent loopholes (e.g. scrubbing berried lobster);
- 'Toothless' management measures that can be ignored (e.g. voluntary v-notching schemes for undersized/berried lobster);
- Current legislation constraining management decisions or being expensive/prohibitive to implement (e.g. Regulating Orders).

Potential solutions put forward were:

- Learn from management measures introduced elsewhere, e.g. Canada, Norway - don't need to reinvent the wheel;
- Management decisions at a local level. More responsive than decisions taken centrally, and locals have better knowledge of the fishery(ies) and how to implement appropriate solutions;

- Implement technical measures alongside creel limits to mitigate effort increase (e.g. mandatory escape panels).

6.3 Topic: Integrating Inshore Fishing and Wider Marine Spatial Management

Two topics were discussed by the two groups:

- 1) Displacement of small boats from traditional fishing grounds;
- 2) Inshore fishing grounds being increasingly shared with other marine users.

The key challenges with these issue were:

- Long running issues between different fishing sectors, who have been operating in the same place, are being accentuated with other marine users claiming sea space;
- Lack of involvement in the marine spatial management and the planning process;
- Increasing pressure from the environmental lobby;
- Fishing sector is underfunded for dealing with marine spatial planning;
- Out of date maps of marine use e.g. ScotMap now out of date;
- Increase in aquaculture and sea bed cables in inshore waters.

Potential solutions put forward were:

- Improved management, better guidance and more funding;
- The burden of proof should sit with the developer, who should also meet the costs;
- An enhanced role for Inshore Fisheries Groups (IFGs), e.g. similar to that of Inshore Fisheries and Conservation Authority (IFCAs) in England;
- Better, more inclusive and continuous consultation process;
- Mechanisms for all fishers to have their say in wider marine management including sea bed cables and aquaculture installations and proposals;
- The possible use of Regulating Orders or other management mechanisms.

6.4 Topic: Changing Consumer Demands and Market Opportunities

Six issues were discussed during the two sessions:

- 1) Impact of MSC certifications - now considered by many as the Holy Grail, but not well suited to inshore fisheries, yet responsible fishers are harmed if not certified;
- 2) Crab and lobster creels catch multi-species (e.g. whitefish) but no entitlements to land other species;
- 3) Inshore fisheries now operate out to 12 nm but current regional Inshore Fisheries Group (rIFG) boundaries set at 6 nm;

- 4) Lack of domestic markets for Scottish products;
- 5) Producing and selling Scottish products in a way that suits UK consumers;
- 6) Securing viable prices in the UK market that compete with prices secured for products in overseas markets.

The key challenges highlighted were:

- Inshore fishing no longer reflects the sea area managed by the 1984 Inshore Fisheries Act;
- Creel fishers do not have historical records, therefore are unable to access quota species so cannot benefit from alternative markets;
- Markets for smaller quantities of mixed species, demand is there, but current economic model for most species is dependent on overseas export;
- Onshore storage and handling capacity of mixed landings is lacking;
- High volume of import for into the UK seafood market;
- Delivery times between landing locations in Scotland/UK and key domestic markets (UK cities);
- Suitable processing and selling facilities that can deal with smaller diverse volumes as well as economies of scale;
- UK/Scottish attitudes and cultures towards consuming seafood.

Solutions proposed to tackle these issues included:

- Community quotas of mixed species - rather than any changes to licences - to allow inshore fishers to diversify;
- Update facilities in key local ports to allow local businesses to store and process more species and promote local markets to reduce dependence on overseas markets - [Connect Local](#) was mentioned as a positive scheme;
- Community/cooperative approaches to support and develop local markets;
- Support to create domestic markets e.g. public sector contracts (hospitals/schools) and general awareness raising;
- Changing primary and secondary production to better fit with UK market demand;
- Long term planning to change UK consumers attitudes to seafood.

7. Summary of Findings

7.1 Creel Effort

The majority of creel effort in Scotland's inshore waters can be broken down into three key fisheries; the west coast *Nephrops* creel fishery; the west coast crab and lobster creel fishery and; the east coast crab and lobster creel fishery. The type of gears used is more dependent on the fishing environment and to a lesser extent species targeted. For the west coast the standard 'D' shaped prawn creel dominates in the *Nephrops* and the standard 'D' shaped lobster creel in the crab and lobster fisheries due to the more sheltered grounds and deeper waters compared to the east coast where a mixed range of the stronger parlour creels are used to target crab and lobster on the hard substrate and turbid waters closer to shore. Few creels had any form of adaptation and those that had have been disabled to improve retention rates of target species, mainly velvet crab.

Access and deployment rates vary between these fisheries with vessels accessing up to a maximum of 3,000 (deployment 2,500) creels in the west coast *Nephrops* fishery compared with 1,200 (deployed 900) creels in the west coast crab and lobster fishery and 2,300 (accessed and deployed) in the east coast crab and lobster fishery. The average number for creels accessed and deployed by vessels was much lower than the maximum figures which was on average 1,009 (926 deployed) in the west coast *Nephrops* fishery, compared to a 359 creels (294 deployed) in the west coast crab and lobster fishery, and 542 (455 deployed) in the east coast crab and lobster fishery.

The amount of creels deployed are best related to length of vessel or, more favoured by fishers, number of crew. When broken down by crews the number of *Nephrops* creels deployed has a somewhat linear increase (+~600 creels per crew member) which is also the case in the east coast crab and lobster fishers (+~350 creels per crew member). These increases are higher than the reported average daily hauling rates of 400 creels per crew member in the *Nephrops* fishery and 200 creels per crew member in the crab and lobster fisheries.

Creel numbers deployed do not appear to vary significantly between seasons in the west coast *Nephrops* fishery, but they do vary substantially in the east coast crab and lobster fishery with an increase of almost a third from the lowest deployment levels in February up to peak deployment levels in August. Hauling frequencies also varied between season in all fisheries with most fishers hauling every 2 days during the summer or good weather periods which extended up to a week or longer in winter or poor weather periods.

7.2 Future Reporting of Creel Effort

The recent revisions to the new Fish1 forms should result in improved reporting of creel effort by all inshore vessels. This will allow effort data to be linked to landings

data and effort monitoring to take place throughout the year. There are still some limitations with this approach to data collection, such as fishers having to manually record the data and only provide the start location of fishing and not the direction or distance the gear is deployed. However, at this time, this is considered to strike the correct balance between data requirements and reporting burden on those operating in these fisheries. The Scottish Inshore Fisheries Integrated Data Systems (SIFIDS), a new European Maritime Fisheries Funded (EMFF) project, is focused exclusively on exploring an integrated system for the collection, collation, analysis and interrogation of the Scottish inshore fishing fleet and the work programme will make recommendations on a range of new techniques and technologies to improve inshore data collection in the future.

7.3 Views on Future Management

There was a clear view that current shellfish management needs to be reviewed, if not a direct request for management intervention from most of the fishers interviewed. Creel saturation, on available grounds, also more widely termed as 'creel on creel conflict', was voiced as the key concern for shellfish fisheries on both the east and west coasts of Scotland and exploring the options of creel limits was supported by over three quarters of fishers interviewed (76-77%). This extends to unlicensed/hobby fishers which was most prevalent on the east coast but also, but to a lesser degree, present on the west coast.

Spatial conflict between static and mobile gear vessels is still an issue on both coasts, but some alternative approaches used in recent years (communication on known creel grounds with visiting vessels and courtesy notices by trawling vessels when working in the vicinity of creel grounds), and local zoning arrangements, do appear beneficial and should continue to be supported to improve on these interactions. It is, however, inescapable that as competition for marine space continues, conflicts between sectors will remain and trade-offs from all sides will need to take place.

Notwithstanding these two key concerns, there still appeared to be a degree of optimism about creel fishing and it continuing to provide a good livelihood with around two thirds of those interviewed stating that they were either confident and able to develop their businesses or were happy to maintain at the current level even if did not want to develop further. Of the remaining one third who were not confident, creel saturation and spatial conflict were the main reasons, those not exclusively, and this was slightly higher for the east coast than the west coast.

A higher proportion of fishers on the west coast (63%) were against spatial management of creel vessel compared to the east coast (45%), voicing the displacement as the main reason for not favouring these types of approaches. Those who were in favour of management support more flexible arrangements, such as seasonal/temporal closures to support target species during vulnerable stages in

their life cycle (breeding or moult) or to protect landed price. They also felt that spatial management of static vessels needed to be a collaboration between the local and national administrators.

Effort management is the approach most favoured by 81% of fishers on the west coast and at a slightly lower proportion of 76%, on the east coast. Permit limitations along with creel limits were the options most discussed. Many views were given on how to create a fair and equitable system. A key issue when accounting for creel limits was how to manage creels being used to holding ground vs. creels not being fished due to bad weather. Most fishers voiced the need for a flexible system that reflects the hazards and natural complexity of working in the marine environment, but also regulations that are tough enough to deal with those deliberately breaking the rules. This was also raised as a key challenge during the group discussions at the workshop on suitable legislation for managing inshore fisheries.

Spatial management was a less supported option potentially due to a misunderstanding into the range of spatial management options which could be used to benefit fisheries management rather than just those that are put in place for conservation. More resistance was recorded on the west coast where conservation measures in the form of Marine Protected Areas are prevalent and most fishers associated spatial management with marine conservation rather than a tool in fisheries management. More information on the potential role of spatial management should be shared between fishers and fisheries administrators to improve its understanding and successful implementation.

7.4 Conclusion

This report presents a 'snap shot' of creel fishing effort in four regions in Scotland. This has produced a range of parameters which allows the fishing industry and Marine Scotland to explore options of future management at a local and regional level. There are two concluding remarks:

1) It is increasingly clear that creel fishing, in opposition to a number of other marine fisheries is, predominantly, a local issue and any future management should be tackled at the local level. National regulation is clearly not suitable, as demonstrated by the wide divergence of fishing practices around the coastline detailed in this report and the variation in numbers and types of creels deployed. A regional framework may offer guidance for what should be considered for inshore shellfish fisheries, but any form of creel management is likely to require local negotiations for particular fishing grounds, which will require exploring spatial as well as effort regulations at a localised level.

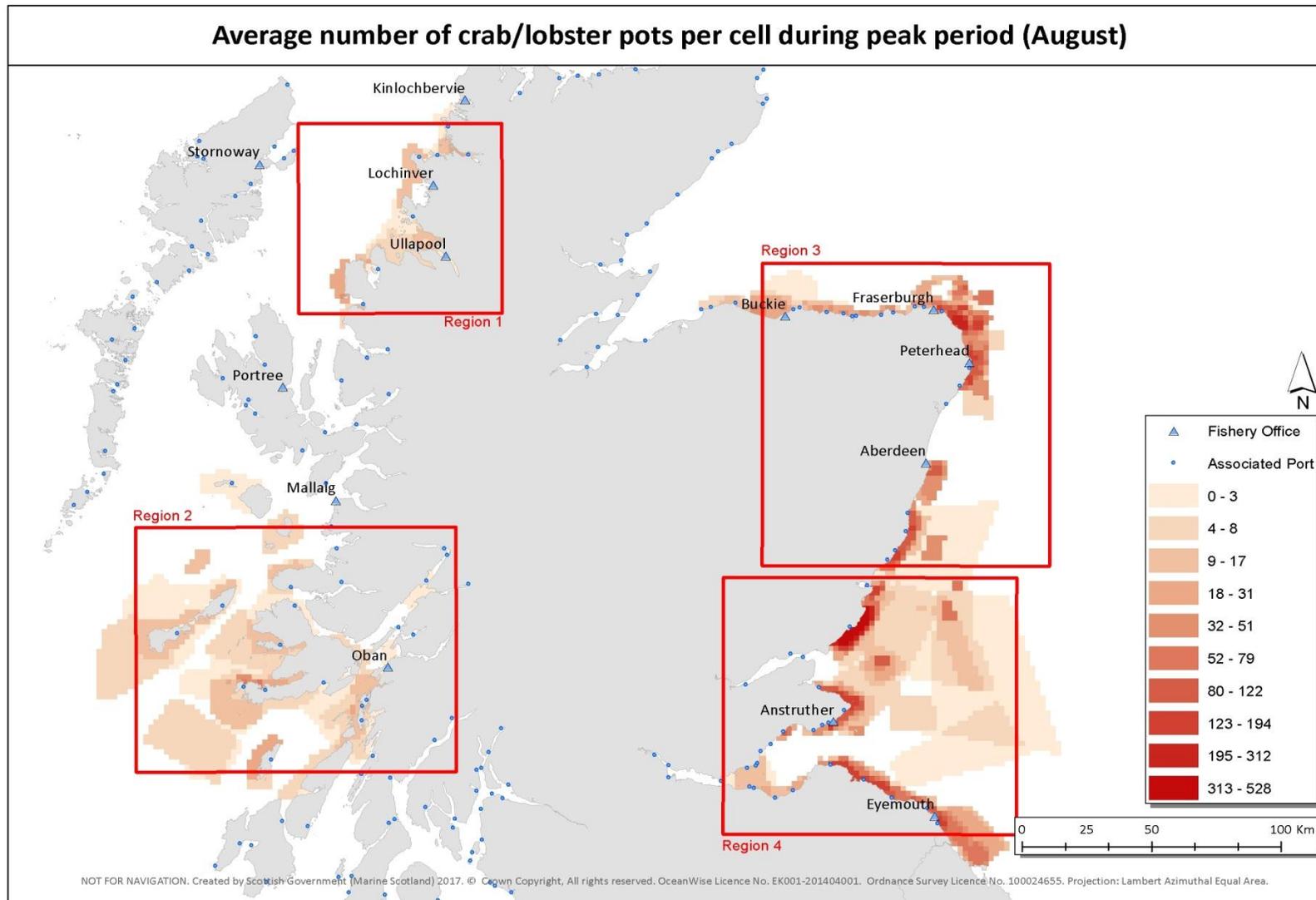
As outlined in Annex 2 and discussed by a range of industry stakeholders, the current legislation for managing inshore fisheries has limitations for supporting legally-based forms of management in an adaptive manner. Therefore management opportunities, in the short term, are most likely at the local, level and through

informal agreements. An option would be to trial local management in a region where fishers support is high and any voluntary agreements would, on the whole, be supported and respected. Such a trial would allow further evidence to be gathered to help inform a more formal management structure or framework, should local management prove workable. This approach, although still open to the criticisms voiced during the stakeholder interviews regarding enforcement, 'toothless' management and the punishment of wrong doers, does offer the opportunity to develop bottom-up rules and regulations in a flexible manner which allows adaptation to regulations should problems or unintended consequences become evident. This approach would need to be supported by both Marine Scotland and Regional Inshore Fisheries Groups (rIFGs) and suitable pilot sites identified.

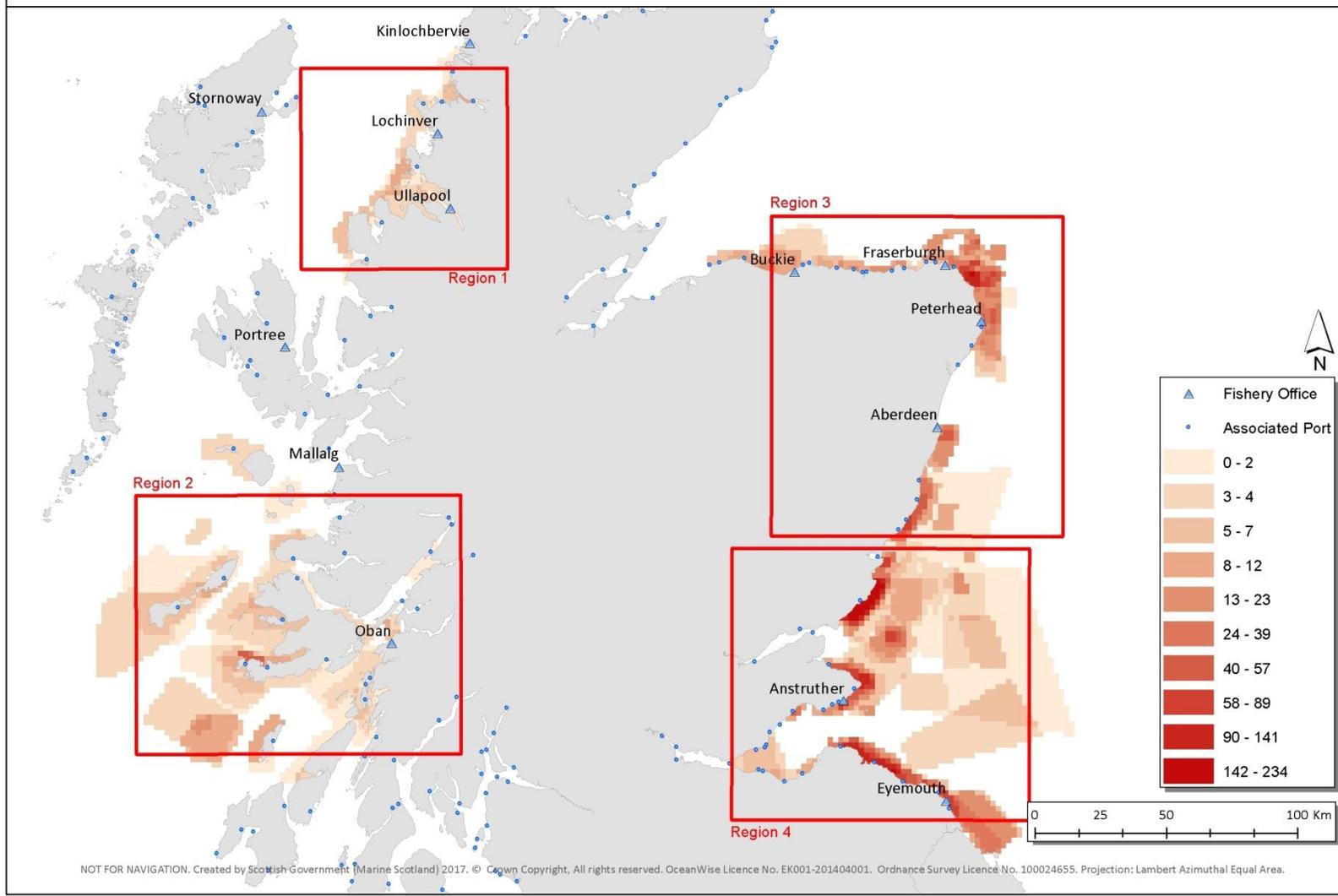
2) Effort monitoring should continue so all creel vessel activity can be mapped and total effort deployed in Scottish waters quantified. These data will become available through the new Fish1 forms and once available can be updated and monitored. This new data stream along with the SIFIDS work programme presents a significant opportunity to improve data exchange between fishers and scientists and feed into regional and local management.

Producing a census on creel fishing effort will allow meaningful integration of inshore fishing activity with wider marine spatial planning and provide more evidence of the value of the creel sector in these waters. This will improve the evidence based for inshore fishers to quantify and explain likely impacts from marine development and the likely trade-offs when negotiating marine space with other marine users.

Annex 1: Average number of pots hauled per day per cell (4 km²) and peak period from all surveyed vessels



Average number of crab/lobster hauls per cell per day



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Annex 2: Current Management Controls and Summary of Legislative Powers for Inshore Fisheries Management in Scotland

A summary of the main management controls covering brown crab, velvet crab and lobster is set out below:

- These fisheries are not covered by EU total allowable catch or other such restrictions on the tonnage that can be landed.
- There is an EU set restriction on annual fishing effort for vessels over 15 metres in length fishing for brown crab in ICES areas V and VI and VII. However, with the exception of Area VII, these provisions have not seen a practical impact on the activity of vessels.
- The principle method of controlling landings is through minimum landing size regulations which are designed to protect juvenile animals.
- Commercial fishing for brown crab, velvet crab and lobster is restricted to those vessels which have a shellfish entitlement attached to their fishing licence.
- Provisions are also in place around the maximum landing size of female lobsters and a 'v-notching' scheme to protect egg-carrying females.
- There are also local restrictions around the Scottish coast which apply temporal prohibitions on fishing activity.

A summary of the main management controls covering *Nephrops* creel fishing is set out below:

- Principally, the *Nephrops* fishery is managed by an EU set Total Allowable Catch which limits the amount of *Nephrops* that can be removed each year. This limits the catch that each vessels takes.
- Minimum landing size provision limits the size of *Nephrops* that can be landed

Legislative Powers

Scottish Ministers are responsible for the regulation of sea fishing around Scotland within 12 nautical miles and can introduce controls provided that the EU has not already regulated in the area. The main control mechanism for the management of inshore fisheries along with a summary of their scope are listed below:

Inshore Fisheries Act (Scotland) 1984

- Extends to 6 nautical miles
- Prohibit fishing for specified descriptions of sea fish
- Prohibit fishing by specific methods
- Ministers can state the dates to which prohibitions apply

Seafish Conservation Act 1967

- Allows for the regulation of the size of sea fish that can be caught
- Allows for the regulation of regulate of nets and other fishing gear that can be used
- Prohibit fishing for certain sea fish in specific areas

Sea Fisheries (Shellfish) Act 1967

- Allows for the establishment of Regulating Orders - give powers of management over shell fisheries
- Only one in Scotland (Shetland)

Commercial Licences

- All commercial fishing vessels must be licensed
- Conditions can be attached to licences
- Marine Scotland only licences Scottish vessels

There is a general recognition that the current legislative powers surrounding inshore fisheries management in Scotland is outdated. The current framework allows for Statutory Instruments to be introduced after extensive consultation and scrutiny of management proposals. However, introducing new controls through legislation is usually a time consuming process and, on the whole, does not allow for regional variation.

Management controls can also be introduced by licence condition which is a more responsive than a Statutory Instrument under one of the orders listed above. However, these only apply to Scottish vessels and not visiting vessels from other countries.



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